



ALL INDIA COUNCIL FOR TECHNICAL EDUCATION

Annexures

20th Meeting

10-30 A.M. 23rd SEPTEMBER 1969

VIGYAN BHAVAN NEW DELHI



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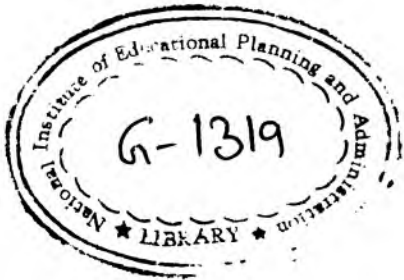


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**Government of India
MINISTRY OF EDUCATION & YOUTH SERVICES
NEW DELHI**

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ALL INDIA COUNCIL FOR TECHNICAL EDUCATION

20TH MEETING

DATE: 23rd September, 1969 PLACE: Commission Room "H",
Vigyan Bhavan,
NEW DELHI.

TIME: 10.30 A.M.

A N N E X U R E S

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ANNEXURE I
(Item No.1)

Proceedings of the 19th meeting of the All India Council for Technical Education held at New Delhi on the 25th May, 1968 at 10.00 A.M. under the Chairmanship of Dr. T. Sen, Union Education Minister.

.....

The following were present:

- | | |
|---------------------------|--|
| 1. Dr. T. Sen | Chairman |
| 2. Prof. Sher Singh | Education Minister of State, Government of India. |
| 3. Shri G.K. Chandiramani | Secretary to the Government of India, Ministry of Education. |

Chairmen of the Regional Committees of the Council
(Ex-officio)

Northern Regional Committee:

- | | |
|---------------------|--|
| 4. Shri M.R. Chopra | Vice-Chancellor,
University of Roorkee,
Roorkee. |
|---------------------|--|

Southern Regional Committee:

- | | |
|----------------------|---|
| 5. Dr. A.L. Mudaliar | Vice-Chancellor,
Madras University,
Madras. |
|----------------------|---|

Chairmen of the All India Boards of Technical Studies(Ex-officio)

Commerce:

- | | |
|----------------------|---|
| 6. Prof. M.V. Mathur | Vice-Chancellor,
University of Rajasthan,
Jaipur. |
|----------------------|---|

Engineering & Metallurgy:

- | | |
|---------------------|--|
| 7. Prof. P.J. Madan | Pro-Vice-Chancellor,
M.S. University, Baroda. |
|---------------------|--|

Architecture & Regional Planning

- | | |
|----------------------|--|
| 8. Prof. V.N. Prasad | Director, Indian
Institute of Technology,
Kharagpur. |
|----------------------|--|

Chemical Engineering &
Chemical Technology:

9. Dr. C.R. Mitra

Director, Harcourt Butler
Technological Institute,
Kanpur.

Representatives of Ministries/
Departments of Govt. of India

Defence

10. Col. C. Adikesavan

Director of Technical
Education, Army Head-
quarters, New Delhi.

Finance

11. Dr. (Miss) Kaumudi

Deputy Financial Adviser,
Ministry of Finance,
New Delhi

Health & Family Planning:

12. Dr. J.B. Shrivastav

Additional Director General
of Health Services,
New Delhi.

Home Affairs

13. Shri G. Jagathpathi

Joint Secretary (Manpower),
Ministry of Home Affairs,
New Delhi.

Information & Broadcasting:

14. Shri S.S. Aiyar

Chief Engineer,
All India Radio, New Delhi.

Steel, Mines & Metals
Department of Mines & Metals:

15. Shri K.S.R. Chari.

Coal Mining Adviser,
New Delhi.

Irrigation & Power:

16. Shri M.M. Gidwani

Director, Central Water
& Power Commission,
R.K. Puram, New Delhi.

Labour, Employment and
Rehabilitation (Deptt.
of Labour & Employment)

17. Col. S.G. Pendse

Director General of
Employment & Training,
New Delhi.

Petroleum & Chemicals.

18. Shri A.S. Grewal

Deputy Secretary,
Ministry of Petroleum and
Chemicals, New Delhi.

Ministry of Transport &
Shipping (Roads Wing).

19. Shri S.N. Sinha

Director General,
(Road Development)
Ministry of Transport &
Shipping, New Delhi.

Planning Commission:

20. Dr. B.D. Nag Chaudhuri

Member (Education),
Planning Commission,
New Delhi.

Parliament of India
Lok Sabha

21. Shri R.D. Bhandare, M.P.

22. Shri Y. Gadilingana Gowd, M.P.

Rajya Sabha:

23. Shri C.D. Pande, M.P.

STATE GOVERNMENTS:

Andhra Pradesh

24. Shri T.R. Doss

Director of Technical
Education.

Assam

25. Shri J.B. Hagjer

Minister for Education,
Assam.

Gujarat

26. S-hri P.S. Kalwachwala Director of Technical
Education, Gujarat.

Jammu & Kashmir:

27. Shri Tirath Ram Additional Secretary to
Government Higher & Technical
Education, Government of
Jammu & Kashmir, Srinagar.

Kerala:

28. S-hri K.C. Chacko Director of Technical
Education

Maharashtra:

29. Shri R.S. Kenkre Joint Director of
Technical Education.

Madhya Pradesh:

30. Shri K.L. Mehta Deputy Minister of Education,
Madhya Pradesh.

Madras:

31. Shri T. Muthian Director of Technical
Education.

Nagaland :

32. Shri K. Jethro Angami Assistant Director of
Education.

Orissa:

33. Shri Harihar Patel Minister for Industries,
Orissa.

Punjab:

34. Shri Kewal Krishan Director of Technical
Education.

Rajasthan:

35. Shri S.P. Datta Director of Technical
Education.

Uttar Pradesh:

36. Shri D.N. Joshi

Director of Technical Education

West Bengal:

37. Shri B. Datta

Secretary,
Education Department.

UNION TERRITORIES:

Chandigarh:

38. P-rof .R.C. Sharma

Head of Civil Engineering
Department, Punjab Engineering
College, Chandigarh.

Himachal Pradesh:

39. Shri V.R. Vaish

Secretary (Technical
Education).

Tripura:

40. Shri Krishnadas
Bhattacharjee.

Minister for Education,
Tripura.

INDUSTRY AND COMMERCE:

All India Organisation of
Industrial Employers

41. S-hri B. Maitra

Calcutta Chemical Co. Ltd.,
Calcutta.

42. Prof. M.P. Gandhi

M.P. Gandhi & Co., Bombay.

Federation of Indian Chambers
of Commerce and Industry

43. Shri B.P. Poddar

18, Rabindra Sarani,
Calcutta.

44. Shri V.D. Jhunjunwala

6-C, Short Street,
Calcutta.

LABOUR:

Indian National Trade
Union Congress:

45. Shri V.G. Gopal

K. Road, Jamshedpur.

46. Shri Manohar Bandiwdekar

Laxmi Niketan, 111, Hindu
Colony, Dadar, Bombay-14.

All India Trade
Union Congress:

47. Shri V.N. Ghanekar

Kamla Kuti,
128, Bhandar Guli,
Mahim, Bombay-16.

PROFESSIONAL BODIES:

Institution of Engineers
(India), Calcutta:

48. Prof. P.J. Madan

Pro-Vice-Chancellor,
M.S. University, Baroda.

Indian Institute of
Architects, Bombay

49. Shri Homi N. Dallas

Medows House,
Medows Street, Bombay.

Indian Institute of Chemical
Engineers, Calcutta.

50. Dr. C.R. Mitra

Director, Harcourt Butler
Technological Institute,
Kanpur.

Aeronautical Society of
India, New Delhi.

51. Prof. C.V. Joga Rao

Department of Aeronautical
Engineering, Indian Institute
of Science, Bangalore.

Mining, Geological Metallurgical
Institute, Calcutta.

52. Shri G.S. Marwaha.

Director, Mines Safety,
Eastern Zone, P.O. Sitarampur,
Distt. Burdwan,
West Bengal.

Indian Institute of Metals,
Calcutta:

53. Dr. D.P. Antia.

Member, Council of the
Indian Institute of Metals,
Calcutta.

Indian Society of Agricultural Engineers

54. Prof. C.V. Paul

Head of Agricultural Engineering Department, Allahabad Agricultural Institute, Naini, Allahabad.

Institution of Surveyors, New Delhi

55. Shri P.N. Gadi

B-5, Lajpat Raj Road, Jangpura Extension, New Delhi.

Institution of Town Planners, New Delhi

56. Shri T.J. Manickam

Director, School of Planning & Architecture, New Delhi

Nominees of Government of India

57. Dr. S.R. Sen Gupta

18, Lake Town, Block-B, Calcutta-28

University Grants Commission:

58. Dr. D.S. Kothari
(Ex-officio)

Chairman,
University Grants Commission,
New Delhi.

59. Dr. S.K. Das Gupta

Development Officer,
University Grants Commission,
New Delhi.

National Institute of Sciences of India

60. Dr. H. Trivedi

7, Laxman Bagh,
Nawab Ganj, Kanpur.

National Council for Rural Higher Education.

61. Shri D.J. Hatekar

Principal,
Rural Institute, Wardha.

National Productivity Council:

62. Shri B.N. Bhattasalli

Executive Director,
National Productivity Council
New Delhi.

Inter-University Board
of India:

63. Dr. A.S. Adke

Vice-Chancellor,
Karnatak University,
Dharwar.

Association of Principals
of Technical Institutions(India)

64. Prof. R.N. Dogra,

Director, Indian Institute
of Technology, Hauz Khas,
New Delhi-29.

65. Shri G.R. Damodaran

Principal, P.S.G. College
of Engineering & Technology,
Peelamedu, Coimbatore.

Member-Secretary:

66. Shri L.S. Chandrakant.

Joint Educational Adviser
(Technical), Ministry of
Education, New Delhi.

The following attended the meeting as Special invitees:-

1. Shri D.P. Nayar

Planning Commission.

2. Dr. A. Ramachandran

Director, Indian Institute
of Technology, Madras.

Shri T.C. Ajmani, Shri D.V. Narasimham, Shri G.N. Vaswani
and other officers of the Technical Division were present.

The following members were unable to attend:

Chairmen of the Regional
Committees of the Council:
(Ex-officio)

Eastern Regional Committee:

1. Shri J.J. Ghandy.

Director, Tata Sons Private
Ltd., Jamshedpur.

Western Regional Committee:

2. Shri Arvind N. Mafatlal

Mafatlal House,
Backbay Reclamation, Bombay.

Chairmen of the All India
Boards of Technical Studies:
(Ex-officio)

Post-graduate & Research:

3. Prof. M.S. Thacker

4, Kushak Road, New Delhi.

Textile Technology:

4. Dr. N.M. Swani

Prof. of Textile Technology,
Indian Institute of
Technology, New Delhi.

Applied Art:

5. Prof. V.N. Adarkar.

Director of Art,
Maharashtra State,
Bombay-1.

Management:

6. Shri J.J. Ghandy

Director, Tata Sons
Private Ltd., Jamshedpur.

Representatives of Ministries/
Departments of Govt. of India:

Food, Agriculture, Community
Developments and Cooperations:

7. Dr. O.P. Gautam

Deputy Director General,
Indian Council of
Agricultural Research.

Ministry of Steel, Mines
and Metals: (Deptt. of
Iron & Steel).

8. Shri Maheshwar Prasad

Director,
Department of Iron and Steel

Railways (Railway Board)
(Ex-officio)

Director, Mechanical
Engineering (Production),
Railway Board.
New Delhi.

Industrial Development &
Company Affairs (Department
of Industrial Development).

10. Dr. R.D. Kalelkar.

Director General of Technical
Development, Department of
Industrial Development.

Tourism and Civil Aviation:

11. Shri S. Ramamritham.

Deputy Director General,
Civil Aviation Directorate.

Works, Housing and Supply:

12. Shri P.K. Sen.

Joint Secretary,
Deptt. of Works & Housing.

Department of Communications:

13. Shri C.P. Vasudevan.

Member (T.D.), Department
of Communications,
P. & T. Board.

Department of Atomic Energy:

14. Shri H.N. Sethna.

Director,
Bhabha Atomic Research
Centre, Bombay.

STATE GOVERNMENTS:

Bihar:

15. Shri S.N. Sharma

Director of Technical
Education.

Mysore:

16.

Minister of Education,
Mysore.

Haryana:

17.

Minister-in-charge,
Technical Education,
Haryana.

UNION TERRITORIES:

Delhi

18. Executive Council-in-charge,
Technical Education,
Delhi Administration.

Goa, Daman and Diu:

19. Dr. P.S. Varde. Director of Education and
Additional Secretary.

Manipur:

20. Seat vacant.

Pondicherry:

21. Shri S.Manickavachagan. Minister of Education,
Pondicherry.

INDUSTRY & COMMERCE:

Associated Chambers of
Commerce and Industry:

22. Shri S.K. Datta General Manager,
Burn & Co. Ltd., Howrah.
23. Shri Pratap Singh M/s Vissanji Sons & Co.,
Mathuradas. 9, Wallace Street, Bombay.

Employers Federation of India:

24. Prof. G.M. Nabar Director, Department of
Chemical Technology,
University of Bombay.
25. Shri G.Y. Mangrulkar Tata, Iron & Steel Co. Ltd.,
Staff Training Institute,
Jamshedpur.

LABOUR:

Hind Mazdoor Sabha:

26. Shri Shanta Ram S. Secretary, Steel, Mazdoor
Tawade. Sabha, Bombay.

PROFESSIONAL BODIES:

Institution of Tele-
Communication Engineers:

27. Dr. P.K. Kapre

Industrial Director,
Philips India Ltd.,
New Delhi.

Lalit Kala Akademi:

28. Shri N.S. Bendre

10, Kala Nagar,
Bandra East, Bombay.

All India Management
Association:

29. Mr. A.K. Sen.

Managing Director, All India
Management Association,
Calcutta.

Nominees of Government:

30. Dr. S. Dhawan.

Director, Indian Institute
of Science, Bangalore.

Council of Scientific and
Industrial Research
(Ex-officio)

31.

Director General,
C.S.I.R., New Delhi.

Central Advisory Board
of Education

32. Dr. Vikram A. Sarabhai

Chairman,
Atomic Energy Commission
and Secretary,
Department of Atomic
Energy, Bombay.

The Union Education Minister (Dr. Triguna Sen), and Chairman, All India Council for Technical Education welcomed the members. In his address, the Chairman referred to the atmosphere of uncertainty about the economic development of the country in which the Council was meeting and the critical problems that had arisen as a result of the postponement of the Fourth Five Year Plan. He stated that unemployment among engineering graduates and diploma-holders that had been practically unknown till about two years ago had become serious and large numbers of them were in great distress. The financial resources for education in general, and for technical education in particular, that were never too big in the past years, had

become still meagre and, as such, it was increasingly difficult for the All India Council to press on with the various projects and programmes that were already on the ground. He suggested that the conference should take stock of technical education in this difficult situation and find new directions for its development and improvement.

The Chairman outlined the various measures that the Central Government had formulated to solve unemployment among technical personnel. He referred, in particular, to the expanded programme of practical training for graduates and diploma-holders under which over 5,000 training places had been secured. He requested the Council to take a long-term view of the problem and project the efforts over the next 10-year period. He suggested that the Central Government and State Governments should take full advantage of the present situation to consolidate technical education and improve its standard and quality. To that end, a rational and coordinated plan of restricting admissions to technical institutions that did not have adequate instructional facilities should be formulated and implemented. As for the measures needed for qualitative improvement, the Chairman emphasised the importance of faculty development through in-service and pre-service training programmes, inter-institutional cooperation, equipping serving teachers with industrial experience and curriculum development, preparation of textbooks and other instructional materials. In this connection, he made a strong plea to the Institutes of Technology and other centres of advanced study to undertake programmes of quality improvement that could reach out to engineering colleges and polytechnics in their respective areas. He also suggested that the polytechnic diploma courses should be re-organised and functionally oriented towards training the correct type of technicians needed by industry. To that end, he pleaded for selecting the right type of candidates for diploma courses with adequate training in technical skills, diversification of subject-fields in relation to industrial needs, organising cooperative engineering programmes with industry and practical training for diploma-holders in industry. He concluded by explaining that the consolidation of technical education demands that we should continuously discover the ends and means of technical education to produce an engineer or technician both for today's needs and to meet the challenges of tomorrow. The products of our technical institutions must become better employable than they have been so far. More, we should make them self-reliant and capable of carving out a place for themselves in the sun through their own efforts. He emphasised that the business of good technical education is accomplished only when a prospective employer seeks an engineer or technician from our institutions and offers him opportunities of first-rate professional work.

The full text of the address of the Chairman is given at Annexure-I.(Not attached)

In the course of a general discussion that followed, the members supported the suggestion of the Chairman to restrict admissions to technical institutions on a selective basis, and make a deliberate effort to improve standards and quality. They suggested that, with the pressure of numbers reduced, we should optimise the utility of instructional and other facilities created in technical institutions. The other important suggestions made by the members included organised practical training for technical students, exchange of technical personnel between industry and institutions, vocationalising secondary education and extension of the provisions of the Apprenticeship Act to students of technical, vocational schools, formation of engineers' cooperatives, manufacture of scientific and technical equipment within the country, organising refresher courses for persons in industry and encouraging Indian engineering consultancy services.

The Council then proceeded to consider the agenda together with the recommendations of the Coordinating Committee.

Item No.1: Confirmation of the minutes of the 18th meeting of the Council held on 22nd July, 1966.

....

The All India Council confirmed the minutes of the 18th meeting subject to the corrections indicated in the agenda papers.

Item No.2: To report the membership of the reconstituted Council.

....

Noted.

Item No.3: To nominate a representative of the Council on the General Council of the Institute of Applied Manpower Research.

.....

The All India Council approved the recommendation of its Coordinating Committee that Shri G.Y. Mangrulkar, Chief, Management Planning and Development, Tata Iron & Steel Company Ltd., Jamshedpur be nominated as its representative on the General Council of the Institute of Applied Manpower Research.

Item No.4: To nominate representatives of the Council on the re-constituted Western Regional Committee, Southern Regional Committee and Northern Regional Committee.

.....

The Member-Secretary announced that the following members had been unanimously elected to represent the All India Council on the Regional Committees:-

(i) Western Regional Committee:

Shri Homi N. Dallas,
Meadows House, Bombay.

(ii) Southern Regional Committee:

Prof. C.V. Joga Rao,
Deptt. of Aeronautical Engineering,
Indian Institute of Science,
Bangalore.

(iii) Northern Regional Committee:

Dr. C.R. Mitra,
Director,
Harcourt Butler Technological Institute,
Kanpur.

Item No.5: To report on action taken on the recommendations/decisions of the All India Council at its 18th meeting.

(1) Procurement of equipment for engineering institutions.

The All India Council noted that the Institutes of Technology, Indian Institute of Science, Bangalore and other engineering institutions had started work on the design and fabrication of laboratory apparatus and equipment. The All India Council decided that a detailed report should be obtained quickly from all these institutions on the progress made so far, and considered at the next meeting. It was also decided that the report should be circulated to other engineering institutions.

(2) Formulation of a draft Fourth Five-Year Plan for Technical Education and role of industry in faculty improvement in technical institutions.

.....
The All India Council noted that, since the Fourth Five-Year Plan had been deferred, no meeting of the Committee

could be held. A new Fourth Plan would be formulated and implemented from 1969 and, to that end, draft guidelines had been prepared in consultation with State Governments and other authorities.

(3) Development of Diploma Course in Commercial Practice:

The All India Council noted that the Regional Committees had processed several schemes for introducing a Diploma Course in Commercial Practice in polytechnics and other institutions in their respective areas. It was decided that the Secretariat should prepare a detailed report on the progress of the schemes and place it before the Council at its next meeting.

(4) Training of Chemical Operators

The Council noted that the Western Regional Committee was examining certain proposals for starting centres for training chemical operators in its region in cooperation with industry. The Council also noted that two centres in Southern region and two centres in eastern region had started functioning for training chemical operators.

The All India Council decided that the Regional Committees in consultation with industry, may revise/reformulate the course for training chemical operators and wherever necessary, institute the course as a regular diploma course at the polytechnic level.

(5) Practice School for Students of Chemical Engineering.

The All India Council approved the recommendation of its Coordinating Committee that institutions that were interested in conducting practice schools in chemical engineering should be permitted to do so with adequate flexibility to adapt their training programme to suit industry and their course content.

(6) Teaching of Soil and Water Conservation in Engineering Colleges.

The All India Council noted that the names of experts furnished by the Ministry of Irrigation and Power had been circulated by the Secretariat to all technical institutions.

(7) Training of Teachers of Regional Schools of Printing and Art Schools.

The All India Council approved the recommendation of its Applied Art Board regarding summer schools and in-service training programmes for teachers of printing schools and art schools, and requested the Association of Principals of Technical Institutions to conduct the programmes.

(8) Revised Qualifications for Polytechnic Teachers

The All India Council approved the recommendation of its Coordinating Committee that the qualifications for polytechnic teachers be revised according to the recommendations of the Seven-man Committee as under item No.15 of the agenda.

(9) Establishment of an Institute of Industrial Design

The All India Council approved the suggestion of the Ministry not to start a separate institute at this stage, but to make a beginning with training in this field at the Indian Institute of Technology, Powai, Bombay.

(10) Recommendations made by the Education Commission on Vocational & Technical Engineering and other related aspects of education.

The All India Council noted that the report of the Seven-man Committee would be dealt with under item No.15 of the agenda.

(11) Pay-scales of teachers in technical institutions.

The All India Council noted that this matter would be considered under item No.15 of the agenda regarding recommendations of the Seven-man Committee.

(12) Note from the Planning Commission regarding the purpose and quality of diploma course.

The All India Council noted that specific recommendations had been made by the Conference of Directors of Technical Education for diversifying and re-organising diploma courses under the Fourth Five-Year Plan.

(13) Uniform scales of fees for degree and diploma Institutions.

The All India Council noted that the Mudaliar Committee had met on the 22nd May, 1968 and submitted its report.

The All India Council endorsed the following recommendations of the Mudaliar Committee:-

"Although a uniform grant-in-aid code for all States would not be practicable, there should be for each State a well defined Code to govern all private institutions in that State. The State grant-in-aid code should be formulated on the basis of the following general principles:-

- (i) The entire deficit in the recurring expenditure after taking into account the income from tuition fees, contributions by private managements and other sources should be met by the State Governments. The quantum of contributions by private managements may not necessarily be uniform. Nevertheless, it is essential that the quantum of these contributions should be settled at the time of establishment of the institution concerned;
 - (ii) In assessing the expenditure of an institution, it should be ensured that the admissible items are generally according to the standards prescribed by the All India Council for Technical Education and its Regional Committees;
 - (iii) As regards fees, the institutions should not charge more than those prescribed for State Government institutions or 25 per cent of the approved gross expenditure. The scale of fees should normally be according to the recommendations of AICTE, viz., tuition fees of Rs.360/- for engineering colleges and Rs.180/- for polytechnics and special fees of Rs.40/- both for colleges and polytechnics;
- (14) Requirement of Compulsory Service by the State Governments in respect of students admitted to the institutions in the State.

.....

Shri Mchta, Deputy Education Minister, Madhya Pradesh informed the Council that his State had accepted the recommendations to waive bonds being executed by entrants to technical institutions to serve the State as a condition of admission.

Item No.6: To receive a report on the Development Programmes approved by the Chairman on behalf of the Council since the last meeting.

.....

Noted.

The All India Council also noted that part-time degree courses had been started at the SV Engineering College, Bombay, and arrangements were in progress to start a similar course at the Bihar Engineering College, Patna.

Item No.7: To receive a note on the three annual Plans for Technical Education for the years 1966-67, 1967-68 and 1968-69.

.....

Noted.

The All India Council also noted that, to consolidate technical education and improve standards and quality, the Central Government had formulated a scheme for rational adjustment of admissions to engineering institutions on the basis of instructional facilities available and, under the scheme, proposals had been made to restrict admissions to certain institutions where increased admissions had been proposed earlier.

Item No.8: All India Boards of Technical Studies.

A. Matters for Report:

I. Applied Art Board.

(i) Additional facilities for diploma courses in printing technology.

The All India Council approved the recommendation of its Applied Art Board that each Regional School of Printing should be provided with additional equipment facilities at an estimated cost of Rs.2,91,000/-.

(ii) Examinations.

The All India Council agreed with its Coordinating Committee that the recommendation of the Applied Art Board for empowering selected art institutions to conduct their own examinations be referred to the State Governments concerned for their consideration.

(iii) Correspondence Courses in Printing Technology.

The All India Council agreed with its Coordinating Committee that the time had not yet come when correspondence courses in printing technology were needed.

B. Matters for Decision:

(a) Scholarships.

The All India Council approved the recommendation of its Applied Art Board that a few post-graduate scholarships of the value of Rs.250/- be instituted at selected art institutions for advanced studies and research.

(b) Summer Schools for Art Teachers.

The All India Council approved the recommendation of its Applied Art Board that summer schools for art teachers should be organised and requested the Association of Principals of Technical Institutions to formulate a suitable programme and implement it.

(c) National Intermediate in Applied Art.

The All India Council approved the recommendation of its Applied Art Board that no separate certificate designated as "National Intermediate in Applied Art" should be awarded after the preparatory stage, nor should any public examination be held at the end of that stage. The All India Council also endorsed the recommendation of its Coordinating Committee that art institutions should conduct short-term functional courses in different fields of art, depending upon the need for such courses in their respective areas.

(d) Orientation Programme for Art Teachers

The All India Council approved the recommendation of its Applied Art Board regarding an orientation programme for art teachers, and recommended that the programme be organised as soon as practicable at well established art schools. The All India Council also decided that the estimates for such a programme should be according to the standards laid down for summer institutes.

II. Architecture Board.

A. Matters for Report.

The All India Council approved the following recommendations of its Architecture Board:-

- (i) Final recognition of Diploma in Architecture awarded by the Government College of Fine Arts and Architecture, Hyderabad.
- (a) Admission should be open to students who have passed the qualifying examination, not less than the higher secondary or its equivalent, with at least 50 per cent marks. Such eligible candidates should be subjected to an aptitude test as a result of which admission should be made strictly on merit. Admission to higher classes should ~~not~~ be automatically granted to the students passing the Architectural Assistantship Course from the Women's Polytechnic;
- (b) The State Government should make available to the Institute a non-recurring grant of Rs.50,000 and a recurring grant of Rs.25,000 for three years to enable it to have a suitable library;
- (c) The salary scales of the Principal and the Professors as well as other teachers should be at par with those of corresponding posts in government engineering colleges in Andhra Pradesh;
- (d) The provisional recognition granted to the diploma may continue and the question of final recognition should be considered only after the above mentioned conditions have been fulfilled.
- (ii) Recognition of two-year part-time course in Town and Regional Planning conducted at the B.E. College, Calcutta.

The All India Council approved the recommendation of its Architecture Board that the present two-year part-time diploma course in town planning conducted at the Bengal Engineering College, Sibpur should be re-placed by a full-time two-year diploma course to train town planners of the correct standard.

As for the recommendation of the Board that a separate three-year part-time course (of which the last year should be on a full-time basis) be instituted at the College, the Council decided that the matter should be re-examined by the Board in view of the practical difficulties that might arise in conducting a course of that type.

- (iii) To review Architectural Assistantship Course

The All India Council approved the recommendation of its Architecture Board regarding reorganisation and development of Diploma Course in Architectural Assistantship. The

Council, however, agreed with its Coordinating Committee that the syllabus of the course as formulated by the Architecture Board should be regarded only as a model and not enforced rigidly. The State Boards of Technical Education should be free to adopt or adapt the syllabus subject to the condition, however, that the minimum standards visualised in the scheme were safeguarded.

(iv) Recommendations of the Town Planning Ministers' Conference on the expansion of training facilities in town planning.

The All India Council agreed with its Coordinating Committee that, since a precise estimate of the demand for town planners has yet to be made in the context of the revised Fourth and Fifth Plans, we should proceed cautiously in expanding training facilities in this field. Our efforts should be concentrated on consolidating the present institutions and improving their quality and standard.

The All India Council further recommended that the existing institutions conducting town planning courses should be treated as all-India institutions for the purpose of admission of students from every part of the country.

The All India Council noted that, on the recommendation of its Western Regional Committee and Architecture Board, the town planning course now conducted at the Poona Engineering College, would be shifted to the J.J. School of Architecture, Bombay.

In view of the importance of traffic engineering and related problems, the All India Council asked its Architecture Board and Engineering Board to examine the question of conducting training courses in this field at selected institutions.

B. Matters for Decision:

(i) S-cheme and Syllabus for organising a Course in Valuation of Lands & Buildings.

The All India Council approved in principle the scheme for training in valuation of lands and buildings as formulated by its Architecture Board. As for organising facilities for training in this field, the All India Council endorsed the recommendation of its Coordinating Committee that the Regional Committees and State Governments should examine the precise needs in their respective areas, and formulate schemes for instituting the course in suitable technical institutions. The All India Council further endorsed the recommendation of its Coordinating Committee

that training in this field should be for the examinations of the Institution of Surveyors and no separate degree or diploma or certificate should be awarded either by universities or by State Boards.

The All India Council requested its Architecture Board to examine the question of whether training in quantity surveying should be included in the above scheme.

(ii) Practical Training for Students of architectural courses.

The All India Council agreed with its Coordinating Committee that practical training for architectural students in an architect's office was important, but it was not necessary for each architectural school to have a separate training officer for the purpose. It was decided that a member of staff of an architectural school may be designated as the training officer, if necessary, to look after the practical training programme of the students.

(iii) Organising a Certificate Course in Town Planning.

The All India Council agreed with its Coordinating Committee that the need for organising a certificate course in town planning according to the scheme formulated by the Architecture Board should be examined by each Regional Committee in consultation with the State Governments concerned. Wherever such training was needed, it should be organised at institutions that are conducting diploma courses in town planning.

III. Chemical Engineering Board

A. Matters for Reports

(i) Expansion of Training Facilities in Chemical Engineering.

The All India Council agreed with its Chemical Engineering Board that till firm estimates of the demand for chemical engineers were available, no further expansion at the degree level should be undertaken at this stage.

The All India Council also recommended that special efforts should be made by the Regional Committees in consultation with State Governments and industry, to extend the programme of training for chemical operators according to the needs of industry.

(ii) Training of Teachers in Chemical Engineering

The All India Council agreed with its Board of Chemical Engineering Studies that special efforts be made by Chemical Engineering Institutions to recruit suitable candidates against their present vacancies of staff, and send them for training under the Technical Teachers' Training Programme. Further, the rules of the training programme should be made flexible enough to admit sponsored candidates without insistence on his possessing a first division or at least 60 per cent marks in their degree examination.

(B) Matters for Decision:

(i) Practice Schools for Chemical Engineering Students.

The All India Council agreed with its Coordinating Committee that chemical engineering institutions may formulate their own schemes for practice schools in cooperation with industry with sufficient flexibility to suit local conditions and course content. Further, the estimates of cost of the schemes should be within reasonable limits, not in excess of the usual per capita expenditure for post-graduate studies.

The All India Council decided that the scheme received from the Harcourt Butler Technological Institute be processed by the Secretariat according to the above principles.

IV. Commerce Board

A. Matters for report

(i) Syllabus for M.Com. Degree Course.

Noted.

(ii) Proposal of Andhra University regarding M.Com.(Hons) Degree by Research.

The All India Council endorsed the recommendation of its Commerce Board that the institution of the M.Com. (Hons) degree by research was not necessary.

(iii) Proposal of Allahabad University for the change in nomenclature of commerce degrees from B.Com. and M.Com. to B.Sc.(Com)& M.Sc.(Com)

The All India Council endorsed the recommendation of its Commerce Board that there was no need to change the nomenclature of commerce degrees.

(iv) Relaxation in the practical training prescribed for the award of National Diploma in Commerce

The All India Council approved the recommendation of its Commerce Board that relaxation in the prescribed period of practical training up to three months may be permitted in individual cases according to the merit of each case.

IV. Commerce Board (Addendum to Agenda).

A. Matters for Report.

The All India Council noted the general principles laid down by the Commerce Board for the formulation of research schemes in Commerce by universities and other institutions.

The All India Council also noted that the Chairman of the Commerce Board, Prof. Mathur, had agreed to co-opt Prof. M.P. Gandhi as a member of the Research Committee.

B. Matters for Decision

(i) Research in Commerce

The All India Council endorsed the recommendation of its Commerce Board that according to the report of the Rao Committee, the development of commerce education at the Master's Degree level in universities and research in this field should be regarded as a professional subject and, for that purpose, a special allocation should be made in the Fourth Five-Year Plan for giving assistance to commerce faculties of selected universities.

To make a beginning with research in commerce, the All India Council endorsed the recommendation of its Commerce Board that an annual allocation of Rs.5 lakhs be made.

(ii) Syllabus for M.Com. Degree Courses.

The All India Council approved the outlines of the syllabus for the M.Com. degree course as formulated by the Board.

(iii) B.Com. Education Degree of Regional Colleges of Education.

The All India Council approved the recommendation of its Commerce Board that the B.Com. Education Degree awarded to the students of the Regional Colleges of Education at Mysore, Ajmer, Bhopal and Bhubaneswar be recognised for those teaching posts for Diploma in Commercial Practice that require trained commerce graduates, but for which a Master's Degree in Commerce is not a necessary qualification.

V. Engineering Board

(A) Matters for Report

(i) Introduction of new courses
at diploma level

The All India Council approved the recommendation of its Coordinating Committee that, in view of the need to diversify diploma courses and orient them functionally to industrial needs, our polytechnics should be free to institute diversified courses in different branches of engineering and technology both at the diploma and post-diploma stages according to the felt needs of industry for technicians in their respective areas. The diversified courses should also include agro-industries and engineering work in rural areas for which there is considerable potential. The All India Council also decided that the precise fields of diversification should be identified by the Regional Committees and State Boards of Technical Education in consultation with industry in their respective areas. Technical institutions should be encouraged to have a dialogue with industry to identify the needs of the latter. The Council emphasised the need to maintain the minimum standards for diploma courses even in diversified subjects.

(ii) Facility to private students to take
diploma examination in engineering

The All India Council approved the recommendation of its Coordinating Committee that a State Board of Technical Education may permit private students to appear for its diploma examinations subject to the following conditions:-

- (a) The students concerned should be working in engineering occupations and should possess a minimum number of years of practical experience before appearing for the examination;
- (b) The State Board should appoint a panel of inspectors to inspect the organisations where such candidates are working and certify about the bona fides of their practical experience;
- (c) The permission to sit for a particular examination should be restricted to candidates working in the State concerned, and not extended to students working in other areas.

(iii) Teaching of Timber Engineering in Engineering Colleges

The All India Council endorsed the recommendation of its Engineering Board that, wherever necessary, a short-term specialised course in timber engineering may be conducted by the Forest Research Institute, Dehra Dun for those candidates who are interested in undergoing training in this field.

(iv) Award of Certificates in National Intermediate Examination in Civil, Electrical and Mechanical Engineering

The All India Council approved the recommendation of its Engineering Board that there was no need to award National Intermediate Certificates in Engineering.

B. Matters for Decision

- (i) To consider the question of continuation or otherwise of the three-year degree courses in Civil, Mechanical and Electrical Engineering for science graduates

The All India Council generally endorsed the recommendation of its Engineering Board that, wherever an institution is conducting a conventional 4-5 year integrated course in civil, mechanical and electrical engineering, it should not conduct a parallel course of three years' duration for science graduates in the same fields. The All India Council, however, agreed with its Coordinating Committee that certain well established institutes like the Institutes of Technology and university departments of engineering, that have adequate resources should undertake on experimental basis, engineering courses for first-class science graduates to produce engineers with better scientific equipment for research, design and other types of creative work. In order to consider this question in detail and to make specific recommendations for the **Institutes** of Technology, the All India Council authorised the Chairman to set up an expert committee.

- (ii) To consider the proposal of the Government of Maharashtra for introducing new courses at post-diploma level.

The All India Council agreed that, in the context of diversifying diploma courses, State Boards of Technical Education be permitted to institute diploma courses in specialised branches of engineering and technology in relation to the felt needs of industry for technicians.

VI. Textile Technology Board

B. Matters for Decision

(i) Organising a diploma course in textile design

The All India Council approved the scheme of diploma course in textile design as formulated by its Textile Board. It was, however, decided that the scheme should be regarded purely as a model and it should be adopted or adapted in individual institutions according to the needs of industry.

As for the centres where the course should be conducted the All India Council decided that the Regional Committees should select suitable institutions in consultation with State Governments and industry and according to the demand for trained personnel in their respective areas.

The All India Council also decided that the estimates as prepared by the Textile Board for the scheme should be vetted by the Regional Committees to bring them down to reasonable limits.

VII. Management Board (Addendum to item No.8)

A. Matters for report

(i) M.B.A. Course in Management

The All India Council approved the recommendation of its Management Board that Delhi University be selected as a centre for full-time M.B.A. degree course.

(ii) US-AID programme of assistance to the development of Management Education.

The All India Council noted that, because of inadequate funds, USAID had not been able to accommodate assistance to Bombay and Delhi Universities for management courses in this year's programme.

(iii) UGC Representation on the Management Board

The All India Council approved the recommendation of its Management Board that a representative of U.G.C. should be nominated on the Board and, to that end, the constitution of the Board should be suitably revised.

Item No.9: Regional Committees.

(A) Western Regional Committee

(i) Matters for report

Noted.

(ii) Matters for Decision

- (a) Revision of cost of furniture for polytechnics with 120 intake capacity.

The All India Council approved a ceiling of Rs. one lakh for furniture for polytechnics in the Western Region. It was further decided that the revised provision should apply only to new institutions to be established, if any.

(B) Southern Regional Committee.

- (a) Matters for Report

Noted.

- (b) Matters for Decision

The All India Council approved the proposals made by the Southern Regional Committee to encourage design and fabrication of scientific and technical equipment by technical institutions. The All India Council also decided that the other Regional Committees may formulate similar proposals.

The All India Council decided that the Regional Committees be requested to prepare an action programme to implement the scheme in selected institutions in their respective areas.

C. Eastern Regional Committee

- (i) Matters for Report

Noted.

D. Northern Regional Committee

- (i) Matters for Report

Noted.

- (ii) Matters for decision

- (a) Proposals to designate Secretary, Northern Regional Committee as Member-Secretary

The All India Council decided that the Regional Officers should be designated as member-Secretaries of their respective Regional Committees and the constitution of the Regional Committees should be amended accordingly.

Item No.10: To consider the question of holding a common admission test for technical institutions.

The All India Council endorsed the recommendation of the Inter-University Board that, as a practicable proposition, admission tests be held on a State-wise basis and the initiative for conducting these tests should be taken by the universities in that State, the actual manner of collaboration among universities being left to them and State Governments.

The All India Council endorsed the recommendation of the Coordinating Committee that, as and when a particular State holds an admission test, sufficient safeguards should be taken in respect of those students belonging to other States who seek admission to institutions in that State. For this purpose the performance of the students at the I.I.T. Admission Test plus their performance at the qualifying examination may be the basis of selection.

The All India Council also endorsed the recommendation of its Coordinating Committee that the first ten rank holders in Higher Secondary/Intermediate Board Examinations in each State should automatically be entitled to admission to engineering colleges or Institutes of Technology of their choice in any part of the country. As for universities conducting PUC or other qualifying examinations in a State, the total number of top rankers entitled to admission may not exceed 10 for the State as a whole and that number should be divided equitably between the students of the universities concerned.

Item No.11: To consider a note on Technical Vocational Education at the Secondary state.

The All India Council agreed with its Coordinating Committee that State Governments should be requested to consider the question of re-organising their junior technical schools, secondary technical schools and other vocational schools according to the draft scheme formulated by the Ministry. The State Governments would, however, be free to adopt or adapt the scheme to suit the local needs depending upon how they wish to vocationalise and terminalise secondary education according to the report of the Education Commission.

The All India Council further recommended that there should be close coordination between the Ministry of Labour and Ministry of Education at the Centre, and corresponding departments in the States in the implementation of the scheme, and particularly for certification of students for their trade skills and in-plant training under the Apprenticeship Act.

Item No.12: To consider a note on the situation arising out of large-scale unemployment among engineering graduates and diploma-holders in the country.

The All India Council noted that the Central Government, in consultation with the Planning Commission, had formulated

a series of measures to ease present unemployment among engineering graduates and diploma-holders. The measures included increasing practical training places for at least 5,000 graduates and diploma-holders; undertaking adequate preparatory work and investigatory work for various development projects, particularly for irrigation and power development; training technical personnel for the operation and maintenance of thermal power station; filling up technical vacancies in various organisations, particularly in the Defence Services; development of Indian consultancy organisations; encouraging engineers to set up small-scale industries; strict enforcement of contractual provisions requiring building contractors to employ qualified engineers; encouraging engineers to form cooperatives for undertaking construction work or for setting up repair and servicing facilities for agricultural machinery in rural areas; employment of engineers for marketing, sales and management in public service undertakings; drawing up rural development plans for water supply, sanitation and drainage with the help of engineers.

The All India Council also approved the proposal of the Central Government to reduce admissions to technical institutions in a rational and coordinated manner to improve standards and quality.

Item No.13: To consider a note on the formulation of the Fourth Plan for Technical Education.

The All India Council noted that, because of the changed circumstances since 1966, a new Fourth Five-Year Plan would be implemented from 1969 and, to that end, preparations were in progress to formulate the Plan.

The All India Council noted that a Conference of State Directors of Technical Education was held on 23rd May, 1968 to lay down the broad guidelines for the revised Fourth Plan. The All India Council endorsed the guidelines suggested by the Conference (Report attached).

Item No.14: To consider proposals received from State Governments and Ministries/Departments of the Govt. of India for development of technical education.

(A) Notes received from the Govt. of Andhra Pradesh

(i) Expansion and Development of Junior Technical Schools

The All India Council suggested that the State Government may re-organise their Junior Technical Schools as per the scheme and recommendations under item No.11 of the Agenda.

(ii) Revision of scales of pay of Physical Directors in technical institutions

The All India Council agreed with its Coordinating Committee that the posts of Physical Instructors/Directors in technical institutions should be treated as members of

teaching staff, and their pay-scales should be the same as those recommended by University Grants Commission for similar posts in universities.

(B) Note received from the Govt. of Assam

Qualifications for Junior Instructors in Diploma Institutions in Engineering.

The All India Council noted that the qualification of diploma in engineering prescribed for Junior Instructors/ Demonstrators was only for those posts that were on the teaching side, and not for Instructors in Workshops. For workshop Instructors, the prescribed qualification was ITI Certificate or appropriate competency in the particular trade. The All India Council suggested that the Secretariat may send the necessary clarification to the Assam Govt.

(C) Notes received from the Government of Kerala

(i) Higher Institute of Technology at Cochin

The All India Council agreed with its Coordinating Committee that there was no need to establish any new institute of technology in the Fourth Five-Year Plan, but selected and well-established engineering colleges should be up-graded and assisted for advanced studies and research in engineering and technology comparable to the Institutes of Technology. As for selecting an engineering college in Kerala for the purpose, the All India Council recommended that the Central Government may consider the matter at the appropriate stage.

(ii) Equipment position in technical institutions in Kerala State

The All India Council was informed by the Secretariat that the requirements for equipment for technical institutions in Kerala had been covered under the US-12-million-dollar loan.

(iii) Post-graduate Courses in engineering and technology in Kerala

The All India Council agreed with its Coordinating Committee that the present post-graduate courses should be consolidated and their standards improved before proliferating such courses at other places with the risk of fall in standard.

(iv) Re-organisation of Junior Technical School Courses

The All India Council recommended that the State Government may re-organise their Junior Technical Schools according to the scheme formulated and recommendations made under item No.11.

(v) Diploma Courses in Fisheries Technology

The All India Council agreed with its Coordinating Committee that Fisheries Technology should be accepted as a diversified subject at the diploma level and facilities for training in that field should be organised at selected polytechnics according to local needs.

(vi) Starting Aeronautical Engineering Course at the College of Engineering, Trivandrum

The All India Council agreed with its Coordinating Committee that no new centre for training in aeronautics should be opened till a firm indication was available from the industry regarding its requirements for technical personnel in this field.

(vii) Pre-Vocational Courses

The All India Council agreed with its Coordinating Committee that the State Government may organise pre-vocational courses in Junior Technical Schools/Secondary Technical Schools if there was a clear need for such training in that State.

(D) Notes received from the Government of Madhya Pradesh

(i) Establishment of a new engineering college at Ujjain

The All India Council agreed with its Coordinating Committee that the question of approving the Ujjain College for central assistance should be considered only after the revised Fourth Five-Year Plan had been formulated.

(ii) Junior Technical Schools.

The All India Council recommended that the State Government may consider the question of reorganising their Junior Technical Schools according to the revised scheme formulated by the Ministry, and recommendations made under item No.11.

(E) Notes received from the Govt. of Madras

- (i) Establishment of the polytechnics in collaboration with industry under private sector in Madras State

Noted.

- (ii) To consider the question of sanctioning 50 per cent grant (within the State Plan) and 50 per cent loan (outside State Plan) by the Government of India for the construction of staff quarters in technical institutions in Madras State

The All India Council agreed with its Coordinating Committee that the proposal should be considered by the Central Government while laying down the pattern of Central assistance for the revised Fourth Plan.

- (iii) To consider the question of sanctioning 50 per cent grant (within the State Plan) and 50 per cent loan (outside the State Plan) by the Government of India for the construction of students hostel in technical institutions in Madras State

The All India Council agreed with its Coordinating Committee that the proposal should be considered by the Central Government while formulating the pattern of Central assistance for the revised Fourth Five-Year Plan.

(F) Notes received from the Government of Uttar Pradesh

- (i) (a) Medium of Instruction and Examination

The All India Council noted that the policy was to change the medium of instruction to regional languages as a deliberate attempt to improve standards and, as such, the change in the medium should only be brought about after adequate preparations had been made for textbooks, instructional materials and teachers.

- (i) (b) Provision of special grants by the Govt. of India for accelerating availability of textbooks and other teaching aids.

The All India Council agreed with its Coordinating Committee that the proposals made by the State Government

be considered under the overall programme of the Central Government for developing regional languages for educational purposes, particularly preparation of textbooks and other literature.

(ii) Future of Secondary Technical Schools

The All India Council recommended that the State Government may consider the question of re-organising their Junior Technical Schools according to the revised scheme formulated by the Ministry, and recommendations under item No.11.

(iii) Re-organisation of diploma courses to make them more industry-oriented and starting of sandwich courses

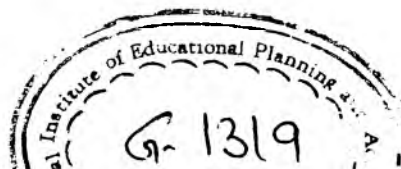
The All India Council noted that the suggestions of the State Government had been covered in the guidelines for the Fourth Five-Year Plan as formulated by the Conference of State Directors of Technical Education under item No.13.

(iv) Change in the pattern of part-time diploma courses.

The All India Council agreed with its Coordinating Committee that there should be no separate staff for part-time courses, but the staff of the institutions that are conducting both part-time and full-time courses should be adequately strengthened to cater for both courses.

(v) Revision of the equipment lists for the diploma courses.

The All India Council agreed with its Coordinating Committee that the equipment lists should only be treated as model lists and sufficient flexibility should be allowed to institutions to equip their laboratories and workshops provided that the limit of financial allocation



not exceeded. The All India Council also decided that the Regional Committees should periodically review the model lists and revise them wherever necessary.

(vi) Greater Provision for Construction of Staff Quarters

The All India Council noted that according to the present decision of the Planning Commission and Central Government, central assistance for construction of staff quarters could only be given according to the provision made by the States in their own plans for this item of expenditure. As for additional assistance to the States for staff housing, the All India Council suggested, that the matter be considered by the Central Government in consultation with the Planning Commission while formulating the pattern of central assistance for the revised Fourth Five Year Plan.

(G) Notes received from the Government of Pondicherry

(i) Establishment of Regional Polytechnics

The All India Council agreed with its Coordinating Committee that establishment of regional polytechnics was not necessary. The ultimate aim should be to develop polytechnics as standard institutions.

(iii) Introduction of "Earn-While-You-Learn" Scheme

The All India Council commended for the consideration of the State Government, the scheme formulated by the Western Regional Committee in collaboration with Saifi Foundation in Bombay, and suggested that the State Government may develop similar a scheme in co-operation with local entrepreneurs.

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The All India Council also decided that the Saifi Foundation scheme should be circulated to all other State Governments for information.

(H) Notes received from the Ministry of Health and Family Planning

The All India Council recommended that an under-standing of the problem of population explosion and related aspects be included as a part of the curriculum in general education in technical courses.

(I) Note received from Ministry of Labour, Employment and Rehabilitation

The All India Council noted that the detailed scheme had not yet been received from the Ministry of Labour (Department of Rehabilitation).

As for industrial technicians, the All India Council noted that recommendations had already been made for diversifying diploma courses in collaboration with industry.

(J) Note received from the Ministry of Works, Housing and Supply

The All India Council noted that this matter had been dealt with in detail under item No.8.

Item No.15: To consider the Report of the 7-Member Committee appointed to study the Education Commission's Report in detail and to submit report on the action to be taken on the recommendations made by the Commission in the field of technical studies.

The All India Council generally endorsed the recommendations of the Special Committee regarding different aspects of improvement and development of technical education. The All India Council recommended that the recommendations of the

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Committee should be worked up in the form of suitable schemes for inclusion in the revised Fourth Plan both in the States and at the Centre.

As for Junior Technical Schools, the All India Council recommended that the State Governments may consider the schools at the secondary stage according to the scheme formulated by the Ministry, and decisions under item No.11.

Question of re-organising their technical, vocational

As for the qualifications prescribed for the posts of Senior Instructors/Assistant Lecturers and Junior Instructors/Demonstrators in the report of the Special Committee, the All India Council agreed with its Coordinating Committee that the degree of Bachelor of Technology Education awarded to the students of Regional Colleges of Education at Mysore, Bhopal, Bhubaneswar and Ajmer should be recognised as an alternative qualification.

The All India Council also agreed with its Coordinating Committee that the qualifications and experience for the post of Workshop Instructors should be specified separately in terms of ITI certificate or junior technical school certificate or appropriate competency in the concerned trades.

Item No.16: To consider the schemes formulated in the Ministry for improving the quality and standard of technical education and training

The All India Council noted that the schemes had been considered in the Conference of State Directors of Technical Education on the 23rd May 1968 and the Conference had laid down broad guidelines for the preparation of the revised Fourth Plan.

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The All India Council recommended that, according to these guidelines, the State Governments may formulate specific schemes for improving the quality and standard of technical education in their respective Five-Year Plans.

Item No.17: Any other Business

Supplementary Agenda to Item No.17:

To consider a letter No.X-54 dated April 25, 1968 received from Shri M.P. Gandhi, regarding unemployment among engineering graduates and diploma holders.

The All India Council noted that for easing the present unemployment among engineers and technicians, the Central Government, in consultation with the Planning Commission had formulated specific measures.

As for the problem of student indiscipline, the All India Council decided that the matter should be examined in detail by the Coordinating Committee at its next meeting after obtaining the comments of Vice-Chancellors and other educational authorities.

The Chairman announced that the next meeting of the Coordinating Committee would be held on Saturday, the 24th August, 1968 and that of the All India Council for Technical Education on Saturday, the 7th December, 1968.

The meeting terminated with a vote of thanks to the Chairman moved by Prof. M.P. Gandhi and seconded by other members.

GUIDELINES FOR THE FOURTH FIVE-YEAR PLAN OF TECHNICAL EDUCATION
RECOMMENDATIONS OF STATE DIRECTORS OF TECHNICAL EDUCATION

Consolidation of technical institutions to improve their quality and standards, inservice training of technical teachers for their professional development, diversification of polytechnic diploma courses in cooperation with industry to train the correct type of technicians, practical training of graduates and diploma-holders, curriculum development, preparation of textbooks and instructional materials for degree and diploma courses, design and fabrication of laboratory apparatus and equipment and re-organisation of pre-service training of teachers were recommended as guidelines for the formulation of the Fourth Five-Year Plan by State Directors of Technical Education at their conference held on 23rd May 1968 in New Delhi. The Union Education Minister, Dr. Triguna Sen, presided. The Conference was attended by Directors of Technical Education from Andhra Pradesh, Assam, Madhya Pradesh, Orissa, Rajasthan, Madras, Kerala, Maharashtra, Gujarat, Uttar Pradesh, Punja-b, Mysore as also the officials of the Union Territories.

The State Directors agreed that there should be no further expansion of technical education because of the uncertainty about the future demand for engineers and technicians, and the present unemployment among technical personnel. They suggested that the efforts and resources of the Centre and States should be devoted mainly to consolidating the existing engineering colleges and polytechnics to improve standards and to produce better types of engineers and technicians. To that end, they have recommended that the highest importance should be given to faculty development including preservice and in-service training of technical teachers and providing them with opportunity for professional advancement. In-service training, the Conference suggested, should include summer institutes and sequential courses, organised field experience particularly in industry and advanced studies and research for those teachers whose academic qualifications need to be improved.

As for diploma courses, the Conference recommended that polytechnics should designedly be brought into close relationship with industry to conduct cooperative programmes of training for technicians in selected fields, diversification of subjects in relation to regional requirements and structural re-organisation of polytechnics. Among the subjects for diversified courses, the Conference suggested automobile engineering, refrigeration air-conditioning, radio and electronics, fisheries technology, machine tool technology, instrument technology, and chemicals manufacture.

Research in technical education with special reference to curriculum development, preparation of textbooks, teachers' guides and instructional materials was considered by the Conference of great importance to improving the standard and quality of technical institutions. It was agreed that such research programmes should be organised and conducted by the Indian Institutes of Technology at Kharagpur, Madras, Bombay, Kanpur and Delhi and other well established institutes that have adequate expert personnel. It was also agreed that the Institutes of Technology should not remain in complete isolation from the rest of engineering colleges and polytechnics, but with their better resources and expertise should reach out to helping serving teachers in other institutions by conducting in-service training programmes and developing a new methodology of technical education. It was also agreed that the Institutes of Technology and other Institutes should undertake design and fabrication of laboratory apparatus and equipment, experimental units that are needed by engineering colleges and polytechnics.

The Conference recommended that the Technical Teachers Training Institutes set up by the Central Government at Madras, Chandigarh, Bhopal and Calcutta should re-organise their programmes to cater primarily for teachers sponsored by technical institutions. They should also give special attention to equipping technical teachers with pedagogical skills and techniques. Re-organisation of Teacher Training Programmes for college-level teachers on similar lines was also recommended.

The Union Education Minister, Dr. Triguna Sen, who presided over the Conference, outlined the various steps taken by the Central Government to ease the present unemployment among engineers and technicians, and announced that the Central Government had made arrangements immediately to give practical training in industry and other organisation for over 5,000 graduates and diploma-holders. He emphasised that we should get away from our obsession for physical targets in technical education and concentrate on quality and standards to produce better employable engineers. He also suggested that planning for technical education should not be imposed from the top by any Central authority but it should start from the State level with responsiveness to local needs. On a national plane, the State plans should be integrated and coordinated to form a coherent system of technical education.

The guidelines formulated by the Conference of State Directors of Technical Education will be considered by the All India Council for Technical Education at its meeting scheduled to be held on 25th May 1968 in New Delhi.

MINISTRY OF EDUCATION
RESOLUTION

New Delhi-2, the 30th November, 1945.

(The resolution below incorporates all amendments made from time to time)

.....
(ESTABLISHMENT OF AN ALL INDIA COUNCIL
FOR TECHNICAL EDUCATION)
.....

No.F.16-10/44-E.III - In their plan for post-war Development in India the Central Advisory Board of Education have given reasons for their belief that technical education at the higher stages cannot in modern conditions be effectively organised on a provincial basis. They have emphasised the need for planning this particular branch of education on an All India basis if there is to be substantial industrial development in the post-war period and have remarked that "to stimulate, co-ordinate and control the provision of the educational facilities, which such a development as well as existing industry will need there must be an All India body in supreme charge". They have accordingly recommended the establishment of a National Council for Technical Education which they suggest, should control policy in technical education generally and deal with all technical institutions above the higher school stage except the Technological Departments of Universities. It is obvious that this recommendation raises issues, agreement on which is likely to be reached only after considerable discussion with the various authorities concerned. At the same time the

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development of technical or practical instruction at all stages is important not only in view of the accepted need for making Indian Education generally more realistic but also because it has an essential and urgent contribution to make towards other branches of post-war reconstruction which will demand a large increase in the available supply of Indian technologists and technicians. A necessary preliminary to any planned and balanced development of technical education is a survey by a single competent body of existing facilities, probable post-war requirements and present and prospective proposals for development in this important sphere of education. For the immediate task of survey and advice it is not necessary that an All India Council for Technical Education should be endowed with executive, administrative or controlling powers of any kind or that its establishment should be delayed until all the issues raised by the Central Advisory Board's recommendations have been settled. It has accordingly been decided that the All India Council for Technical Education should be set up immediately, composed in the way suggested by the Central Advisory Board, but entrusted in the first instance with advisory functions only.

It will be understood that the decision to set up the Council immediately with advisory functions is without prejudice and at the same time without commitment to the full implementation at a later date of the proposals in this behalf of the Central Advisory Board.

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2. Functions: The immediate task for the Council for Technical Education will be to survey the needs of the country as a whole for higher technical education, with special reference to prospective post-war needs, and to advise in what areas technical institutions should be established, for what branches of technology each should provide and upto what standards they should operate. In particular it will be empowered :-

- (a) To survey the whole field of technical education in consultation with Provincial Governments and such acceding States as may be willing to cooperate with it;
- (b) To consider such immediate projects as are already under consideration by various Ministries of the Government of India, i.e., the provision of senior All India Polytechnics on the lines of the Massachusetts Institute of Technology or the establishment of a Technical College of Electrical (Power) Engineering, and to assign to these their appropriate place in an All India Scheme; and
- (c) To conduct preliminary investigations with a view to ascertaining the conditions on which the authorities in control of existing technical institutes would be prepared to cooperate in an All India Scheme.

3. Constitution: The Central Advisory Board have envisaged the establishment of a Council representative of all the main interests concerned with technical education. Acceptance of this view precludes the setting up of a small and compact body. Technical Education has many facets and the representation of the interest best qualified to assist the attainment of the object in view can be achieved only at the expense of enlarging the size of the Council. It will be open to the Council to appoint such

executive committee or other subordinate bodies as may be required to facilitate the discharge of its business.

The Council will be composed as under:-

i) MEMBERS

- a) Chairman - Minister-in-charge Central Government (On occasions when he is unable to preside over a meeting of the Council the members present should elect a Chairman from amongst themselves for the particular meeting).
- b) i) Educational Adviser to the Government of India.
ii) Educational Adviser (Tech.) to the Government of India.
- c) Chairmen of the Regional Committees of the Council (Ex-officio)
- d) Chairmen of the All India Boards of Technical Studies and Post-graduate Studies (Ex-officio)
- e) Representatives of the Ministries and Departments of the Government of India.
- f) Two members of the Lok Sabha elected by it.
- g) One member of the Rajya Sabha elected by it.
- h) i) One representative of each of the States.
ii) One representative each of the Union Territories having an Engineering College and/or a Polytechnic.
- i) Eight representatives of Industry and Commerce to be nominated by the Organisations approved by the Government of India.
- j) Four representatives of Labour to be nominated by organisations approved by the Government of India.
- k) One member of the Central Advisory Board of Education.
- l) One member of the Inter-University Board of India.

- m) Two representatives of the Indian Society for Technical Education.
- n) Twelve representatives of Professional Bodies.
- o) Not more than two members nominated by the Government of India to represent other interests.
- p) i) Chairman, University Grants Commission (Ex-officio)
ii) One representative of the University Grants Commission.
- q) One representative of the National Institute of Sciences of India.
- r) One representative of the National Council for Rural Higher Education.
- s) One representative of the National Productivity Council.
- t) Director General, Council of Scientific and Industrial Research (Ex-officio)
- u) Member-Secretary.

ii) Terms of Office. The term of office of all non-official members who were first elected or nominated to the Council shall be 3 years reckoned from the first day of the first meeting of the Council namely the 30th April, 1946, and the term of office of all non-official members subsequently elected or nominated shall be three years reckoned from the appropriate anniversary of the day; provided that member elected or nominated under-clause (f)(g)(k) and (l) above shall cease to be member of the Council if he ceases to be a member of the Lok Sabha, the Rajya Sabha, the Central Advisory Board of Education or the Inter-University Board of India as the case may be. The official members of the

Council will continue until they are replaced by others. All casual vacancies among the members (other than ex-officio members) shall be filled by the authority or body who nominated or elected the member whose place becomes vacant, and the person appointed to a casual vacancy shall be a member of the Council for the residue of the term for which the person whose place he fills would have been a member.

4. No proceedings of the Council shall be in-validated merely by reason of the existence of a vacancy or vacancies among the members.

5. The All India Council for Technical Education will be attached to the Ministry of Education. A member of the staff of that Ministry will be the Member-Secretary of the Council. It will be the function of the Educational Adviser(T) to the Government of India assisted by the Member-Secretary of the Council to prepare the agenda for its meetings and attend to all work relating to the Council.

6. The names of the members of the Council under Para 3(i) above will be announced in due course.

ORDERED that a copy of this Resolution be communicated to all Principal Governments and Minor Administrations and All Ministries of the Government of India.

2. ORDERED also that the Resolution be published in the Gazette of India for information.

Sd/-
D.M.Sen
Secretary

Composition of the Regional Committees of the
All India Council for Technical Education.A. CONSTITUTION

Ministry of Education and Youth Services.	One representative.
Ministry of Labour, Employment & Rehabilitation (National Council for Training in Vocational Trades)	-do-
Ministry of Railways.	-do-
States.	One representative from each State.
	(Northern Region - 8 Eastern Region - 8 Western Region - 4 Southern Region - 6)
Eminent persons connected with Industry, Commerce and Labour	Three (To be nominated by the Chairman of the Council).
Indian Society for Technical Education.	One representative.
Technical Institutions & Universities having Technological Departments.	Six representatives (To be nominated by the Chairman of the Council).
Institution of Engineers (India).	One representative.
All India Council for Technical Education.	One representative (to be elected from amongst non-official members of the Region).
State Boards of Technical Education.	Chairman of the State Board of Technical Education (or his nominee in each State in the Region).
Boards of Apprenticeship Training.	Chairmen of the respective Boards (Ex-officio).
By cooption (if considered necessary).	Two members.
The Regional Officers of the Ministry of Education to act as Member-Secretaries to the Committees.	& Youth Services

:-49 -:

Composition of the Re-constituted All India
Boards of Technical Studies of the AICTE

ANNEXURE-IV
(Item No.5)

1. ALL INDIA BOARD OF TECHNICAL STUDIES
IN APPLIED ART

(List of members for the term 1.1.1969 to 31.12.1971)

- | | | | |
|------|--|----|--|
| 1. | Representative of
A.I.C.T.E. | 1. | Shri N.S. Bendre,
10, Kala Nagar
Bandra (East),
Bombay-51. |
| 2-5. | Representative of Co-
ordinating Committee of
the All India Council
for Technical Education. | 2. | Prof. V.N. Adarkar,
'Adari', 2, Kala Nagar
Bandra (East), Bombay-51. |
| | | 3. | Shri Chintamoni Kar,
Principal,
Government College of Arts
and Crafts, 28, Jawaharlal
Nehru Road, Calcutta-16. |
| | | 4. | Shri C.N. Parameswar,
Color-Craft,
414, Hind Rajasthan
Departmental Centre,
4th Floor, Dadasaheb
Phalke Road, Dadar,
Bombay-14 DD. |
| | | 5. | Shri Manohar Joshi,
Art Director,
Mah Advertising,
Bombay-1. |
| 6. | Representative of
Indian Society for
Technical Education,
C/o I.I.T., Hauz Khas,
New Delhi-29. | 6. | Shri L.R. Nagpal,
Principal,
School of Printing Technology,
Allahabad. |
| 7. | Representative of
affiliated institutions.
(College of Art,
22, Tilak Marg,
New Delhi.). | 7. | Shri B. Mukerji,
Principal,
College of Art,
22, Tilak Marg,
New Delhi-1. |
| 8-9. | Representative of Trade,
Commerce and Industry, | | |
| (i) | The Indian Institute
of Art in Industry,
Park Hotel Building,
17, Park Street,
Calcutta-16. | 8. | Shri S.N.Guha Ray,
(Hony. Director, Indian
Institute of Art in
Industry, Calcutta)
Shri Saraswaty Press Ltd.,
32, Acharya Profulla
Chandra Road, Calcutta-9. |

Contd.....

- (ii) The Employers' Federation of India,
Army & Navy Building,
148, Mahatma Gandhi Road,
Bombay-1.
9. Shri F.S. Mulla,
Chief Public Relations
Officer, Tata Sons Pvt.Ltd.
Bombay House, Bruce Street,
Bombay-1.
- 10-11. Representatives of
Professional Bodies:
- Lalit Kala Akademi,
Rabindra Bhavan,
New Delhi; 1.
10. Shri K.Srinivasulu,
Design Demonstration Centre
Government of Tamil Nadu,
Madras-8.
11. Shri V.R. Amberkar,
9, Kala Nagar,
Bandra (East),
Bombay-51.
12. Representative of
Inter-University Board of
India and Ceylon,
Rouse Avenue,
New Delhi.
12. Shri N. Choudhury,
Prof. and Head of
Sculpture Department,
M.S. University of Baroda,
Baroda.
- 13-15. Co-opted members.

II. ALL INDIA BOARD OF TECHNICAL STUDIES IN ARCHITECTURE & REGIONAL PLANNING.

(List of members for the term 1.1.1969 to 31.12.1971)

- | | | | |
|-------|---|----|--|
| 1. | Representative of the A.I.C.T.E. | 1. | Shri H.N. Dallas,
Meadows House,
39, Nagindas Master Road,
Bombay-1 |
| 2-5. | Nominees of the Co-ordinating Committee of the All India Council for Technical Education. | 2. | Shri S. Pithavadian,
Head of the Architecture Department, University of Madras, Madras. |
| | | 3. | Shri H. Rehman,
Senior Architect,
C.P.W.D., Nirman Bhavan,
New Delhi. |
| | | 4. | Shri Aditya Prakash,
Head of the Architecture Department, College of Architecture, Chandigarh. |
| | | 5. | Prof. D.V.R.Rao,
School of Planning and Architecture, Indraprastha Estate, New Delhi. |
| 6. | Representative of the Indian Society for Technical Education, New Delhi. | 6. | Shri B.V. Doshi,
Director,
School of Architecture,
Navrangpura, Ahmedabad. |
| 7. | Representative of the Inter-University Board of India, Rouse Avenue, New Delhi. | 7. | Shri R.N. Dogra,
Director, Indian Institute of Technology, Hauz Khas, New Delhi. |
| 8. | Representative of Affiliated institutions. (School of Planning & Architecture, New Delhi.) | 8. | Prof. T.J. Manickam,
Director, School of Planning & Architecture, Indraprastha Estate, New Delhi-1. |
| 9-11. | Representatives of Professional Bodies: | | |
| (i) | The Indian Institute of Architects, Prospect Chambers Annexe, Dadabhoy Naoroji Road, Fort, Bombay-1(BR) | 9. | Shri Piloo Mody,
Stadium House,
Vir Nariman Road, Church Gate,
Bombay-1. |

- | | |
|--|--|
| <p>(ii) The Institution of Engineers(India),
8, Gokhale Road,
Calcutta-20.</p> | <p>10. Shri B.P. Kupadia,
Pearl Mansion,
91, Queen's Road,
Bombay-20(BR)</p> |
| <p>(iii) Institution of Town Planners, Indraprastha Estate, New Delhi.</p> | <p>11. Shri C.S. Chandrasekhara,
Town & Country Planner,
Town & Country Planning Organisation, E-Block,
Delhi Vikas Bhavan,
Indra-prastha Estate,
New Delhi.</p> |
| <p>12. Representative of Trade, Commerce & Industry.
Rep. Builders Association of India, 3-B,
Pherozechah Mehta Road,
Fort, Bombay-1. (BR)</p> | <p>12. Shri B.V. Apte,
Chief Engineer,
M/s Mackenzies Ltd.,
Sewree, Bombay-15.</p> |

13-15. Co-opted members.

III. ALL INDIA BOARD OF TECHNICAL STUDIES IN CHEMICAL
ENGINEERING & CHEMICAL TECHNOLOGY

(List of members for the term 1.1.1969 to 31.12.1971)

- | | | |
|------|--|--|
| 1. | Representative of the
A.I.C.T.E. | 1. |
| 2-5. | Nominees of the Coordinating
Committee of the All
India Council for
Technical Education. | 2. |
| | | 3. |
| | | 4. |
| | | 5. |
| 6. | Representative of the
Indian Society for
Technical Education. | 6. |
| 7. | Representative of the
Affiliated/Recognised
Institutions. | 7. |
| 8-9. | Representatives of Trade,
Commerce & Industry: | |
| (i) | Representative of Indian
Chemical Manufacturers
Association, India Exchange
Place, Calcutta-1. | 8. Dr. H.E. Eduljee,
M/s National Peroxide Ltd.,
Neville House, Graham Road,
Ballard Estate, Bombay-1. |
| (ii) | Representative of All
India Organisation of
Industrial Employers,
Federation House,
New Delhi-1. | 9. Shri D.M. Trivedi,
M/s Synthetics & Chemicals Ltd.,
New Great Insurance Building,
7, Jamshedji Tata Road,
Church Gate Reclamation,
Bombay-1. |

10-11. Representatives of
Professional Bodies:

- | | |
|--|--|
| (i) Indian Institute of
Chemical Engineers,
Calcutta-32. | 10. Prof. D.K. Dutt,
Head of the Department
of Chemical Engineering,
Jadavpur University,
Calcutta-32. |
| (ii) Indian Chemical Society,
92, Acharya Profulla
Chandra Road,
Calcutta-9. | 11. Dr. M.M. Chakrabarty,
University College of Science,
92, Acharya Profulla
Chandra Road, Calcutta-9. |
| 12. Representative of the
Inter-University Board
of India & Ceylon,
Rouse, Avenue, New Delhi. | 12. Dr. S.K. Mandi,
Department of Chemical
Engineering,
Indian Institute of
Technology, Kharagpur. |
- 13-15. Co-opted members.

IV. ALL INDIA BOARD OF TECHNICAL STUDIES IN COMMERCE

List of Members

(For the period 1.1.1967 to 31.12.1969)

- | | |
|---|--|
| 1. Chairman. | 1. Prof. M.V. Mathur,
Director,
Asian Institute of Education,
Planning & Administration,
Indraprastha Estate,
New Delhi. |
| 2-6. Nominees of the All
India Council for
Technical Education. | 2. Shri R.B. Bose,
2/2, Keyartola,
Calcutta-29.

3. Prof. A. Dasgupta,
Delhi School of Economics,
Delhi University,
Delhi.

4. Shri Ravi Mathai,
Director,
Indian Institute of
Management,
Vastrapur, Ahmedabad-6.

5. Shri I.P. Anand,
General Manager,
Karamchand Thapar (P) Ltd.,
Thapar House,
124, Janpath, New Delhi.

6. Prof. P.N. Dhar,
Director,
Institute of Economic Growth,
University Enclave,
Delhi-7. |
| 7. Representative of the
Indian Society for
Technical Education. | 7. Shri R.S. Davar,
Principal,
Davar's College of Commerce,
Bombay. |
| 8-11. Representatives of
State Board of Technical
Education (one from each
region) | 8. Principal,
R.C. College of Commerce,
Bangalore.

9. Shri H.N. Barua,
Director Incharge of
Technical Education,
Shillong. |
| 1. Mysore. | |
| 2. Assam. | |

Contd....

12. Representative of Inter-University Board.
- 13-17. Representative of Universities.
- 18-20. Representatives of Trade, Commerce and Industry.
10. Sura A.R. Desai,
Principal, Sir K.P. College
of Commerce, Surat.
11. Shri Tirath Ram,
Secretary, State Board of
Technical Education, Jammu
& Kashmir, Srinagar.
12. Dr. S. Misra,
Vice-Chancellor,
Utkal University,
Bhubaneswar.
13. Dr. T.N. Kapoor,
Head of the Commerce Deptt.,
Punjab University,
Chandigarh.
14. Prof. N.L. Nadda,
Head of the Deptt. of
Commerce & Applied Economics,
Patna University, Patna.
15. Shri V.R. Pillai,
Dean of the Faculty of Arts,
Kerala University,
Trivandrum.
16. Shri B R. Dhakney,
Principal,
Sydenham College of Commerce,
Bombay.
17. Prof. A.B. Ghosh,
Head of the Commerce Deptt.,
University of Delhi,
Delhi.
18. Shri P.K. Mukherjee,
Imperial Chemical Industries
(India) (P) Ltd.,
18, Strand Road,
Calcutta-1.
19. Shri Gujar Mal Modi,
Modi Industries,
Modi Nagar, U.P.
20. Shri G.L. Bansal,
Secretary-General,
Federation of Indian
Chambers of Commerce & Industry,
Federation House, New Delhi.

21-24. Representatives of
Professional Bodies:

- | | |
|--|--|
| i) The Institute of
Chartered Accountants
of India, New Delhi. | 21. Shri R.Thakur,
M/s S. Vaidyanatha Aiyar
& Co., Thapar House,
Janpath, New Delhi. |
| ii) The Indian Institute
of Bankers, Bombay. | 22. Vacant. |
| iii) The Institute of
Costs & Works
Accountants,
Calcutta. | 23. Shri N.K. Bose,
11, Swinhoe Street,
Calcutta. |
| iv) Department of
Company Affairs
(Company Law Board) | 24. Shri B.F.Roy,
Secretary, Company Law
Board, Ministry of
Industrial Development
and Company Affairs,
(Deptt. of Company Affairs)
Udyog Bhavan, New Delhi. |
| 25. Representative of Board
of Management Studies. | 25. Prof. D.K. Sanyal,
Director, Indian Institute
of Social Welfare and
Business Management,
College Square West,
Calcutta. 7. |
- 26-30. Coopted members,
(upto five members,
if necessary).

V. ALL INDIA BOARD OF TECHNICAL STUDIES
IN ENGINEERING & METALLURGY

(List of Members for the term 1.1.1969 to 31.12.1971)

- | | |
|--|--|
| 1. . Representative of
A.I.C.T.E. | 1. Dr. P.K. Kapre,
32, Golf Links,
New Delhi-3. |
| 2-5. Nominees of the Co-
ordinating Committee of
the All India Council
for Technical Education. | 2. Shri A.F. Jambulingam,
Principal,
Technical Teachers' Training
Institute, Adyar, Madras-20.

3. Shri P.S. Mani Sundaram,
Principal,
Regional Engineering College,
Tiruchirappalli-15.

4. Shri Y. Saran,
Principal,
S.V. Government Polytechnic,
Bhopal.

5. Dr. P.K. Kelkar,
Director,
Indian Institute of
Technology, Kanpur. |
| 6. Representative of the
Indian Society for
Technical Education. | 6. Shri T.A. Desai,
36, Bhagwat Sadan,
Behind Aurora Cinema,
Matunga (East),
Bombay. |
| 7. Representative of
affiliated institutions
(College of Engineering
Delhi.) | 7. Shri J.N. Moudgil,
Principal,
Delhi College of Engineering,
Kashmere Gate, Delhi. |
| 8-9. Representative of Trade
Commerce & Industry etc. | |
| i) All India Manufacturers
Organisation, Jeevan
Sahakar, Pherozeshah
Mehta Road, Bombay.1. | 8. Shri Pran Lal Patel,
Malleable Iron & Steel
Casting Co., Lower Parel,
Bombay. |
| ii) The Employers Federation
of India
148, Mahatma Gandhi Road,
Bombay-1. | 9. Shri B.L. Fernandez,
C/o The Jamshedpur
Technical Institute,
The Tata Iron & Steel Co.Ltd,
Jamshedpur. |

10-11. Representatives of
Professional Bodies:

- | | |
|--|---|
| 10. Institution of
Engineers(India)
8, Gokhale Road,
Calcutta-20. | 10. Dr. G.P. Chatterjee,
61/L, Kalighat Road,
Calcutta. |
| 11. Mining, Geological
and Metallurgical
Institute of India,
29, Chowringhee,
Calcutta-16. | 11. Shri G.S. Marwaha,
Director,
Deptt. of Mines & Safety,
P.O. Sitarampur,
Distt. Burdwan. |
| 12. Representative of
Inter-University Board
of India. | 12. Prof. S.K. Bose,
Director,
Indian Institute of
Technology, Kharagpur. |
- 13-16. Co-opted members.

11 30 21

VI. ALL INDIA BOARD OF TECHNICAL STUDIES
IN MANAGEMENT

(List of Members for the term 1.1.1969 to 31.12.1971)

- | | | |
|------|--|--|
| 1: | Representative of the All India Council for Technical Education. | 1. Shri P.K. Kapre,
32, Golf Links,
New Delhi-3. |
| 2-6. | Nominees of the Coordinating Committee of the All India Council for Technical Education. | 2. Shri J.J.Ghandy (CHAIRMAN)
Central Administration
Office, Tata Iron & Steel
Co. Ltd., Jamsheipur.
3. Shri M.K. Raju,
Managing Director,
India Pistons Ltd.,
Madras-11.
4. Prof. A. Das Gupta,
Delhi School of Economics,
Delhi-University,
Delhi-7.
5. Dr. K.S. Basu,
Director,
Jammalal Bajaj Insitute
of Management Studies,
164 Backbay Reclamation,
Bombay-20.
6. Shri D.K. Sanyal,
Director,
Indian Institute of Social
Welfare & Business Manage-
ment, Collège Square West,
Calcutta-7. |
| 7. | Representative of Indian Society for Technical Education. | 7. Prof. G.R. Damodaran,
Principal,
P.S.G. Collège of Technology,
Coimbatore-4. |
| 8-9. | Representatives of Trade, Commerce & Industry. | |
| (i) | Federation of Indian Chambers of Commerce and Industry. | 8. Dr. R.S. Tarneja,
C/o New Central Jute
Mills Co. Ltd., Engg.
Division; 11 Clive Row,
Calcutta-1. |
| (ii) | Associated Chambers of Commerce of India. | 9. Shri J.K. Srivastava,
14/1 Civil Lines, Kanpur. |

10-13. Representatives of
Professional bodies:-

- | | |
|---|--|
| (i) Institute of Production Engineers, Howrah. | 10. Shri N.N. Sen Gupta,
Principal,
Calcutta Technical School,
Calcutta-13. |
| (ii) Institute of Chartered Accountants of India. | 11. Shri P.K. Lahiri,
M/s P.K. Mitra & Co.,
P.7, Mission Row Extension
Calcutta-1. |
| (iii) Indian Institute of Public Administration,
New Delhi. | 12. Shri J.N. Khosla,
Director,
Indian Institute of
Public Administration,
Indraprastha Estate,
Ring Road, New Delhi-1. |
| (iv) Indian Institute of Personnel Administration,
Calcutta. | 13. Shri D.P. Mukerjee,
Andrew Yule & Co. Ltd.,
8, Clive Row, Calcutta-1. |
| 14. Representative of the Inter-University Board of India & Ceylon,
Rouse Avenue, New Delhi. | 14. Dr. A.N. Agarwala,
Dean, Faculty of Commerce,
University of Allahabad,
Allahabad. |
| 15. Department of Company Affairs
(Company Law Board) | 15. Shri A.C. Bose,
Joint Secretary,
Company Law Board,
Deptt. of Company Affairs,
New Delhi. |
| 16. Representative of the All India Board of Technical Studies in Commerce. | 16. Dr. T.N. Kapoor,
Head of the Department
of Commerce & Business
Administration,
Punjab University,
Chandigarh-14. |
| 17. Representative of National Productivity Council. | 17. Shri B.N. Bhattasali,
Executive Director,
National Productivity Council
Golf Links, New Delhi-3. |
| 18. Representative of All India Management Association. | 18. Shri K. Pennathur,
Executive Director,
All India Management
Association, 29, Nizamuddin
East, New Delhi-13. |

Contd....

19-22. Co-opted members.

19. Shri R.P. Billimoria,
Director (Personnel),
Hindustan Steels Ltd.,
P.O. Hinoo, Sindri,
Bihar.

20. Prof. R. Mishra,
Indian Institute of
Technology, Kharagpur.

21. Prof. G.V. Krishna Rao,
Director, Deptt. of
Management Studies,
Madras University,
Madras-5.

22. Shri Keshub Mahindra,
Mahindra & Mahindra Ltd.,
Gateway Building,
Apollo Bunder, Bombay-1.

23-24. Directors of Institutes
of Management,
Calcutta and Ahmedabad
(Ex-officio).

23. Shri Krishna Mohan,
Director,
Indian Institute of
Management, 56-A,
Barrackpore Trunk Road,
Calcutta-50.

24. Shri Ravi J. Mathai,
Director,
Indian Institute of
Management, Vastrapur,
Ahmedabad-6.

25. Representative of the
University Grants
Commission,

25. Dr. P.J. Philip,
Secretary,
University Grants Commission
Bahadur Shah Zafar Marg,
New Delhi.

VII. ALL INDIA BOARD OF TECHNICAL STUDIES IN
TEXTILE TECHNOLOGY

(List of members for the term 1.1.1969 to 31.12.1971)

- | | |
|--|--|
| 1. Representative of the A.I.C.T.E. | 1. Shri G.R. Damodaran, Director, P.S.G.College of Technology, Coimbatore-4. |
| 2-5. Nominees of the Co-ordinating Committee of the All India Council for Technical Education. | 2. Shri S. Huthee Singh, Shahi Bagh, Ahmedabad.
3. Dr. P.V. Sheshadri, Professor, Government Central Textile Institute, Kanpur.
4. Shri Bharat Bhushan, Principal, Institute of Textile Technology, Amritsar.
5. Dr. P.C. Mehta, Deputy Director, ATIRA, Ahmedabad-9. |
| 6. Indian Society for Technical Education, New Delhi. | 6. Dr.E.D. Daruwala, Principal, Government Central Textile Institute, Kanpur. |
| 7. Affiliated Institutions. | 7. Vacant. |
| 8-10. Trade, Commerce and Industry - | |
| (i) The Employers Federation of India, Army & Navy Bldg. 148. Mahatma Gandhi Road, Bombay-1. | 8. Prof. R.K. Mody, Principal, Secretary, Victoria Jubilee Technical Institute, Matunga, Bombay-1. |
| (ii) All India Organisation of Industrial Employers, Federation House, New Delhi-1. | 9. Shri K.N. Modi, Vice-Chairman, Modi Enterprises, Modinagar (U.P.) |
| (iii) The Southern India Mill Owners' Association, Coimbatore, P.B.1400, Coimbatore-18. | 10. Shri A.R. Nityanand, Spinning Master, Madura Mills Co. Ltd., Madurai. |

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11. Professional Bodies:

The Textile Association
(India) Regd.,
Navrangpura, Ahmedabad-9.

11. Dr. N.M.Swani,
Prof. & Head of Deptt.
of Textile Technology,
Indian Institute of
Technology, Hauz Khas,
New Delhi-29.

12. Inter-University Board
of India & Ceylon,
Rouse Avenue,
New Delhi.

12. Dr. S. Krishnamurthi,
Prof. of Textile Technology,
University of Madras,
A.C.College of Technology
Building, Guindy, Madras-25.

13-15. Coopted members.

VIII. COMPOSITION OF BOARD OF POST-GRADUATE ENGINEERING STUDIES AND RESEARCH (UPTO DECEMBER 1969)

CHAIRMAN: Prof. M.S. Thacker,
2A, Mafatlal Park,
Warden Road, Bombay-26.

MEMBERS.

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|--|---|
| 1. Scientific Adviser to the Minister of Defence. | Dr. S. Bhagavantam. |
| 2. Chairman, UGC or his nominee. | Dr. S.K. Dass Gupta. |
| 3. Educational Adviser(T), Ministry of Education and Youth Services. | Shri G.K. Chandiramani. |
| 4. D.G., C.S.I.R. or his nominee. | Prof. G.S. Ramaswamy,
Director, Structural Engineering Research Centre,
Roorkee, U.P. |
| 5-8. Four representatives of Industries: | |
| (i) Northern Region. | i) Dr. Tuhin Kumar Roy,
Consultant,
Chemical & Metallurgical Design Co. Private Ltd.,
A-60, Kailash, New Delhi-14. |
| (ii) Southern Region. | ii) Dr. B.V. Baliga,
Formerly Managing Director,
Bharat Electronics,
Bangalore. |
| (iii) Eastern Region. | iii) Shri D.M. Sen,
Director(Technical),
Martin Burn Ltd., Calcutta-1. |
| (iv) Western Region. | iv) Shri Pranlal Patel,
Tulsipipe Road,
Lower Parel, Bombay-13. |
| 9-11. Three representatives of HTIs:- | |
| (i) Kharagpur. | i) Prof. S.K. Bose, Director,
Indian Institute of Technology, Kharagpur. |
| (ii) Kanpur. | ii) Dr. P.K. Kelkar, Director,
Indian Institute of Technology, P.O., IIT, Kanpur. |
| (iii) Madras. | iii) Dr. A. Ramachandran,
Director, Indian Institute of Technology,
Madras. |

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12-13. Two representatives of
University Institutions:

i) Punjab University. ii)

Shri P.G. Deo,
Principal,
Punjab Engineering College,

ii) Annamalai University. ii)

Prof. A. Srinivasan,
Dean, Faculty of Engineering,
Annamalai University,
Annamalai Nagar.

14-16. Three representatives
to be nominated by the
ISTE. i)

Dr. J.P. Choudhry,
Director of Technical
Education, Bihar, Patna.

ii)

Shri G.R. Damodaran,
Principal,
P.S.G. College of Technology,
Coimbatore.

iii)

Dr. Swami Sharan,
Principal,
Regional Engineering College,
Kurukshetra.

17-20. Representatives of
AIBTS' s:

i) Engineering. i)

Prof. M. Sen Gupta,
Banaras Hindu University,
Varanasi.

ii) Chemical Engg./
Chemical Tech. ii)

Dr. D. Venkateswarlu,
Head of Department of
Chemical Engineering,
Indian Institute of Technology,
IIT, P.O. Madras-36.

iii) Textile Technology. iii)

Shri N.M. Swani, Head of
Deptt. of Textile Technology,
I.I.T., Hauz Khas, New Delhi-29.

iv) Architecture. iv)

Prof. T.J. Manickam,
Director, School of
Architecture & Planning,
New Delhi.

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21-24. Four experts nominated
by the Chairman, AICTE.

i) Dr. H.C. Guha,
Vice-Chancellor,
Jadavpur University,
Calcutta-32.

ii) Dr. Gopal Tripathi,
Banaras Hindu University,
Varanasi.

iii) Prof. D. Banerjee,
Principal,
Bengal Engineering College,
P.O. Botanic Garden,
Howrah.

iv) Dr. A.R. Verma,
Director, National Physical
Laboratory, New Delhi.

25. Representative of
the Deptt. of concerned
of the Central Government.

Shri M.M. Vadi,
Industrial Adviser (Engg.)
Directorate of Technical
Education, New Delhi.

Progress report on
action taken by Regional Committees
on Diversification of Diploma Courses.

EASTERN REGION:

The Eastern Regional Committee expressed the views that the diversification of courses and selection of Polytechnics where those courses would be started, should be considered by the respective State Boards/Councils for Technical Education in consultation with industry according to precise man-power requirement in specific fields in the State and thereafter the State Government might send those proposals to the Committee for further necessary action. The Committee further suggested that in addition to starting full-fledged Diploma Courses in diversified subjects, the possibility of introducing some of these subjects as electives in the 3rd year of the Basic Engineering Courses without increasing the intake might also be explored by the State Boards.

In this connection it might be mentioned that State Council for Technical Education, Orissa, already set up a Committee of which the Regional Officer was a member to consider the question of diversification of courses in detail according to felt needs of industry in the Orissa State. It was hoped that other State Councils would also act accordingly in near future.

The Eastern Regional Committee also recommended that the industrially advanced states of West Bengal and Bihar should, in places where there is concentration of chemical industries, start Chemical Operators' Course or Diploma Course in Chemical Engineering in co-operation with industry.

NORTHERN REGION.

The Northern Regional Committee at its meeting held in January, 1969 recommended setting up of Working Groups by the State Governments consisting of Directors of State, prominent industrialists and persons drawn from the field of technical education and the Regional Officer. These working Groups should identify the special areas in which trained technicians are required and also the employment potential in these areas. Thereafter, these Groups should work in collaboration with the State Boards of Technical Education and formulate the curriculum, syllabi and contents of the new courses depending upon their felt needs either at diploma or post-graduate level. The State Governments have been requested to constitute such Working Groups. The State Board of Technical Education, Haryana, has already decided to constitute a Committee consisting of

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/E&R/Public Health, Chief Engineer, prominent industrialists of Haryana, Chief Engineer, Irrigation and Chief Engineer, Electricity Board, to examine the feasibility of the diversification of diploma courses in the State. The State Governments in the Region are alive to the problem of diversification and are formulating proposals for consideration of Regional Committee.

In fact in Haryana, YMCA Institute of Technology, Faridabad is going to start courses from the current session in the following fields:-

1. Mechanical Engineering Stream.
 - (i) Machine Tool Production & Maintenance.
 - (ii) Foundry and Forging.
 - (iii) Refrigeration & Air-conditioning.
2. Electrical Engineering Stream.
 - (i) Electronics and Control Systems.
 - (ii) Electrical Meters and Measuring Instruments.
 - (iii) Electrical Machine Design.

WESTERN REGION

A Sandwich Course in Mechanical Engineering for I.T.I. passed students is commencing from this year at Bombay (Fr. Agnel Technical Institute, Bombay).

A Sandwich course in Chemical Technology has also been started at Wadia Institute, Bombay from this year.

Gujarat State has formulated a proposal for starting diversified diploma courses from the current session.

At degree level, courses in Mechanical & Electrical Engineering at S.P. College of Engineering and Technology are being reviewed to fit into sandwich pattern in consultation with University of Bombay.

Sandwich Courses in Mechanical Engineering have commenced this year at M.S. University, Baroda.

Maulana Azad College of Technology, Bhopal is also proposing to introduce sandwich courses at the first degree level in Mechanical and Electrical Engineering in collaboration with Heavy Electricals, Bhopal.

SOUTHERN REGION

The Regional Committee appointed a Sub-Group consisting of industrial representatives to consider reorganisation and diversification of diploma courses. The Committee is engaged in taking a preliminary occupational survey of the requirements of the employing agencies. After completing the Survey, the Committee will demarcate the areas of specialisation. It will then be considered whether it would be necessary to have the full-time diploma courses in these areas or to teach them in existing broad fields of Civil, Mechanical and Electrical Engineering as electives during the last few months or to have a post-diploma course. The specialities suggested are Machine Construction, Civil Engineering construction, Precision Mechanics, Mining Textile Technology and Industrial Methodology.

The State Boards of Technical Education in the Region have also been requested to consider in consultation with the local industries and in line with the regional requirements, the diversification that can be possible in the diploma institutions in their States. Out of the 4 States, only Mysore has spelled out certain specialities for diversified courses.

It was agreed by the Committee that generally the diversification should be on cautious lines and admission to the various courses should not exceed 5 to 20 and the same course need not be repeated in more than two polytechnics.

Reports adopted at the Conference of
student representatives held on ANNEXURE VI
May 23-25, 1969. (Item No. 6)

Report of the committee on student
participation, curriculum and
Examination Reform.

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Student Participation:

The Committee unanimously recommended effective student participation in the academic and administrative affairs of universities and colleges. It was agreed that this should not be delayed or shelved.

The Committee also recommended that student representatives should have the right and responsibility of managing all co-curricular activities and programmes of student welfare. These should be under complete student management with appropriate assistance/guidance from university or college authorities. Suitable machinery for student management of these activities should be devised where it does not exist at present, and steps should be taken to ensure effective and active student participation in these areas. The money spent on these activities should be with the approval and counter-signature of the student representatives concerned.

The Committee also unanimously accepted the principle of effective student representation in the decision making statutory bodies of universities and colleges. It was stated that the court or the senate, which is the policy-making body in a university, provided representation to various groups and interests of including industry, commerce, local authorities etc. It was regretted that no representation as yet had been given to the student community, which constituted the major component of a university, on this body. Sometimes decisions were taken in the senate relating to academic and administrative policies which had a direct bearing on the work and career of a student. It was noted that in the M.S. University of Baroda the student representative was given an observer's status. This the Committee felt that was not enough. It was recommended that effective student participation in the senate/court as full members with full powers is necessary. The Committee also supported student representation on the governing bodies/committees of management of colleges. Educationists, teachers and students only must form the governing body.

The Committee also strongly supported the principle of student representation in the academic council/board of studies, the executive council/syndicate and other relevant committees. It was felt that while student representatives may not participate in matters relating to the conduct of examinations, evaluation of student performance, appointment

of teachers and other secret matters, their participation should be ensured in all other academic and administrative decisions taken by these bodies. Students must have a say in matters relating to curriculum and examination reforms, structure of courses and allied matters. It was also pointed out that student opinion should be sought in the assessment of the performance of teachers and, in this connection, it was suggested that a secret proforma should be circulated to the students and their opinion elicited at regular intervals. This would be helpful to the department as well as the teachers concerned to improve their work.

The Committee recommended that there should be the same salary scales for teachers with the same qualifications in the universities and colleges. This is necessary since the colleges where about 85% of the student population receive instruction are losing their competent staff in view of the disparities in college and university salary scales.

The existing procedure for selection of teachers also needed reform. It was observed that sometime the best qualified and most competent teachers were not appointed and this is a wrong committed against the study community. While the student representatives may not be included in the actual processes of selection the composition of selection committees needs to be modified to include the best available experts from within and outside the universities in the field in which appointments are to be made. In the case of colleges the committees constituted for selection of teaching staff should have effective university representation of recognised experts so as to eliminate all malpractices such as nepotism and other forms of parochialism. In this connection the Committee considered the procedure for the appointment of Vice-Chancellor and expressed the opinion that it must be ensured that the Vice-Chancellor was selected for his eminence in the academic and educational world.

The Committee discussed at length the question of discipline and expressed the view that for dealing with the cases of breach of discipline by students within the university/college campus, a discipline committee should be constituted with 50:50 representation for teachers and the elected student representatives.

It was pointed out that it would be advantages to have a proper code of conduct for students and teachers.

Apart from student representation on the statutory bodies, it was emphasized that there is an urgent and pressing need for joint consultative committees consisting of representatives of teachers and students who would be responsible for day-to-day administration in the university departments/colleges.

The U.G.C. should make available suitable matching grants for the Union activities in addition to their own resources (i.e. membership contributions).

The Committee recommended that there should be a democratically elected union in every college and university with compulsory union membership.

The Committee expressed the hope that these suggestions would be implemented during the next academic session without referring them to more committees/sub-committees.

Curriculum and Examination Reform.

The Committee considered questions relating to curriculum and examination reform and allied matters. The Committee was of the opinion that the present educational system was outmoded and was not attuned to the needs of the society. The syllabi prescribed, the methods of teaching and the examination system were also out-dated and needed drastic improvement. The courses should be directly related to socio-economic conditions in the country.

It was suggested that the courses of study should be reviewed and modernised. An attempt should be made to have uniform courses of study throughout the country. It was pointed out in this connection that there is an urgent need to evolve a uniform pattern of structure of education in various courses. This would inter-alia facilitate the mobility of the students, who sought admission to other universities. The Committee emphasised that there is a pressing need for diversified and employment oriented courses.

The Committee was of the opinion that the methods of teaching and the system of examination required change and improvements. The following recommendations were made:-

- (a) Under the existing system there is an emphasis on formal lectures. The lecture method should be used most sparingly. It should give place to guided reading and discussion method.
- (b) Glass-room lectures should change into round-table discussions with a view to ensuring a two-way participation in instruction.
- (c) Individual and group assignments should be given evaluated and discussed frequently to provide help for better learning.

(d) The system of examination should be so modified as to discourage selective study. It should lead to the development of higher abilities and not memorisation. Different forms of questions found suitable for testing various objectives, as also the course content, should be used.

(e) Evaluation of students' progress should be very comprehensive as also continuous.

(f) Quality of question papers as also other aspects of the examination system should be so improved as to make it more reliable and valid. The universities should avail of the latest expertise available in the field to the best advantage of the students.

(g) The practice of dictating notes which encouraged cramming should be dispensed with and lectures may be carefully planned and co-ordinated. Cyclostyled synopses of lectures and suggestions for further reading should be supplied to students in advance. In this connection, it was also pointed out that the staff-student ratio in many university departments/colleges was highly unsatisfactory and needed improvement.

(h) The system of examination has to be modified and improved. More emphasis should be given to objective tests and problem - oriented questions. The Committee did not favour the system of one final examination at the end of each year or after three years and desired that the examinations be properly spaced out. Provision, has to be made for continuing assessment of student performance through periodical tests throughout the year. In any case examinations should not be memory-oriented. The Committee felt strongly that periodical examinations would help the students to shed their load and thus enable them to improve their performance at regular intervals.

(i) No scheme of examination can be divorced from the course of study. Therefore, without a proper scheme of diversified courses and provision of flexibility any scheme of examination reform would mean only increasing the number of examinations which would do more harm than good to the students. The Committee was, therefore, strongly of the view that a proper scheme of diversified and job-oriented courses should be drafted and implemented along with examination reforms, to enable the students to select a number of independent courses in each semester. The Committee felt that examinations must help in testing the understanding, interpretation, application and ability to solve problems on the part of the students. Thus examination would be closely related to the goals of instruction. At the same time, like instruction, examination has to be a continuous process.

(j) The Committee also felt that a proper machinery should be set up to keep a regular check against any partiality or favouritism.

(k) Examination should be strengthened by the introduction of viva-voce. At the same time, the system of oral tests may also be tried in some of the subjects to test the expression of the students. Such tests are universally recognised and are necessary specially in the case of languages where oral expression is very vital.

(l) The Committee was of the view that it was desirable to adopt double fictitious roll numbers by the examination branch of the University to allay misgivings about the identity of scripts.

(m) The Committee suggested that the University authorities should lay down a fool-proof system of appointment of examiners specially at the post-graduate and honours levels. The rules of moderation should be so framed as to see that no injustice is possible. It would be necessary to refer each script to two examiners and both of them should give their evaluation independently and secretly. The two result sheets should then be moderated by independent moderators who may review cases of discrepancies in each question. This would remove any change of favouritism or subjective prejudices working against a candidate.

(n) The Committee was of the opinion that the system of assessment by grading rather than by numerical marking of students performance offered many advantages and could be experimented with at selected centres.

(o) The question of compulsory attendance at lectures was considered by the Committee. In view of the recommendation regarding continuing assessment of student performance, the committee decided that the system of compulsory attendance should be established at the post-graduate as well as under-graduate level.

(p) It was suggested that all private schools should be abolished.

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Report of the committee on employment opportunities and related problems.

The Committee discussed in detail various issues relating to employment opportunities and related problems, particularly in relation to higher education, its structure, aims and objectives and linking it with economic development.

The Committee was of the view that in spite of three Five-Year Plans, the education imparted in our universities and colleges has not been purposeful, productive and employment-oriented. The Committee felt that the planning system of India has been completely defective and needs a radical change.

The Committee suggested that foreign enterprise and investment should be discouraged.

The Committee felt concerned that even after twenty years of independence, the country is not in a position to assess reasonably well its manpower requirements and to deploy the available resources in productive endeavours which would generate further employment.

The Committee was of the opinion that the government endeavour should be to encourage the public sector and bring all the sectors under public control. The Government should exercise effective control over national trade as far as possible. Some participants felt that socialism was the only solution to the present unemployment problem. The Committee was of the view that the right for employment should be recognised as a fundamental right of every adult citizen of India.

The Committee was of the opinion that problems of educated and unemployed and uneducated and unemployed cannot be viewed in isolation from each other. It was felt that educated unemployment was better than uneducated unemployment and therefore the government should encourage the development of education.

Analyzing the root cause of unemployment, some shared the view that capital distribution was not well-spread and was largely concentrated in large cities. The emphasis should shift to the rural areas and agriculture should be given primary importance. It was felt that graduates should offer themselves for work in rural areas.

The Committee recommended that investment in education as a proportion of the national income should be increased considerably.

The Committee felt that the resources of the country had been wasted in unproductive purposes such as construction of huge buildings, offices etc. This should be avoided and the savings thus effected should be utilised for providing more employment.

The Committee made the following recommendations:-

- (a) Educational system should be job-oriented and linked to employment needs. Greater emphasis should be placed on the introduction of vocational subjects in the degree course, such as secretarial practice, stenography, management etc.
- (b) The government should put a ceiling on land holdings and distribute land among the unemployed. Financial assistance should be provided for the cultivation of land. Unemployed persons should be encouraged to work on uncultivated land.
- (c) India in its present situation should harp on utilisation of manpower and not on automation.
- (d) There should be a ceiling of Rs. 1,500/- p.m. on the experience of an individual.
- (e) The ratio between the maximum and minimum salary should be 10:1.
- (f) Small scale industries, workshops, fine arts, crafts and other schemes should be encouraged on cooperative basis.
- (g) In order to break the bonds of casteism and communalism, people going in for inter-caste, inter-state and inter-religious marriages should be given job preference.
- (h) The government should abolish privy purposes and use the money for economic growth and development of the country.
- (i) Cooperative stores and cooperative farming should be encouraged.
- (j) There should be compulsory "drafting" into army for all students.
- (k) A central pool should be created for enabling graduates to undertake research.
- (l) Food armies should be set up to plough the vast waste-land in the country.

- (m) Social Service Corps should be started on the lines of the Peace Corps.
- (n) Universities should make efforts to help in finding part-time employment to needy students and to bring students in close contact with their prospective employers.
- (o) Students should be associated with the deliberations of the Committees appointed by the State Governments and the Central Government to examine the problem of unemployment.
- (p) The government should give loans to engineers and others to create self employment by starting small-scale industries.
- (q) Compulsory rural service should be prescribed for agricultural and medical graduates.
- (r) The government should provide allowances to the unemployed.

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Report of the Committee on the role of the students Advisory Bureaux and Employment Information and Guidance Bureaux, National Service Scheme and the role of student organisations in University Life.

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The role of student Advisory Bureaux & Employment Information & Guidance Bureaux in universities:

The Committee considered the present working of the Employment Information and Guidance Bureaux in universities and was of the view that the majority of them have not been either effective or popular with students, mainly because they lacked proper personnel and adequate publicity. Yet the need for improving information and placement machinery for the guidance and employment of students was unquestioned, and it was necessary to take steps to improve the machinery.

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The Committee generally agreed with the recommendations of the U.G.C. Panel on Employment Information and Students Service Bureaux, and made the following recommendations:-

- (a) Each university should have an Employment Information and Guidance Bureau. Universities may follow the model of the Department of Placement set up by the I.I.Ts., with suitable modifications to suit local conditions. A note on the subject is attached. ()
- (b) Persons to be appointed to the key post of employment officer require necessary background and ability to establish liaison between industries and other employing agencies on the one hand, and the universities on the other. This may be kept in view when planning the organisation of the bureaux.
- (c) In the case of affiliating universities, the Committee recommended that each University must make itself responsible for a continuous flow of employment information to its affiliated colleges. In this connection the Committee would like to invite attention to the working of the Bombay University Employment Information and Guidance Bureau and its impact on the students in the colleges, (Report attached). Particular attention is invited to the system of obtaining vacation employment for needy students.
- (d) The Committee felt that the liaison with the industries and other employing agencies should be established by all universities and departments primarily with a view to informing the students regarding job opportunities and acquainting the industry with the kind of students being trained in the universities at present. Such liaison could be strengthened and employment opportunities improved if the universities invited research projects from the industries on specific problems and entrusted them to particular departments and students. The success of such a scheme would depend to a large extent on the imagination, drive and spirit of the faculties and the students.
- (e) There was some discussion regarding the overlapping of students' efforts to obtain admission to higher courses, particularly in universities abroad. The Committee felt that in each institution, the professors should be made responsible for coordination of efforts by the students to obtain admission/fellowships in other institutions as well as in their efforts to obtain jobs so as to avoid duplication of efforts.

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(f) The employment bureau, should also collect regular information regarding placement of ex-students with a view to obtaining their assistance in placing present students.

(g) The Committee considered the suggestion made by the Panel on Employment Information and Students Service Bureaux that information on employment opportunities and manpower requirements could be greatly improved by involving university faculties and students in collecting detailed data at the local levels and felt that there was a pressing need for such information in order to make calculations regarding manpower requirements more realistic. The Committee recommended in this connection that such studies could be undertaken by students either as a part of their academic programme or as vacation jobs on payment of suitable remuneration.

National Service Scheme.

The Committee felt that membership of the N.C.C. should be voluntary and students should be free to continue as members as long as they desired during their university career.

Regarding the National Service Scheme, the Committee was of the view that it could be a powerful instrument of national integration. It can be used to introduce urban students to rural life as well as students from one state to life in other states. Under this scheme projects of permanent value could also be undertaken as a symbol of the contribution of the student community to the progress and upliftment of the nation.

The projects could be formulated by committees of teachers and students at the institutional level, giving full freedom to the students in choosing the kind of project/service that they would like to be associated with. While designing such projects, the specialised fields of studies and aptitude of students may be taken into consideration.

It was suggested that these activities should synchronise as far as possible with festivals typical of the area where they are undertaken. The aim should be to combine work with enjoyment and learning something of the customs and cultural heritage of the area. As far as possible such projects should be undertaken on an inter-state/university basis.

Systems and institutions which obstruct students migrating from one state/university to another should be discontinued as early as possible. For the sake of national integration, exchange of students between universities should be encouraged and reservation of seats for students coming from other areas on a reciprocal basis should be adopted by the universities.

Students should resist every attempt to divide India on regional, linguistic or communal lines. This would be the most lasting contribution that the student community can make to India's progress.

Role of Student Organisations in University life.

The Committee discussed the importance of student organisations in university life in the light of the account given by each member of the part played by student organisations in his university/institute. The Committee agreed that student representative organisations for various purposes were essential for enriching student life in the universities. Noting the variety of institutions and practices that were current in the country in regard to this important sector of student life and the difference in attitudes and experiences in relation with the university authorities described by various members, the Committee made the following recommendations:-

- (a) There should be a Student Union/Chatra Sangh in every University. It should be called Union.
- (b) The Unions should have democratic constitutions which should be as far as possible uniform. Where such bodies do not exist, immediate steps may be taken to bring them into existence through the good offices of the U.G.C./Ministry of Education. The Committee felt that to be represented is the birth right of every student and obstructions in its way from any quarter should not be entertained. Suitable premises for the union should be provided by the university concerned.
- (c) Membership of the unions should be automatic as recommended by the Education Commission.
- (d) The funds of the Unions should be under their own charge. Where such a practice does not exist at present, steps may be taken to transfer funds to the unions.
- (e) The fields of activities of the unions should cover student self-government and allied matters and organisation of extra-curricular activities such as sports, scientific, literary, cultural activities etc. Adequate financial assistance should be provided to the unions or their affiliated societies by the universities and university Grants Commission.

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(f) The description of activities by respective student bodies of the universities/institutes given by the members of the Committee was found very informative and the Committee suggested that a periodical may be published to circulate information regarding the organisation and constructive activities of these bodies for the general information of the student community all over the country.

(g) Representatives from student unions should meet once a year in different parts of the country under the auspices of the U.G.C. Invitations for such conferences should be sent directly to the presidents and secretaries of the student unions with copies to the vice-chancellors.

A note on the Training and Placement Units
in Indian Institutes of Technology.

The Training and Placement Unit in IIT Delhi is a full fledged unit with Director of Training and Placement as its Head. The Placement Section at IIT, Madras functions along similar lines, with a senior professor, usually a Head of a Department as the Head. The Training and Placement Unit arranges for practical training of all the students in their fourth and fifth years and arranges for suitable placements for the outgoing students as far as possible. This Unit in the beginning of each year contacts the various industrialists throughout the country and finds out if there are possibilities existing for these industries to take the IIT boys for practical training during the summer or the winter vacation. The Heads of the Departments also on their initiative try to secure as many seats in as many industries as possible. The students during their training in these establishments establish their own contact and liaison and by ensuring a practical chance that they will be employed in the very industry in which they have gone for the training. The Professors and the other members of the faculty are very deeply involved in this whole process of training and placement. Quite frequently, the industrialists are invited to the IIT either by the professors or by the Training and Placement Unit to deliver talks, to meet students over a cup of coffee or dinner or just to talk with the students. This gives the industrialists a good feel of the students and consequently it helps in securing employment opportunities for the students when they pass out. Some industrialists (when it is said industrialists, it does not necessarily mean that they are owners of industries but persons concerned in the employment capacity or other top technical positions in the industry) are also associated with the curriculum of the various departments by appointing them as external examiners of the various examinations of the department - the whole idea being to establish contact and liaison with the industrialists who ultimately will be offering employment opportunities to the students. It is an effort of creating a favourable impression and image of the Institute with the industry; and not only the Training and Placement Unit but all the faculty members; the passed out students, and in some cases even the present students themselves are deeply involved. In IIT Delhi, specific problems faced by a particular industry are taken up by the various departments as projects or research problems. These projects are generally taken up at the initiative of the professors or sent to the Institute by the industry itself. The industrialists consequently take deep interest in the students working on the particular ** projects from various industries and the results have been encouraging. The alumni also inform the Alumni Association about employment opportunities for students in the places where they are employed. The whole effort is geared towards involving as many faculty members as possible into this problem of finding suitable placements for the students.

**concerning their problems. The IIT, Delhi has taken quite a few

Report on Vacation Employment Project undertaken
by the University Employment Information and
Guidance Bureau, Bombay for the summer 1968.

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1. INTRODUCTION.

1.1 This was the third year that the Bureau undertook the project of vacation employment in collaboration with the Rotary Club of Bombay. The project was planned with the assistance of Shri K. Gopal Rao, the then Chairman, Vocation Service Committee of the Rotary Club of Bombay and Shri B.I. Bhambhani, Chairman of the Occupational Information Sub-Committee of the Rotary Club of Bombay. In accordance with the decision taken by a meeting of 22nd September 1967 an appeal was issued to Rotarians under the subject "Earn-While-You-Learn-Scheme" part-time employment to university students, in the months of November-December requesting information as per questionnaire issued last year.

1.2 Members of different Lions Clubs, Indian Engineering Association, Indian Merchants Chamber and various other employers were contacted individually by the Bureau for enlisting their cooperation for finding jobs to deserving and needy students.

2. REGISTRATION.

2.1 In order that only needy and deserving students should be able to get the employment assistance through the Bureau, the Honorary Liaison Officers/the Principals of the Colleges were requested to identify such students and recommend their cases for registration at the Bureau. For this purpose, the Bureau prepared a prescribed form for getting the necessary information about the students, duly scrutinized by the Honorary liaison Officers/Principals. This year, all the interested students were specifically requested to report to the Bureau for registration in person.

From the table, it would appear that in all 1451 including 310 girl students approached the Bureau for enrolling their names for vacation employment as against 1457 including 313 females during the last summer indicating static position.

VACANCIES NOTIFIED

2.2 The table shows that in all 359 vacancies were notified during the summer under review against 395 vacancies during the last summer indicating a fall of 36 over the previous year. This is attributed to the overall recessionary period and unfavourable market conditions.

Contd...

VACANCIES FILLED.

2.3 ---It would be seen from the figures that although there were less notifications and also few employers as compared to the summer of 1967, the number of students placed in employment were more. In all 316 students were placed in employment during the summer vacation of 1968 against 165 and 270 students during the summer vacation of 1966 and 1967 respectively. Thus the overall rise, it would be seen, was 151 and 46 over the 1966 and 67 summer vacation respectively.

NO. OF EMPLOYERS.

2.4 The Bureau could secure assistance of 46 employers during the summer of 1968 as against 61 and 79 during the year 1966 and 67 respectively. This fall in the number of employers is attributed to the reason given in para 2.2 of the report.

The Chairman, Occupational Information Committee of Rotary Club issued an appeal in sufficient advance but it could not bring out the desired results as a sequel mainly to recession. This can be seen from the number of Rotarians approached and vacancies notified by them. The Bureau on its own initiative had made special efforts to increase the number of employers because of which 18 employers notified the vacancies to the Bureau as compared to 9 during the last year.

2.5 As a result of liaison established by the Bureau with the Rotary Club of Bombay, the Bureau could secure 254 vacancies out of which 213 vacancies were filled and rest of the vacancies were mostly cancelled by the Rotarians because of non-availability of vacancies at the time of actual submission. This is against the target of 400 vacancies. The fall in target is due to the reason stated in the foregoing paragraphs. On the other hand the Bureau on its own efforts could get 105 vacancies out of which 103 vacancies were filled and 2 vacancies cancelled bringing the total number of students placed as a result of joint efforts to 316.

2.6 It would appear from the above information that the bulk of the vacancies were of the bank clerks (174) representing 55% of the total vacancies filled. Next to this, are general clerks (73) or 23% of the total vacancies filled. One of the establishments took 45 students to work as investigators for conducting survey for its products. It has been observed that the employers give more weightage to the good academic record and good hand-writing etc. rather than the financial position of the students. Most of the banking institutions prescribed the first Class S.S.C. with Mathematics with good handwriting as the minimum qualification for entry in the bank. In view of this, it is imperative on the part of needy students to improve upon their educational standard etc. to have the employment assistance from the Bureau.

TABLE

Statement showing the occupations against which students could not be sponsored by the Bureau during the summer vacation of 1968.

Occupation	No. of vacancies.	Qualifications laid down by the employer.	Remarks.
Accounts Clerks.	3	B.Com. Knowledge of Gujarati essential.	M.Com. student generally employed because of the holding of evening Cl
Salesman	1	<u>University students job description.</u> Will have to appoint dealers for the sale of Dearalite Aluminium furniture. The person will be required to go round the city of Bombay and suburbs with catalogues. Pay: Will be paid at the rate of Rs. 10/- per dealer and Rs. 7/- per sub-dealer on appointment. No travelling allowance.	Terms and conditions were not suitable to the students.
Project Asstt.	2	Specialised skills preferably with Business Administration background.	No suitable applications were on the Live Register.

TABLE.

Statement showing the distribution of vacancies filled according to pay range and industry.

Name of Activity	<u>V A C A N C I E S</u>						
	100	101 to 150	151 to 200	201 to 250	251-300	301-350	350
Manu- facturing	3	3	29	23	18	2	7
Trade & Commerce.	7	7	4	-	-	-	1

Banking	-	-	22	9	76	67	17
Business/ Other services.	-	3	5	-	-	45	5
Grand Total	3	13	60	32	94	114	310

2.7 Of the total number of vacancies filled 76% were within the pay range of Rs.201 and above and rest of the vacancies were within the pay range of 100 to 200. During the course of pre-submission interview it was observed that vacancies falling with the pay range of Rs.100 to 150 were most unattractive to the students and hence the Bureau found it extremely difficult to sponsor sufficient number of students against such under-paid vacancies. The students main plea is that the remuneration should at least cover the expenses of books and fees by serving during the vacation. On the other hand the employers want to employ the students on stipend basis only. In this regard it is suggested that the employers should take more liberal view while fixing up the payment for the students so that their genuine need can be met.

Employment of Girl students.

2.8 In all 24 girl students were placed in employment. This figure is most disappointing looking to the total registration of 310. Experience has shown that the employers including banking institutions are not coming forward to take up girl students in their employment. This is not because they are inefficient but they have to make extra arrangements for toilet etc. etc. Besides, the vacancies occurring in factories are also found to be unsuitable for the ladies in view of the odd working hours. Some of the girl students were selected for the post of investigators which involved outdoor duty but the experience has shown that their parents had not allowed them to work. It would, therefore, appear from the above explanation that a number of difficulties are involved in placing girl students and hence unless the employers change their outlook towards the recruitment of girl students, it is felt, the Bureau would not be in a position to place them in vacation employment in a significant way.

III. Employment Assistance in terms of Monetary Involvement.

3.1 Keeping in view the object of launching the project, it would be more pertinent to measure the placement activity in terms of monetary involvement rather than the mere number of students placed in employment. Hence efforts have been made on the basis of information available with the Bureau, to estimate as to what extent the students have been benefited financially. On a rough calculation it is seen that the students were given financial assistance to the extent of 1½

lakhs. Further, 74% of the total financial assistance came from the banking institutions.

IV. Selection of Students at the Bureau's premises.

41. The Bank of Baroda, Operation Research Group of Sarabhai Chemicals and some other employers interviewed the students in the University Club House itself. This system was found to be much convenient to the employers, students and more particularly to the Bureau. If other employers follow the same it would be advantageous to all concerned. Besides providing all facilities for undertaking the interviews, this year the university authorities have also made a Hall available to the Operation Research Group, Sarabhai Chemicals to enable them to give a ten days' training course to the students.

From the above, it would appear that with the help of university authorities the Bureau is doing its best to give maximum facilities to the employers as well as to students.

V. How the students and Employers can help the Bureau

5.1 (A) STUDENTS: (i) Registered students are generally found to be under the impression that mere registration will help them to get employment through the Bureau. This is a wholly erroneous presumption. The recruitment is made solely on the performance shown in an interview or test.

(ii) The posts falling within the pay range of Rs.100 to 200 were found to be not acceptable to the majority of students. Since most of the employing units are giving remuneration in the form of stipend or training allowance which is bound to be much below the normal pay it is suggested that at least the needy students should accept such vacancies.

(iii) 90 students had shown unwillingness to work during the factory hours.

(iv) Almost all the students were interested in banking jobs without any thought to their educational performance and handwriting which is the main criteria for selection and appointment. The students are requested to screen themselves and find out where they stand.

(v) Prescribed forms for employment have been filled incorrectly by most of the students. Since filling up of employment form correctly carries weight in getting selected the students should not take it lightly. It

(vi) In order to increase employability, the students should learn typing/shorthand.

(vii) Expression capacity was found to be very poor. This should be improved.

(viii) Many of the students faced the interview without any preparation. This should be avoided.

(ix) The students employed directly should intimate the Bureau so that their colleagues' names could be considered for submission.

(x) Last but not the least, some students reported if an interview without pen. This should be avoided.

5.2 EMPLOYERS: (i) The qualifications required for the post should specifically be given such as studying in B.Sc. final, B.A., Final etc. This will enable the Bureau to recommend only suitable students.

(ii) Since the Bureau sends full particulars of the students in the prescribed form in duplicate regarding names, addresses, age, qualifications etc., etc., duly checked, the filling up of prescribed employment form should not be insisted upon. These should be filled in at the time of interview or actual appointment in the offices.

(iii) Working hours should be intimated to the Bureau since some students are unwilling to work during the factory hours.

(iv) Remuneration should be stated at the time of notifying the vacancies so that names of the disinterested students could be dropped at the Bureau's end.

(v) The employers take a lot of time in calling the students for an interview from the list submitted to them. This delay prevents the submission of names of students against other vacancies.

(vi) Results should be communicated to the Bureau immediately to keep the Live Register up-to-date.

(vii) It is noticed that the students who worked during the last summer were directly taken up by some of the establishments. Recruitment during each summer should be done through the Bureau with a view to keeping the Life Register up-to-date.

(viii) The Selection and appointment of students for vacation employment should not be rigid but it should be flexible enough to take into consideration the financial position of the students.

(ix) Students being freshers to the employment mark experience and other qualifications required for regular posts should not be insisted upon.

(x) Girls students should be liberally considered for appointment.

(xi) The experience certificates giving the nature of job performed and duration should be issued to the students at the end of the service.

Report of the Sub-Committee of the
Jabalpur University regarding
switch-over to Hindi medium.

A meeting of the Sub-Committee appointed by the Faculty of Commerce was held on Saturday, the 4th November, 1967, at 10.00 A.M. in the Principal's Office of the D.N. Jain College, Jabalpur.

The following members were present:-

1. Prof. B.S.Audholia. Dean & Head of the Com.Deptt.
2. Prof. P.L.Daldua. Head of the Deptt. of Bus.Adm.
3. Dr. P.C.Srivastava Head of the Deptt. of Applied
Economic
4. Dr.S.C. Diwakar.
5. Shri C.M. Pachery.

Note: Shri P.C. Jain of Keshernani College being out of station was not present.

The following business was transacted.

1. The Committee prepared a list of books for translation into Hindi (The list of the books attached herewith). Since only one book has been included in the list for each subject prescribed for the M.Com. Degree, the committee feels that they are all of equal importance for the purposes of translation.

2. The Committee strongly feels that in addition to the work of translation, some original books (at least one) in each subject should also be written by experienced teachers in the Faculty of Commerce. If this scheme finds approval with the University, the list of subjects under which original books will be written, shall be drawn and the work shall be allocated.

3. The Faculty of Commerce has been doing the entire teaching work in Hindi upto the B.Com. stage for the last several years. In so far as teaching to the M.Com. classes is concerned, it is presently done both in English and Hindi. The committee feels that the present arrangement is satisfactory since it will lead gradually to a situation when the entire teaching to the post-graduate classes i.e. M.Com. classes will be done in Hindi.

4. The financial outlay of No.(a) translation work of 10 books as per list attached, and No.(b) writing of

original books, of another 10 books will be Rs.2 lakhs at least. The Committee hopes that the necessary money shall be provided by the University so that details may be drawn and work be commenced.

5. The committee requests the University to enquire from other Universities whether any of the Books mentioned in the list (a) are being translated or have been translated in any university. The information so received may be supplied to the Dean, Faculty of Commerce at the earliest date.

List of Books selected for translation in Hindi.

1. Cost Accounts. By Briggs.
2. Financial Organisation and Management. By Gesterberg.
3. Principles of Marketing. By Clark.
4. Monetary Theory. By Halm G.N.
5. Central Banking. By De Kock.
6. International Economy. By Gunnar Hyrdal.
7. Problems of Nationalised Industry. By Hasan.
8. Economics of Agriculture. By Cohan.
9. Economic Development, History, theory and Policy. By Moir & Waldwin.
10. Essence of Management. By Niles.

ALL INDIA BOARD OF TECHNICAL STUDIES IN COMMERCECONSTITUTION AND FUNCTIONSCONSTITUTION:

1.	Chairman - to be appointed by the Chairman, All India Council for Technical Education.	1
2.	Nominees of the All India Council for Technical Education.	5
3.	Representative of the Indian Society for Technical Education.	1
4.	Representatives of the State Boards of Technical Education(one from each region)	4
5.	Representative of the Inter-University Board of India.	1
6.	Representatives of the Universities(to be nominated by the Chairman, A.I.C.T.E.)	5
7.	Representatives of Trade, Commerce and Industry (to be nominated by Chairman of the A.I.C.T.E.).	3
8.	Representatives of Professional Bodies.	4
9.	Representative of the Board of Management Studies.	1
	Total :-	<u>25</u>

The Board may co-opt, if necessary, upto five members.

The term of office of the Board will be 3 years subject to the proviso that a person elected from a particular constituency shall continue to be on the Board so long as he continues to be a member of the particular constituency.

The term of office of the representative of each State Board should be one year. The representatives should be nominated by rotation from each of the State Boards in each region.

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The Board should ordinarily meet twice a year but it will be open to the Chairman to summon meetings of the Board as and when necessary.

FUNCTIONS:

- (a) To formulate detailed schemes for Diploma in Commercial Practice, B.Com. and M.Com. Degree courses on an all-India basis and to lay down standards of instructional and other facilities for conducting these courses.
- (b) To formulate detailed proposals for the introduction of Diploma in Commercial Practice (D.C.P.) Courses in technical institutions in the country through State Boards of Technical Education and other authorities. To recommend general principles regarding Central assistance to the institutions.
- (c) To examine periodically the standard maintained by State Boards and other authorities in respect of D.C.P. Courses and to evolve gradually a system of recognising the Diplomas of State Boards on an all-India basis.
- (d) To advise on the selection of institutions where M.Com. courses may be developed; to assess the requirements of the institutions for the purpose and to recommend Central assistance to be given to them.
- (e) To advise the All India Council for Technical Education, University Grants Commission, State Boards and other authorities regarding all other aspects of coordinated development of Commerce Education in the country.

FACULTY DEVELOPMENT - SUMMARY OF
RECOMMENDATIONS OF THE MANAGEMENT BOARD.

1. QUALIFICATIONS.

Management is an applied academic field in which the aim is to widen the horizons of knowledge with the object of improving management practices.

A faculty member in management education should possess the usual qualities of a pedagogue in post-graduate teaching but in-particular he should:

- (a) have a thorough preparation in basic and applied disciplines relevant to management at the level of a Master's degree;
- (b) be trained to impart his knowledge and in teaching method;
- (c) be willing to apply his disciplines to managerial problems (and have aptitude for so doing) in the knowledge that the world of practice will provide him with raw material relevant to the development of his disciplines;
- (d) know the world of practice so that he is aware of how and when to apply his knowledge in his endeavour to improve management procedures.

2. SOURCES OF FACULTY.

Faculty for management education will be expected to come from four main groups:-

- (a) Existing academicians in India in Management and related disciplines;
- (b) Existing Indian academicians abroad.
- (c) Post-graduates in disciplines relevant to Management.
- (d) Practising managers.

3. FACILITIES:

It was recognised that each group might require a different development approach. The Institutions which could contribute to their development divide into three broad groups as follows:-

- (a) Existing Institutions engaged in management education.

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- (b) Institutions abroad, mainly in the U.S.A.
 - (c) Industry and commerce and other sectors of activity (e.g. agriculture, Government administration, education, transport, defence, commerce).
4. For the development of faculty, the following facilities should be provided:-
- (a) Doctoral programmes in India.
 - (b) Doctoral programmes abroad.
 - (c) Non-degree General Management Programmes in India - duration - 3 months and over.
 - (d) Non-degree Functional Programmes in India - duration - 3 months and over.
 - (e) Short Non-degree Programmes in India - duration - less than three months.
 - (f) Non-degree General and Functional Programmes abroad - duration - 3 months and over.
 - (g) Pedagogic workshops covering both general and functional management.
 - (h) Programmes for Associate Faculty, i.e. faculty members of other institutions (see paragraph 10 below)
 - (i) Faculty internships in Industry (or other sectors) involving job or consultancy assignments.
 - (j) Pedagogic orientation for practising managers who are part or full-time faculty members.

5. DOCTORAL PROGRAMMES IN INDIA:

The doctoral programmes of universities and other institutions in India (see paragraph 4a) should be used for the purpose of development of faculty; they should, preferably have built into them formal methodological and substantive preparation. The teaching load of various categories of staff viz. Professors, Assistant Professors etc. has been fixed so as to allow them reasonable time for research. The teaching staff of management institutions are expected to do research in their spare time. However, for encouraging research in the field of management, scholarships should be instituted on the pattern of research scholarships in other fields. 30 scholarships of Rs.250/- per month for doctoral and 10 scholarships of Rs. 400-500 per month for

post-doctoral work for a minimum of two years should be instituted. Besides individual research, team/institutional research should be encouraged whereby two or more members of faculty of an institution jointly conduct research on specific problems.

The institutions should be provided on a permanent basis, supporting staff like investigators, compilers etc. to ensure that experienced supporting staff for continuous development of research is available.

6. DOCTORAL PROGRAMMES ABROAD:

For the time being doctoral programmes abroad (see paragraph 4 b) will continue to be used for two main reasons, viz. some subjects cannot be handled at present in India and sufficient faculty is not available to supervise and guide the work of the required number of doctorate students. When students go abroad for research and the writing of a thesis, they frequently take up employment abroad when they have completed their doctorate; this may keep them away from India for some five or six years. It is desirable that candidates studying abroad for a doctorate should do their major research and write their thesis in India. If they do, their studies retain a high degree of relevance to the Indian environment; they can contribute valuably to the building up of much needed - case material for management studies in India; and incidentally, the outlay of foreign exchange will be minimised. Management Institutions in India should try to negotiate directly with foreign universities for such training and research facilities for their faculty.

7. NON-DEGREE GENERAL MANAGEMENT AND FUNCTIONAL PROGRAMMES IN INDIA.

These programmes should be used to bring faculty members into direct touch with practising managers. The role of faculty members of management institutions should be two-fold in these programmes. The senior faculty members may be associated with the conduct of the programmes and appropriate faculty members should be sponsored as participants. These programmes will help both the trainer and the participants. The institution/organisation conducting such programmes should reserve some seats for academic staff and if possible give some concession in fees to participants from academic institutions. Further, the expenditure involved in deputing faculty members to such programmes should be considered an approved item of expenditure for giving financial assistance to the Management Institutions.

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8. NON-DEGREE GENERAL & FUNCTIONAL PROGRAMMES ABROAD (para 4f)

The Committee felt that, as and when possible, suitable persons should be sent abroad for such programmes. The negotiations should be direct with the concerned foreign organisations.

9. PEDAGOGIC WORKSHOPS FOR GENERAL AND FUNCTIONAL MANAGEMENT AND PEDAGOGIC ORIENTATION OF PRACTISING MANAGERS (para 4g)

The development of the skills necessary for imparting knowledge to others should be achieved by pedagogic workshops. In addition, courses on pedagogic orientation should be run for practising managers who are full-time or part-time faculty members. Such workshops should be organised by management institutions. The expenditure incurred on such workshops by the institutions should be considered as an approved item of expenditure for the purpose of grants.

10. PROGRAMMES FOR ASSOCIATE FACULTY.

Institutions with well-developed programmes of management education should, at their discretion, be well advised to invite, as associate faculty, teachers from other institutions endeavouring to build up their capabilities. Associate faculty members will thus get the opportunity to absorb the attitudes, skills and substantive knowledge that the host institution has developed. The visiting teachers may be invited for a period ranging from three months to a year. Host institutions should bear the cost of additional expenditure involved in this behalf.

The additional expenditure involved on such deputations of faculty members to other institutions should, however, be treated as approved item of expenditure for the purposes of grants.

11. ASSIGNMENTS IN INDUSTRY AND COMMERCE.

Institutions should approach industrial concerns prepared to offer managerial experience to faculty members for a minimum period of three months as an integral part of their organisations. The faculty members should be paid by the beneficiary organisations for the specific job or projects or consultancy assignment. The Board does not wish to indicate either the types or the number or the period of assignments that may be undertaken by the faculty. However, the following types of activities for different categories of staff may be considered.

TOP LEVEL FACULTY:

(Professors who are heads of Departments, generally aged 40 and over).

(a) Consultancy.

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- (b) Advisory assignments to top management.
- (c) Joint Research projects.
- (d) Cooperation in in-company training programmes - both in organising and teaching.
- (e) Participation in the senior management programmes of IIMA (see paragraph 7)
- (f) Honorary membership of professional bodies.

MIDDLE LEVEL FACULTY (Between 30 and 40)

- (g) Regular jobs giving scope for their academic discipline, or appointments as staff officers assisting general management or heads of departments - duration one year or more.
- (h) Membership of a research team within the company.
- (i) Attendance of in-company training courses as observers or participants.
- (j) Attendance of Management development programmes organised by IIMs Calcutta and Ahmedabad, and the ASCI Hyderabad (see paragraph 7).

12. RESEARCH

Research is an important means of faculty development. Institutions should be encouraged to undertake research and as much assistance may be given as is possible. Institutions should try to explore the possibility of getting assistance from Industry for research projects.

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APPENDIX-I
(Item No.3)

A note on the Fourth Five Year Plan
for Technical Education - 1969-74.

The general approach and the broad guidelines for the formulation of the revised Fourth Five Year Plan 1969-74, were discussed in the first Conference of the Directors of Technical Education held on 23rd May, 1968 and at the meeting of the All India Council for Technical Education on 25th May, 1968.

Preparations for the formulation of the detailed proposals on the basis of the guidelines laid down by the Director's Conference and the All India Council for Technical Education began in early July, 1968. The general outlines formulated by the Ministry of Education including the various schemes that were proposed to be undertaken and the outlays required for implementing those schemes were placed before the meeting of the Coordinating Committee of the All India Council for Technical Education on 24th August, 1968. The Coordinating Committee generally endorsed the outlines formulated by the Ministry.

The draft proposals of the Ministry envisaged a total outlay of Rs.213.00 crores for Technical Education in the Fourth Plan, comprising of Rs.107.00 crores in the Central and Centrally sponsored sectors and Rs.106.00 crores in the States Sector.

Detailed discussions with the Planning Commission began towards the end of December 1968 for finalising the schemes and outlays for technical education. After a series of discussions, and taking into account the availability of overall Plan resources for the next five years, the Planning Commission has made an allocation of Rs.119.72 crores for Technical Education, which is made up of Rs.60.00 crores in the Central and Centrally sponsored Sectors and Rs.59.72 crores in the State's Sector. The scheme-wise

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allocation for programmes in the Central Sector are given in Appendix(i). The State-wise allocations of the outlays in the States Sector are given in Appendix(ii).

The allocation made by the Planning Commission is not adequate to implement all the programmes proposed for the Fourth Plan period. For an appreciation of the magnitude of the problem in terms of investment, the actual expenditure on technical education in the first three plans and also in the three annual plans 1966-69 is given below:-

Period	Actual Expenditure		(Rs. in crores)
	Centre	States	Total
1951-56	11.50	8.70	20.20
1956-61	23.60	25.32	48.92
1961-66	69.91	59.00	128.91
1966-67	15.99	10.06	26.05
1967-68	18.22	9.84	28.06
1968-69	20.54 (Budget Estimates)	11.99 (Budget estimate)	32.53

In the discussions with the Planning Commission the Ministry had emphasised the need for a larger outlay than what has been agreed to and has sought an upward revision in the allocation for technical education programmes. However, due to the uncertainty of the overall resources available for development programmes as a whole, it has not been possible to secure a larger outlay for the present; the matter will nevertheless be closely reviewed if there is any improvement in the overall economic development resulting in increased availability of resources.

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Programmes in the Central and
Centrally Sponsored Sector.

Brief particulars of the programmes proposed to be implemented in the Central and Centrally Sponsored Sectors of the Fourth Plan are given in the following paragraphs :-

A. Central Government Institutions

1. Indian Institutes of Technology

The provision made for the five Institutes of Technology at Kharagpur, Bombay, Madras, Kanpur and Delhi is Rs.10.00 crores. This includes the completion of schemes already undertaken and development of post-graduate courses including the establishment of advanced centres in aeronautics, material sciences etc.

The paucity of resources, the shortage of materials and the consequent rise in prices have all constrained the completion of several schemes and programmes in these institutes as originally scheduled. All of them which are at different stages of development should be completed expeditiously to the extent possible. Deficiencies if any in essential requirements whether instructional buildings, staff, equipment or staff quarters, hostels or student amenities are to be made good. An important programme that all the IITs have to implement in the fourth plan, however, is the strengthening of the post-graduate activities and research. To that end, the Institutes will contain the enrolment at the under-graduate level and concentrate their efforts and resources in giving a purposeful direction to the post-graduate programme. New courses at the post-graduate level will be introduced in some of these institutes in such fields as Material Handling, Thermal Services, Turbomachines, Radar Technology, Electric Traction, Chemical Plant Practice, High Polymer Engineering, Building

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Technology, Computer Technology, Power Apparatus and Systems, Machine Tool Design etc.

The IITs have been conceived as the leading Centres technological education in India. The recent trends in the development of technical education demand that these institutes should not remain in isolation from the remaining engineering colleges and polytechnics, but should assume a more effective leadership by reaching out to help sister institutions by organising training programmes for the faculty and developing new methodology of technical education. The resources and expertise available in the institutes will also be utilised for research in technical education with special reference to curriculum development, preparation of text-books, teacher guides and instructional materials etc. Suitable programmes of action are being drawn up for this purpose for implementation in the Fourth Plan.

It is proposed to set up two centres for advanced studies at IIT Kharagpur and IIT Bombay in Fourth Plan. The Kharagpur centre will be in the field of material science and Bombay centre in Aeronautical Engineering. Both the centres will be assisted in the form of experts, equipment and fellowships from the Soviet Union under the Credit Agreement of December, 1966. It is expected that these two projects will cost over Rs.200.00 lakhs in rupees during the Fourth Plan.

2 Indian School of Mines, Dhanbad

The School had been functioning as a Government Department upto June 1967. From July 1967, it was converted into an autonomous body registered under the Societies' Act and has also been declared a 'Deemed University' from that date.

The School reached an annual admission capacity of 150 in 1957-58 to meet the increasing demands for technical personnel in the field of mining, oil exploration and related fields. The courses offered by the School are Mining Engineering, Applied Geology, Petroleum Technology and Applied Geophysics. However, the recent unemployment in the field of mining necessitated in a considerable reduction in the intake of Mining courses.

The present situation notwithstanding, the ultimate aim is to build up the School into a full-fledged Institute of Mineral Sciences and Technology and a leading Centre for the training of personnel for the mineral industry in the country. To that end, a beginning is proposed to be made in the Fourth Plan by improving the quality of instruction, consolidating the existing facilities and introducing orientation courses at the post-graduate level in special fields. The outlay proposed for these activities in the Fourth Plan is Rs.20,00 lakhs.

3. National Institute of Foundry and Forge Technology, Ranchi.

The Institute was approved in the Third Plan for conducting courses for the specialised training of personnel required by the Forge and Foundry Industry. For various reasons, the establishment of the Institute was considerably delayed and a beginning was made only in 1967-68.

It is envisaged that in the Fourth Plan, the Institute will be fully established. The United Nations Special Fund is assisting this project with experts, equipment and fellowships. The outlay of Rs.180 lakhs proposed in the Fourth Plan is to complete the establishment of this Institute according to the approved programme with such modifications that are considered necessary.

4. All India Institutes of Management,
Calcutta and Ahmedabad.

The original scheme of establishment of these two institutes did not envisage any expenditure from the Central Government towards the construction of buildings. The entire cost of land and buildings was to be met by the State Government concerned, the Ford Foundation and the Industry. However, the Institutes have not been able to raise the necessary resources from industry and as a result, the construction programme has lagged behind. Meanwhile, the academic activities of the Institutes have made rapid progress and at present the Calcutta and Ahmedabad Institutes have student enrolment of 240 and 200 respectively. The need for the minimum buildings have therefore become an urgent necessity and the Central Government have to provide for the cost of construction. A sum of about Rs.27.00 lakhs will be paid to these Institutes during the Fourth Plan to complete the urgent construction works. The total additional recurring expenditure for the Plan period will be about Rs.23.00 lakhs for both the Institutes. The total outlay will thus be Rs.50.00 lakhs.

5. Centre for Industrial Design at IIT, Bombay.

The original proposal was to set up a separate Institut for Industrial Design. But it has since been decided not to set up an independent institute for the purpose but to organise facilities for training in this field at the IIT, Bombay. The Bombay Institute will make a beginning with the scheme in the year 1969-70. The project will be integrated with the development of the Bombay Institute and the outlay of Rs.25.00 lakhs made for this purpose in the Fourth Plan will be utilised by the IIT Bombay.

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6. School of Planning & Architecture -
Completion of Schemes and further
development.

The School is at present conducting under-graduate courses in Architecture and post-graduate courses in Town and Country Planning with specialisation in (i) Urban and Regional Planning, (ii) Housing and Community Planning and (iii) Traffic and Transportation Planning and also in Architecture (urban design). The annual intake of the Institute at present is 104.

In the Fourth Plan, it is proposed to increase the intake to 135 and consolidate the academic activities so far undertaken. The new proposals are to introduce a post-graduate course in Landscape Architecture and to intensify the research activities in the Departments of Town and Country Planning and Urban Design. In addition, it is proposed to set up an Urban Research Unit in the School.

The outlay proposed for these activities is Rs.15.00 lakhs in the Fourth Plan.

7. National Institute for Training
in Industrial Engineering.

The Institute has not been able to complete its programme of establishment within the estimates of expenditure approved for the institute earlier. It is necessary to make up the deficiencies in buildings, equipment and library. Besides, the recurring expenditure has also to be enhanced if the Institute has to carry out all the programmes that are expected to be implemented. The activities proposed to be implemented are expansion of the Executive Development Programme, Organisation of Sandwich programmes for Managerial Trainees, Organisation of courses on an inter-Company basis, provision of consultancy

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services and organisation of seminars and conferences on Special Problems of Industry.

B. Development Programmes for Engineering Studies including post-graduate courses and Research.

8. Development and consolidation of post-graduate courses and research in engineering and technology in State and non-Government institutions (Centrally Sponsored Scheme).

On the recommendations of the Thacker Committee, the All India Council for Technical Education set up a Board of Post-graduate Engineering Studies to implement the programmes of development of post-graduate studies and research in Engineering and Technology. The Board has so far approved 34 institutions for conducting 183 courses with annual admissions of 1555 students. These are in addition to the Indian Institutes of Technology and the Indian Institute of Science, Bangalore which are outside the purview of the Board. These institutions include the University Departments, State Government and non-Government institutions, and the Regional Engineering Colleges.

All these institutions have been running these courses for some years now. But so far, the Government have been paying only the stipends to the students admitted to the courses and no expenditure on building, equipment and staff has been met so far. According to the pattern of assistance now in force, the Central Government is committed to pay the entire non-recurring and recurring expenditure. It has now been decided that from the current year, assistance might be given for equipment, staff and maintenance. Excluding the University Institutions, for which the University Grants Commission will make the necessary provision

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under their continuing schemes, the Ministry of Education will have to meet the expenditure in respect of 95 courses with an annual admission capacity of 920. Based on the estimates prepared for these courses, the continuing commitment of the Centre will come to about Rs.400 lakhs non-recurring and Rs.400.00 lakhs recurring during the Fourth Plan period. Due to the paucity of resources, however, it may not be possible to provide all these facilities in the next five years. The provision that has been made in the Fourth Plan is only Rs.5.00 crores for this scheme.

9. Part-time degree and diploma courses
(completion of schemes already sanctioned).

A scheme to introduce part-time diploma courses at 25 selected centres in the country was approved in the III Plan and the scheme is being implemented from 1963-64. Most of the 25 Centres have started functioning and several of them will complete 5 years during the current year when Central assistance for them will cease. However, a few of them will have to be assisted by the Central Government until they complete the five-year period and therefore adequate provision for this purpose in the Fourth Plan is necessary.

Simultaneously, a scheme for part-time degree courses was also introduced. These courses were to be organised at 30 selected centres. About 17 centres have so far been approved, but all the approved centres have not yet started functioning. The Central Government have to meet the entire non-recurring expenditure and the recurring expenditure for a period of 5 years. Provision has, therefore, been made for the approved Centres.

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10. Development of non-Government technical institutes according to schemes already approved and in the process of implementation.

The Scheme for development of engineering colleges and polytechnics has been under implementation from plan to plan. Under each Five-Year Plan, a large number of Engineering Colleges and polytechnics were expanded and developed with Central assistance. All the private institutions are paid grants directly by the Central Government for their establishment and development and their number is over 100. Apart from the first-degree and diploma institutions, the Scheme also covers Girls' Polytechnics, Junior Technical Schools and other specialised institutions and courses like Chemical Operator's course, Management studies and Commerce Courses. The development programmes approved for these institutions in the recent past have not all been fully implemented. The commitment is to assist these institutions in the capital expenditure and in recurring expenditure for a period of 5 years.

A provision of Rs.400.00 lakhs has been made to meet the spill-over of the commitments in the Fourth Plan

11. Practical Training of Graduates and diploma holders (expanded programme).

The Scheme of Practical Training Stipends for engineering graduates and diploma holders was initiated in 1949 with a view to provide fresh graduates and diploma holders practical training in industry in order to condition them for gainful employment. The duration of the training varied from six months to two years. The scheme expanded considerably during the three plans and at the end of the Third Plan about 2000 places were being utilised every year for Practical training.

The present unemployment among engineering personnel has focussed attention on the need to improve the practical experience of engineering graduates and diploma holders. For this purpose and also partly as a measure to minimise the gravity of unemployment, the Cabinet decided to strengthen the programme and increase the number of training places. In pursuance of this decision, a reorganised programme of Apprenticeship Training has been formulated and is being implemented from 1968-69.

The re-organised programme envisages a substantial increase in the number of training places at the end of the Fourth Plan. The present deficiencies in the programme, particularly in respect of supervision and purposeful training are sought to be remedied. For the effective supervision of the training programme, four Regional Apprenticeship Boards are being set up with participation from industry, technical institutions and other interests. The programme itself will be organised in such a manner as to provide the trainees with all the good elements of effective and purposeful training including basic, secondary and specialist training.

A provision of Rs.7.00 crores has been made in the Plan for payment of stipends for the additional places to be secured in the Fourth Plan together with other expenditure for the implementation of the programme.

12. Management studies at Universities and other Centres.

Apart from the two All India Institutes of Management at Ahmedabad and Calcutta, there are some Universities and other institutions affiliated to Universities which offer courses in

Management studies. These latter institutions are conducting mainly two types of courses: (i) a part-time post-graduate diploma course in Management for practising supervisory personnel in industry and commerce and (ii) a full-time Master's degree programme for fresh graduates. Some institutions are also conducting and have proposals to conduct functional courses like Personnel Management, Marketing, Financial Control etc.

In order to complete the programmes already approved and to implement the new proposals to expand the facilities for management studies if necessary in the Fourth Plan, an outlay of Rs.150.00 lakhs has been proposed.

13. Development of Regional Engineering Colleges (Centrally Sponsored Scheme).

The Scheme for the establishment of 15 Regional Engineering Colleges was approved in 1958. The first College started in 1959 at Warangal and the fifteenth one is yet to start functioning at Silchar in Assam. According to the scheme approved, the Central Government is to meet the entire non-recurring expenditure for these colleges and 50% of the recurring expenditure for a period of 5 years. Most of the Colleges completed the Five-year period and in their cases, it was agreed to continue Central assistance upto 1968-69. However, the Colleges at Tiruchirappaly and Silchar will still be entitled to Central assistance for recurring expenditure and provision has to be made in the Fourth Plan for this purpose.

The scheme when it was approved in 1958, made a total estimate of Rs.19.30 crores for all the 15 Colleges, for non-recurring items of expenditure. However, no college has been able to establish fully with-in these estimates. Due to the

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rise in the cost of equipment, rates of construction and the general rise in the prices, it is estimated that the total cost for non-recurring items would go up to about Rs.30.00 crores for all the colleges together. The deficiency of the order of about Rs.10.00 crores will therefore have to be made good.

A total provision of Rs.8.00 crores is therefore proposed in the Fourth Plan for the Regional Engineering Colleges.

14. Loans for construction of hostels (completion of projects already approved and for limited expansion of hostel accommodation).

The Central Government has been sanctioning loans to technical institutions for construction of hostels from the first Plan. While non-Government institutions get interest free loans, the loans for Government institutions are interest-bearing. The loans are given for a maximum of 50% of the total student population in non-residential institutions and 100% of the student body in residential institutions.

The loans paid to Government and non-Government technical institutions in the three plans amounted to Rs.46.00 crores. The accommodation provided against this amount was of the order of 45,000 seats.

At the end of the Third Five Year Plan, there was an undisbursed balance of Rs.10.50 crores recommended by the All India Council for Technical Education to be paid by the Government. Another Rs.1.50 crores were recommended by the Council between 1966 and 1969. Almost all these loans have also been approved by the Government of India. The actual disbursement during three years 1966-69 will amount to about 4.00 crores only. Thus against the commitments so far made, an amount of

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Rs.8.00 crores will have to be met by the Government for which provision of Rs.5.00 crores has been made in the plan because of paucity of resources. This has to be reviewed during the Plan period.

When the construction of all these hostel programmes is completed, accommodation will have been provided to about 65,000 students in the various technical institutions.

15. Specialised courses to be conducted in cooperation with industry as pilot projects and refresher courses for personnel from industry.

The courses offered at present in our technical institutions enable the students to equip themselves with the necessary theoretical background through institutional training at the diploma, first degree and post-graduate levels. There are at present no facilities in this country for technical personnel from industry to improve their knowledge or to acquaint themselves with modern developments in engineering and technology except through the medium of joining a regular post-graduate course. These courses are generally of two-year's duration and often the industry would be reluctant to release their employees for studies extending over a period of two years. If suitable courses are designed in the form of refresher courses in selected fields, extending over shorter periods, the industry would readily sponsor their employees to attend these courses which will enable them to improve their knowledge. Such courses will also place adequate emphasis on the practical aspects of the speciality. The formulation and organisation of such courses will also required an active involvement of the industry in this effort. The proposal is to

organise such different types of refresher, advanced or specialised courses in cooperation with industry as a pilot project in the Fourth Plan.

C. Quality Improvement Programmes through Central effort.

- 16. Technical Teacher's Training for College level teachers, In-service training, Summer Institutes and other programmes for faculty development both for college level and polytechnic teachers and research in Technical Education including curriculum Development etc.

(a) Teacher Training Fellowship

The Teacher Training Fellowship programme was introduced in 1959 at five centres. The programme started with 100 trainees in the first year. Later, the programme was expanded to provide every year for the training of 250 graduates at 14 centres. The fresh graduates recruited for training under the scheme joined engineering colleges in different parts of the country as teachers. The number of graduates trained so far is 600.

The scheme was introduced primarily to meet the acute shortage of trained teachers. During the years that the scheme has been under implementation, it has provided a regular source for the supply of fully equipped and adequately trained teachers. The teachers trained under the programme have been well-received and the scheme has served a most useful purpose in meeting the shortage of teachers. However, with the expansion programme at the degree level almost at a standstill, and the progressively diminishing shortage of teachers in the technical institutions, the scope for recruiting fresh graduates and training them for placement as teachers has considerably decreased. Therefore,

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the scope of the scheme will be somewhat restricted in the Fourth Plan.

Considering the utility of the scheme and the impact that it has made on the improvement of faculties in technical institutions, the scheme should continue in the Fourth Plan at least to cover the teachers who are sponsored by technical institutions. These sponsored teachers may already be working in institutions or they might have been recruited against vacant posts. In either case, the teachers on completion of training will be guaranteed with employment and there will be no difficulty about placement. The training programme will also be made flexible enough to answer the individual demands and provision will be made to equip the trainees with some industrial experience and more important, with adequate understanding in the methodology of teaching.

(b) Summer Institutes.

If the quality of technical education has to be improved, an all-out effort has to be made to improve the professional competences of a very large number of teachers in engineering and technology. In the case of those teachers who possess the necessary qualifications, their knowledge has to be improved through advanced treatment in broad specialised fields to make their education more scientific and modern. Also, the continuous improvement of the professional competence of the highly specialised and well-qualified teachers has to be ensured through short-term symposia, seminar, intensive short-term programmes etc. At the polytechnic level, the large number of diplomaholders of the faculty need improvement of their knowledge particularly relating to the teaching of

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practicals in laboratories and workshops, because most of them have no industrial experience and are not confident of their ability to handle apparatus and equipment.

Most of the Institutions cannot at present afford to send their teachers for full-time courses to improve their qualifications. Further, the problem is one of numbers. Therefore, the only practicable means through which the subject competence and teaching techniques of teachers can be improved in as short a time as possible is the agency of Summer Schools. The broad objectives of the Summer Schools programme are: (i) improvement of teaching methods, (ii) improvement of subject matter competence and (iii) provision of opportunities for exchange of upto-date knowledge in specialised fields.

During the Fourth Plan two types of Summer Schools for college and polytechnic teachers will be organised. (a) Sequential programmes of 6-8 week's duration (b) advanced programmes of 4 weeks duration. This will ensure every year about 800-850 college teachers participating in the programme, and about 2500 of them completing their training during the Plan period. As for polytechnics, about 1200 teachers will participate every year and 4000 of them will complete training in the Fourth Plan.

(c) Other programmes of Faculty Development.

While the Summer Institute Programme or the Teacher Training Fellowships Programme would, to an extent, help in the improvement of faculties, we must designedly bring to the training centres a very large number of serving teachers who have not had the benefit of post-graduate training and prepare them for the Master's degree and equip them with professional

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competences. This would require a practical arrangement with the engineering colleges to get their teachers on long study leave of 2-3 years. During that period, the colleges should have adequate supernumerary posts to take care of the normal teaching work. An extension of the same process will include preparing selected teachers for the Ph.D. degree and equipping them for higher faculty positions.

Also programmes for practical training or apprenticeship in industry for the benefit of serving teachers, promotion of consultancy services with the participation of teachers, seminars, workshops etc. are proposed to be drawn up for implementation in the Fourth Plan.

- (d) Research in technical education including curriculum development preparation of instructional materials and text books, design of laboratory equipment etc.

The improvements in quality demand, apart from good teachers, a variety of teaching aids and instructional materials. Also, the curriculum of various courses have to be so tailored as to meet the demands of a developing economy and a fast-changing technology. It is, therefore, necessary that the system of technical education is kept continuously under review so that appropriate changes can be incorporated from time to time. These changes brought about in the curriculum would require suitable aids to students to comprehend the changes. The instructional materials including text books etc., have also to keep pace with these changes. An all-out effort should, therefore, be made at selected centres for the development of curriculum and preparation of instructional materials for the first degree and diploma courses. For degree courses, the

Institutes of Technology, in association with selected engineering colleges in their respective regions, would be very good centres. Groups of experts who have an understanding of the problem of engineering education and industrial needs will be set up at these centres to work intensively on curriculum development and preparation of instructional material. Simultaneously, they will also work on designing scientific equipment and apparatus needed by technical institutions for their laboratories. Prototypes of apparatus and equipment should be made and their production would be undertaken either at these institutes or by industry.

A plan of action for this purpose is being drawn up for implementation.

The total outlay made for all these programmes in the Fourth Plan is Rs.380.00 lakhs.

17. Technical Teachers Training Institutes for Polytechnic Teachers.

The Technical Teacher Training Institutes at Bhopal, Calcutta, Madras and Chandigarh were established by the Government of India to meet the shortage of trained teachers in the polytechnics in the country. The institutes offer two types of courses: one of 18 months' duration for engineering graduates and another of 2½ years' duration for diploma holders. The present intake in each of the four institutes is 60.

Three of the four institutes started functioning from 1966 and the fourth from 1967. All these institutes have not yet been fully established. The total non-recurring expenditure yet to be incurred on them is about Rs.70.00 lakhs. This, together with the recurring costs in the Fourth Plan will amount to about Rs.140.00 lakhs.

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In addition these institutions will be required to take up new activities like organisation of summer schools, curricular research, production of text books etc. designed to improve the quality of polytechnic education. The detailed schemes for this purpose have not been worked out so far.

The total outlay proposed for all these schemes together in the Fourth Plan is Rs.200.00 lakhs.

18. Improvement of salary scales of technical teachers (spill-over of commitments).

The scheme for revision of salary scales recommended by the All India Council for Technical Education was accepted by most of the State Governments except Kerala, Maharashtra and West Bengal. According to the scheme, the Central Government will meet the entire additional expenditure for a period of 5 years from the date of acceptance of the scheme by the State Government concerned. All the State Governments except one, who have accepted the scheme have completed the five year period.

In the case of a large number of States, the claims for reimbursement for the last two years have yet to be settled. Moreover, the commitment in respect of the five-year period in the case of one State will extend to the first year of the Fourth Plan. To meet these commitments and also to settle the arrears of claims for the past years, an outlay of Rs.50.00 lakhs is proposed in the Fourth Plan.

D. Schemes implemented by University Grants Commission.

19. Development of technical education in University Institutions including Post-graduate courses, Management studies etc.

All programmes of technical education in the University Departments and other institutions managed by the Universities

are implemented through the University Grants Commission and the development grants are disbursed by the Commission. These programmes include post-graduate courses, development of undergraduate courses and specialised courses, management studies and so on. To meet the share of the University Grants Commission payable to the various Universities for the schemes approved in the Third Plan an outlay of Rs.720.00 lakhs has been made in the Fourth Plan.

20. Indian Institute of Science, Bangalore.

The Indian Institute of Science, Bangalore is a deemed University and all the development activities of the Institute will come within the purview of the University Grants Commission. It is proposed to strengthen the post-graduate activities and research at the Institute. There is also a scheme to set up a Centre of advanced studies in Electronics and automation at the Institute with Soviet collaboration. The Institute also proposes to develop its computer centre and Instrumentation courses.

For all these new programmes, a provision of Rs.1.90 crores is proposed in the Fourth Plan.

Proposals of the State Governments and the outlays approved for States in the Fourth Plan.

The proposals of all the State Governments were discussed in the Working Groups for Technical Education in October-November, 1968. The programmes proposed by the State Governments and the salient features of their proposals are given in the following paragraphs:-

1. Admissions to Engineering Colleges and Polytechnics.

The present acute unemployment among engineering

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graduates and diploma holders had focussed attention on two important aspects of development of technical education: (a) whether it was necessary to maintain the level of admissions reached in 1967-68 to our engineering colleges and polytechnics in view of the uncertainty about the Fourth Plan and its requirements of technical personnel; (b) whether the present opportunity should be taken advantage of to regulate and contain the enrolment in our technical institutions so that all our resources can be concentrated on the more important task of improving the standard and quality of the technical personnel. The Ministry of Education advised all the state Governments and Universities early last year that we might bring down admissions to degree and diploma courses to a level that the facilities available in each institution can adequately cope with. A rational and coordinated plan was prepared by the Ministry for reducing admissions to technical institutions and the State Governments were requested to implement it with whatever marginal adjustments that were necessary. The plan envisaged a reduction in admissions to degree courses by about 36%, i.e. from 24,200 in 1967-68 to 15,400 in 1968-69 and to diploma courses by about 20%, i.e., from 48,000 in 1967-68 to 38,000 in 1968-69.

Most of the State Governments generally welcomed the plan formulated by the Ministry and agreed to implement it with some modifications, although some State Governments, notably Maharashtra and Gujarat resisted any reduction in the admission capacity. In the discussions with the State Governments, the working Group took the opportunity to review the admissions made in 1968-69 to engineering colleges and polytechnics and it was revealed that the total admissions to first degree courses were

about 17000 and diploma courses 28-30,000. The position as it emerged at the end of the year was that 17890 students were admitted to degree courses and 27255 to diploma courses. Most of the Governments have not suggested the restoration of the admission capacities to the 1967-68 level, by the end of the Fourth Plan; some of them would maintain the reduced level of 1968-69 throughout the Fourth Plan, while some others would make a gradual increase so that the level reaches nearly the 1967-68 mark at the end of the Fourth Plan. On the whole, the programmes proposed by the State Governments indicate that the annual admission capacity in 1973-74 will be about 18-19,000 to degree courses and 30-32,000 to diploma courses, although most of the State Governments have not proposed any definite targets to be reached by 1973-74.

An interesting feature of the admissions to technical institutions in 1968-69 was that in cases where no deliberate attempt was made to regulate admissions according to manpower needs, the market conditions of demand and supply operated and a very large number of institutions, particularly at the diploma level, have had to content themselves with a considerably reduced number of admissions. Institutions in Maharashtra and Gujarat, where the State Governments did not want to impose any out were no exception. In the absence of a National Manpower Policy and a realistic assessment of manpower requirements for the country as a whole for the future, it seems that the present trend will continue and that in any case in the Fourth Plan, the level of admissions will

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be determined largely by the demand for seats in technical institutions, rather than any definite physical targets to be set for the purpose.

2. Quality Improvement Programmes.

While suggesting a reduction in admissions to Engineering Colleges and polytechnics, the Ministry of Education had also considered the possibility of the impact that a sudden recovery in the field of economic development could make on the demand for technical personnel in the future. Although, it is apparent that no immediate increase in the availability of technical personnel is necessary, at least for the next five years, it was felt that any possible short-term quantitative increase in the demand for highly trained personnel could be more than met by a deliberate attempt to improve the quality and standards of personnel at present turned out from our institutions. To this end, it was impressed on all State Governments that their new Fourth Plan should reflect, in adequate measure, such programmes and priorities as are designed to bring about this qualitative improvement. The first task would be to make up all the existing deficiencies in the institutions and to equip them fully in accordance with the standards laid down by the All India Council for Technical Education in respect of buildings, equipment and staff for their approved intakes.

The State Plans generally reflected the urgent need to make up the existing deficiencies and completing the schemes of development that were undertaken in the Third Plan. In most cases, however, State Governments pleaded their inability to allot necessary funds to complete these programmes on an urgent

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basis. Some State Governments had also taken the view that with the reduction in admissions, they could almost adopt a go-slow policy in technical education at least until such time as the scope for development was clearly known. The Working Group however tried to persuade the State representatives to ensure speedier implementation of these programmes and recommended adequate provisions for this purpose in their plans. It was estimated in the national plan that an outlay of Rs.60.00 crores would be required for the completion of the on-going programmes in the States; but the actual outlays recommended in the States Plans fall short of this by about Rs.13.00 crores.

3. Faculty Development Programmes.

Programmes designed to improve and develop the faculties in our institutions are proposed to be implemented in the Fourth Plan largely through Central effort. The pre-service training programme for college teachers, training of polytechnic teachers through the four Regional Teacher Training Institutes, Summer Institute Programmes etc. have accordingly been included in the Central Sector of the Plan. What was expected to be implemented through the State Plans was however, the deputation of a large number of working teachers for longer periods to centres where they could undertake post-graduate courses and improve their professional competences. Also, it was expected that adequate provision will be made by the states for sending their polytechnic teachers to the four Regional Institutes. The State Plans that came up for discussion in the Working Group did not find adequate expression for the fulfilment of these objectives and to an extent lacked a sense of urgency for undertaking programmes of teacher development. The Working Group

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nevertheless, prevailed on most of the States to make necessary provision for this programme in their plans.

4. Diversification of Courses and Reorganisation of Polytechnic Education.

An important area in which deliberate and purposeful action is urgently required is to reorganise our polytechnic education to bring it in close relation to industry and to reorient the courses functionally towards industrial needs. To this end, our polytechnics should conduct sandwich courses, co-operative courses, part-time courses and so on and efforts should be made to identify on a continuing basis the precise needs of industry for technicians which should be reflected in the type of courses conducted by the polytechnics, their curriculum and methodology. The polytechnics should also have a built-in flexibility if they are to be responsive to industrial needs. At a conference of the Directors of Technical Education in the States held in May, 1968 the broad principles on which this programme should be undertaken in the Fourth Plan were discussed and the general guidelines were laid down. The All India Council for Technical Education later endorsed these guidelines and commended them to the State Governments. The State Governments were requested to formulate an action programme in relation to the regional requirements and to include adequate provision in their new Fourth Plans for this purpose.

9. The Working Group noted with satisfaction that most of the State Governments had realised the urgency of the matter and have indicated their readiness to implement this programme in the next five years. To begin with, the proposals were to

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introduce programmes for the training of technicians in selected and diversified fields like automobile engineering, Refrigeration and Air Conditioning, radio and electronics, machine tool technology, instrument technology, chemicals manufacture etc. The Working Group however cautioned the State Governments that in our enthusiasm to diversify courses, no new courses of the conventional pattern should be added and that even in specialised fields, new courses should be organised only in cooperation with industry and that too after a careful study of the requirements of personnel in those fields. As for the general question of reorganising the existing courses and orienting them functionally towards industrial needs, the State Governments did not seem to be too ready to take it up as a crash programme in the Fourth Plan, firstly because most of them were uncertain about the possible allocations that might finally be made for their programmes, and secondly because they have not been able to conduct fruitful discussions with the industry to formulate concrete plans within the short time they were allowed to draw up their plans. The Working Group had, at any rate, emphasised the urgency of this programme and recommended considerable provision in the State Plans for this scheme.

5. Vocationalisation of education at the secondary stage.

It was felt that this is an area in which new ground should be broken in the light of the recommendations of the Education Commission and on the basis of our experience of Junior Technical Schools, multi-purpose schools, technical high schools and vocational schools. A detailed scheme for reorganising and developing secondary technical education was formulated in the

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Ministry which was forwarded to all the State Governments in January, 1968. The scheme was also considered by the All India Council for Technical Education at its meeting held in May, 1968 and the Council recommended to the State Governments to adopt or adapt the scheme to suit their needs and to reorganise their vocational/technical schools. What is important is not to impose from the top, a rigid, uniform and highly structured programme on the States but to leave it to them to take the initiative to formulate their own programmes according to their needs and implement them within their resources.

Granted the present social attitudes and the none too rational determinants that decide the type of education for our boys and girls, it was only to be expected that the State Governments would have reacted cautiously to the scheme and would have only made nominal outlays in their plans for this purpose. Nevertheless, it was encouraging to note that the States do recognise the urgent need to siphon off a sizeable proportion of the student population from the general stream of education and train them in suitable skills and trades that would enable them to enter industry straightaway. Recognising the fact that the success of this scheme would depend in a large measure on the change in social attitudes and the predilections of parents, employers and teachers, the Working Group had to be content with whatever provision was made by the States, although it was possible in some cases to enhance the provision proposed by the State Governments or to include provisions where none was proposed.

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6. Other Programmes - Staff Quarters, Student's Amenities, Scholarships etc.

As in the case of other programmes, the outlays proposed by the State Governments for these schemes also fell for short of the expectations. The main reason was apparently the lack of resources and strictly from the financial point of view such items as amenities for teachers and students had always had a lower priority with the State Governments. To the extent resources permit, however, all the State Governments had included some provision for these schemes and the Working Group tried to ensure that every State was able to undertake these programmes in the Fourth Plan.

7. New Programmes.

As stated earlier, the present unemployment among technical personnel had considerably dampened the enthusiasm of most of the State Governments to earmark any significant part of their outlays for programmes of technical education. Nevertheless some of the State Governments had proposed programmes for the establishment of new engineering colleges and polytechnics. For example, Gujarat, Uttar Pradesh and Madras had proposed the establishment of 4 new degree institutions in these States and Maharashtra, Uttar Pradesh and Andhra Pradesh suggested the establishment of 14 new polytechnics. The Working Group did not agree to any of these new institutions as there was apparently no need to increase the existing facilities at the degree level. As for diploma courses, the view held by the Working Group was that wherever there was an established need for any new courses, they could be introduced in the existing polytechnics by making use of the existing infra-structure, instead of opening new institutions.

FINANCIAL OUTLAYS FOR SCHEMES OF TECHNICAL
EDUCATION IN THE FOURTH PLAN WITHIN RUPEES 60.00
CRORES -CENTRAL SECTOR

(Central and Centrally Sponsored Schemes),

(Rs.in lakhs)

4th Plan outlay

A. Central Government Institutions

- | | | |
|--|------------------|---------|
| 1. Indian Institutes of Technology | | |
| For completion of schemes
already undertaken: | 0
0
0 | 1000.00 |
| For further development
including advanced centres in
aeronautics, materials
sciences, etc. | 0
0
0
0 | |
| 2. Indian School of Mines, Dhanbad | | 20.00 |
| 3. National Institute of Foundry
and Forge Technology | | 180.00 |
| 4. All India Institute of Management,
Calcutta and Ahmedabad. | | 50.00 |
| 5. Centre for Industrial Design
(At I.I.T., Bombay). | | 25.00 |
| 6. School of Planning & Architecture: | | |
| For completion of schemes
for further development | 0
0 | 15.00 |
| 7. National Institute for Training
in Industrial Engineering. | | 40.00 |

B. Development Programmes for Engineering
Studies including Post-graduate courses
and Research.

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| 8. Development and consolidation of post-
graduate courses and research in
engineering and technology in State
and non-Government Institutions,
(Centrally Sponsered Scheme) | | 500.00 |
| 9. Part-time Degree and Diploma
courses (completion of schemes
already sanctioned) | | 50.00 |

10.	Development of non-Government technical institutes according to schemes already approved and in process of implementation (Central aid).	400.00
11.	Practical Training of graduates and diploma-holders (expanded programme)	700.00
12.	Management studies at Universities and other centres.	150.00
13.	Development of Regional Engineering Colleges(Centrally Sponsered scheme)	800.00
14.	Loans for construction of hostels (completion of projects already approved and for limited expansion of hostel accommodation)	500.00
15.	Specialised courses to be conducted in cooperation with industry as pilot projects and refresher courses for personnel from industry.	30.00
C.	<u>Quality Improvement Programmes through Central Effort.</u>	
16.	Technical Teachers's training for college level teachers, In-service training, summer institutes and other programmes for faculty development both for college level and polytechnic teachers and Research in technical education including curriculum development, preparation of instructional materials and textbooks, design of laboratory equipment etc.	380.00
17.	Technical Teachers Training Institutes for Polytechnic Teachers.	200.00
18.	Improvement of salary scales of technical teachers (spill-over of commitments.)	50.00
D.	<u>Schemes Implemented by U.G.C.</u>	
19.	Development of technical education in university institutions including post-graduate courses, management studies etc. (on-going programmes).	720.00
20.	Indian Institute of Science, Bangalore (For all other new programmes to be undertaken in universities provision has been made under appropriate items.	190.00
TOTAL OF THE CENTRAL SECTOR SCHEMES:		6000.00

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Appendix (III)

Allocation for programmes of Technical Education in the States/Union Territories

(Rs. in lakhs)

Total out lay for Technical Education

Name of Name of State/Union Territory	As proposed by State Governments	As recommended by the Working Groups	As approved by the Planning Commission
(1)	(2)	(3)	(4)
1. Andhra Pradesh	500.00	470.00	300.00
2. Assam	497.75	278.28	301.00
3. Bihar	542.00	310.00	310.00
4. Gujarat	330.00	365.00	300.00
5. Haryana	330.00	206.02	155.00
6. Jammu & Kashmir	116.00	81.50	60.00
7. Kerala	465.00	342.00	225.00
8. Madhya Pradesh	600.00	500.00	400.00
9. Maharashtra	1300.00	1033.60	950.00
10. Mysore	300.00	300.00	200.00
11. Nagaland	60.00	45.50	45.00
12. Orissa	247.00	170.00	150.00
13. Punjab	50.00	125.90	85.00
14. Rajasthan	34.00	85.50	30.00
15. Tamilnadu	659.00	564.00	503.00
16. Uttar Pradesh	2000.00	1053.00	1073.00
17. West Bengal	506.50	503.03	370.00
Total	8537.25	6432.33	5432.00

Name of Union Territory 1	2	3	4
1. Chandigarh	152.00	30.00	20.00
2. Delhi	450.00	274.00	251.00
3. Goa, Daman and Diu	97.20	84.20	84.00
4. Himachal Pradesh	98.22	50.00	50.00
5. Manipur	20.00	20.00	20.00
6. Pondicherry	29.54	22.50	20.00
7. Tripurā	125.00	95.00	95.00
Total	971.96	575.70	540.00
All India Total	9509.21	7009.03	6972.00

Allocation for Schemes of Technical Education
Major Schemes in the States including
Union Territories
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(Rs. in lakhs)

<u>Schemes.</u>	Proposed Provision in the National Plan	Provision recommended by the Working Group.	Approved by Planning Commission
1. Continuation Programmes.	6000.00	4722.03	
2. Faculty Development Scheme.	500.00	243.00	
3. Diversification of Courses.	1200.00	862.50	
4. Vocationalisation of Secondary education.	1500.00	418.00	
5. Staff Quarters.	500.00	328.00	
6. Other Programmes.	900.00	435.50	
Total:	10600.00	7009.03	*

* Scheme-wise break up is not available

QUALITY IMPROVEMENT PROGRAMMES
FOR TECHNICAL EDUCATION.

Faculty development, curriculum development
and preparation of instructional materials.

It is generally accepted that the expansion of Technical Education during the first three Five Year Plans has been almost phenomenal, specially since the country has had to build these facilities almost from scratch within a short time. Numbers are, no doubt, important but are not sufficient in themselves. The quality is an equally important concern. It is fruitless to spend large sums on mere expansion of physical facilities without ensuring the standard and quality of education given to our future engineers and technicians. In view of drive for expansion, adequate attention could not be paid in the past to the quality of education given to our future engineers and technicians. Qualitative improvement and maintenance of standards is the national problem which has thus assumed greater urgency. A stage has been reached when we must address ourselves right earnestly to the problem of standards of Technical Education.

2. The crux of the problem of standards in Technical Education is three-fold i.e. teacher, equipment and building. The chief factor having maximum impact on the quality of education is the teacher who is the heart of every educational institution. It is the quality of the staff that in the final analysis makes for the success of an institution. This is even more sharply applicable in the case of a technical institution where the nature of studies demands close contact between the teacher and the taught and academic excellence and professional competence from the teacher. All the first rate technological institutions in the world have been built by the teachers who are well qualified and trained for the job and also are constantly engaged in research, in industrial or professional or other academic activities that keep them in the close contact with the current developments in their fields. The supply of adequate number of teachers of right calibre and of proper qualifications as well as their constant involvement in the activities referred to above, are the two aspects which are very important in the context of building a strong dynamic teaching faculty responsive to the needs of industry as well as to the technological advances. In order to ensure supply of well-qualified and properly trained teachers to the technical institutions, a pre-service regular training programme, which we shall discuss here, is necessary and should be organised on a national basis.

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Constitutionally also, the responsibility of coordination and maintenance of standards in technical education is of the Central Government. Since the shortage of well-qualified and trained teachers imperils the standards of technical education, the Central Government should assume full responsibility to set the position right.

Technical Teachers Training Programme.

3. In order to meet the shortage of staff as far as possible and to ensure a regular supply of well-qualified and trained teachers to the technical institutions, the Central Government in the year 1959 instituted a Technical Teachers' Training Scheme at 5 selected centres, viz. Indian Institute of Technology, Kharagpur, Bengal Engineering College, Howrah; College of Engineering, Poona; University of Roorkee, Roorkee; and College of Engineering, Guindy, Madras. Later, 9 more centres were added, viz. Indian Institute of Technology, Bombay; Jadavpur University, Calcutta; M.S. University, Baroda; School of Planning and Architecture, New Delhi; Indian Institute of Technology, Kanpur; Indian Institute of Technology, Madras; Indian Institute of Technology, New Delhi; Banaras Hindu University, Varanasi and Victoria Jubilee Technical Institute, Bombay. The training has a two-fold objective. One is that of improving and raising the standard of candidates in their subject fields and the second is that of imparting to them the methodology of teaching in class-rooms, laboratories and drawing office. Both these aspects are integrated in this pre-service training programme. The training programme generally extends over a period of 3 years for fresh graduates that includes advanced subject training leading to Master's Degree, actual teaching apprenticeship under the supervision of a senior teacher and the practical training in industry. In case of candidates who already possess a Master's Degree in Engineering/Technology at the time of joining the scheme, the training lasts for one year.

4. Each candidate admitted to the training programme is paid a fellowship of Rs. 400/- per month in case of graduates and Rs. 440/- per month for the Master's Degree holders. On completion of training, the trainees are required to serve designated technical institutions as teachers for a minimum period of three years. The teachers trained under the programme have to be appointed on posts not lower than that of a Lecturer with a starting salary of not less than Rs.530/- inclusive of D.A., if any.

The selection of the candidates was so far being made on an all-India basis excepting for the years/regional basis. The scheme has so far been open to the candidates who must possess at least a Bachelor's Degree in Engineering or Technology in the First Division or with 60 per cent marks and should be less than 27 years of age on the 1st August of the year of selection.

1964 to 66 during which the
selections were made on

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Impact of the Scheme:

5. Since the year of its inception, a number of fellowships were instituted under the programme to train as many teachers as possible. The position regarding the fellowships instituted in the different years and the trainees actually joined the programme is given as below:-

Year	Fellowships instituted	Trainees joined		Total
		Sponsored	Un-sponsored	
1958-59	-	-	-	-
1959-60	150	25	80	105
1960-61	100	32	57	89
1961-62	100	25	44	69
1962-63	100	20	32	52
1963-64	175	27	75	102
1964-65	200	40	105	145
1965-66	200	42	79	121
1966-67	200	16	114	130
1967-68	250	19	130	149
1968-69	50*	30		30

*Sponsored only.

6. So far nearly 600 teachers have completed the training under the programme and have been placed in suitable teaching positions in different technical institutions. The reports received from the institutions had been very encouraging and indicate that the Scheme has been most useful and the candidates trained under the programme are highly satisfactory as teachers. Till recently, technical institutions were very anxious to employ more and more of these teachers who had gone through the training programme. Upto the year 1966, 417 teachers were trained under the programme and all of them were placed in suitable teaching positions immediately on completion of their training without any difficulty. Since 1967, the position has, however, undergone a slight change due to unemployment among engineering graduates and reductions in admissions to technical institutions our teacher-trainees have had to wait for some time before being absorbed in suitable teaching positions in technical institutions. However, the fact that the scheme has had a big impact on improving the staff position of technical institutions needs hardly to be emphasised.

Under the scheme, so far both sponsored as well as non-sponsored candidates were being admitted for training. The sponsored candidates are guaranteed with employment by the sponsoring authorities on completion of their training. For the non-sponsored candidates, the placement has to be arranged by the Government of India in teaching positions in different technical institutions. Till recently, there has been no difficulty in placing the teachers trained under the programme. From the year 1967 onwards, some difficulty

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has been experienced in finding employment for the teachers trained under the programme. Accordingly, it has been decided to restrict the scheme only to the sponsored candidates and from the year 1968 the scheme is no longer open to the non-sponsored candidates.

Having regard to the fact that the scheme will now be open to the candidates sponsored by the different State Governments/Institutions, the eligibility conditions regarding age and qualifications have also been relaxed. It is no longer necessary that the candidates should be less than 27 years of age on the 1st August of the year of selection. Also, the condition of possessing a Bachelor Degree in Engineering or Technology with First Class or 60 per cent marks is not to be enforced and the selection of the candidates will be made on their merits.

Re-organisation of the Scheme:

7. In the light of the experience gained in the last ten years, we should re-organise the Teacher-Training Programme and diversify it to meet the changing needs of teachers for self-improvement. We should also bring into the scheme by design special efforts towards faculty development in technical institutions which is one of the primary objectives of the Fourth Five Year Plan. The proposals for consideration are as follows:-

(a) Full-time training for the Master's Degree.

Since over 500 new teachers have already been trained at the Master's degree level and deployed on the teaching field the demand for pre-service training in the present form is therefore expected to be small. Further, with a big expansion in post-graduate engineering education, opportunities are not lacking for a prospective teacher to qualify himself for the Master's degree. In the circumstances, our concern under the scheme should be for serving teachers. A large number of serving teachers have entered the teaching profession just after their first degree in engineering or technology and gained varying periods of teaching experience in their institutions. Over 60 per cent of our serving teachers (8000) belong to this group and the future development of engineering education in our country largely depends upon how far they are improved and developed. These teachers need depth of knowledge in their own subject-fields and a broader academic background. They also need to possess higher academic qualifications for advancing in their teaching career. For them, actual teaching experience as a preparation for entering the teaching profession is not a primary requirement.

9. Therefore, it is proposed that^{at} selected institutions that have well-established and well-developed programmes of post-graduate courses for the Master's degree

a certain number of places should be reserved and serving teachers should be brought by design on study leave or other terms for two years to prepare themselves for the Master's degree in their respective subject-fields. Since they come on study leave, according to the rules of their sponsoring institutions, these teacher-trainees should be given a fellowship of Rs. 300 per month for the two-year period when they are studying for the Master's Degree. The fellowship is just adequate to cover the cost of lodging and board, books and instruments and other essential needs at the training institutions.

10. The training institutions to be selected for the purpose may be:-

- (i) The five Institutes of Technology;
- (ii) Indian Institute of Science, Bangalore;
- (iii) Bengal Engineering College, Sibpur.
- (iv) Jadavpur University; and
- (v) Baroda University, Faculty of Technology.

The actual number of places to be reserved at each Institute will depend upon the number of serving teachers who wish to avail themselves of this facility. It would, however, be desirable to demarcate areas for each training institute as shown on the next page.

Southern Region:

Indian Institute of Technology, Madras and Indian Institute of Science, Bangalore jointly.

Western Region.

Indian Institute of Technology, Bombay and Faculty of Technology, Baroda University, jointly.

Northern Region:

Indian Institute of Technology, Kanpur and Indian Institute of Technology, Delhi, jointly.

Eastern Region:

Indian Institute of Technology, Kharagpur, Bengal Engineering College, Sibpur, and Jadavpur University, jointly.

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Each institute will correspond directly with engineering colleges in its area, invite nominations for the training places and make selections. Wherever there are more than one training institute for a region, the institutes concerned will jointly formulate the procedures for inviting nominations and for making selections. During the Fourth Plan period, we may institute at all these centres about 200 fellowships each year for serving teachers to study for the Master's Degree course. One would wish that all the 60 per cent teachers are enabled to take their Master's degree within the next five years but that is not practicable. Technical Institutions will not be able to send large numbers of their serving teachers on study leave. Secondly, our post-graduate institutions will not be able to cope with such large numbers. Our aim therefore should be to train the senior lecturers and assistant professors during that period since they are the hard core of the teaching faculty on which depends the future development of the institutions and their problems are urgent and important. The younger and junior faculty members could be looked after in gradual stages.

During the two-year period when a serving teacher is doing his Master's degree he should also be given full opportunity by the institution concerned to acquaint himself with the organisation of teaching work, laboratory practicals, etc. for under-graduate students in the institution. He should be permitted, at his request, to associate himself with a senior faculty member as an under-study to improve his competences and experience as a teacher.

(b) Full-time Pre-service Training:

Although over 80 per cent of faculty positions in our engineering colleges have been filled and recruitment of new teachers will continue in small numbers partly to fill vacant positions wherever they exist and partly for replacement of existing teachers due to retirement or death. The new teachers will be recruited from among those who have taken their Master's degree and wish to take upon teaching career. They, however, need to be trained in the methodology of technical education instead of learning it on the job. That is both laborious and unsatisfactory. The Delhi Institute of Technology has conducted such a programme lasting about a year with great success in elaboration of the present teacher-training scheme. We should continue this programme at Delhi and if possible at other Institutes of Technology, and admit to the programme young Master's degree holders who wish to enter upon the teaching career. The number of candidates may be restricted to about 30 each year. During the one-year-training period they should be given a fellowship of Rs. 400 per month.

It would be preferable to take only those candidates who are sponsored by technical institutions, so that their employment as teachers after the training is assured. Wherever a serving teacher is unable to do research for the doctorate degree in his own institution because of lack of adequate facilities he should be helped by design to go to a selected centre like the Institutes of Technology or the Indian Institute of Science, Bangalore to do his doctorate. The number of such faculty members who require these facilities will be small as compared to those teachers who need to prepare themselves for the Master's degree under category, but there is no gainsaying the fact that the former is an important group of persons whose impact on improvement of technical education in our country will be big if they are given the required opportunity and encouragement.

Each serving teacher possessing the Master's degree who wishes to go on study leave from his institution to do his doctorate at a designated institution should be given a research fellowship of Rs. 500 per month for periods upto four years. In addition, they should be given a grant of Rs. 1000 per year for meeting the expenditure on any special instruments, literature and other materials needed for their research work. The number of such fellowships to be instituted during the Fourth Plan period might be estimated as below:-

1969-70	50 Fellowships.
1970-71	50 Fellowships continuing 50 Fellowships New.
1971-72	150 Fellowships Continuing 50 Fellowships New
1972-73	150 Fellowships Continuing 50 Fellowships New
1973-74	150 Fellowships Continuing 50 Fellowships New.

According to the above pattern, when the whole scheme is stabilised, there will be in any one time 150 research fellows continuing for their doctorate and 50 new fellows joining the scheme. The precise distribution of these fellowships between the Institutes of Technology and the Indian Institute of Science, Bangalore, may be settled in consultation with the Directors of the Institutes.

(c) Full-time Training for the Doctorate Degree:

A serving teacher who has already acquired his Master's degree and has put in some years of service in

an institution needs to be developed further for higher positions on the faculty. For that purpose, he needs to prepare himself for the doctorate degree and qualify himself/a higher level. For the faculty of each technical institution, there must be a continuous process of updating its individual members and challenging them to excellence. It is primarily through the doctorate programme that the process could be accelerated.

(d) Short-term in-service courses for serving teachers.

Each year, we are conducting through the agency of APTI(now ISTE) about 20 summer Institutes for college level teachers with an average enrolment of 800-1000 teachers. The main objective is to expose the teachers to new methods of teaching their respective sub-ject fields and to give them an opportunity to share their experiences. In addition, some summer institutes are also being organised on a sequential basis in selected subject-fields for equipping serving teachers, with depth of knowledge in their chosen fields. The programme of summer institutes will be continued during the Plan period on increasing scale to provide the widest opportunities possible to serving teachers to replenish their knowledge.

Summer Institutes alone, however, will not meet all the demands of faculty development. For instance, a serving teacher needs to know better how to organise laboratory work for students in his subject-field; he needs to be sure of the aims and objects of laboratory work, the type of experiments to be set, the type of equipment to use and so on. He also needs to know how to relate laboratory practical work to theory. Some serving teachers need to know in detail how to teach individual subject-fields or specialities as an integral part of the total curriculum for the degree course. They also need to develop an innovative or creative approach to their teaching. Others need improvement in other directions depending upon their own inadequacies and experience. The problems of faculty development and institutional improvements through the faculty form a broad spectrum. This is precisely the area in which we must make a concentrated effort. There is also the problem of faculty obsolescence which even in the advanced countries is assuming serious proportions. The five Institutes of Technology and other Institutes that are in a position to undertake the responsibility should identify on a continuing basis the precise needs of serving teachers in engineering colleges in their respective areas, design and conduct specific programmes of short-term or long term duration. To press on with this activity along correct lines, each Institute should set up a standing committee consisting of its own senior faculty members and selected professors from engineering colleges to advise on the specific programmes to be conducted from time to time according to the felt needs of engineering institutions.

A serving teacher coming to an institute for these short-term faculty development programmes should be assisted for the expenditure on his lodging and board at the training centre. An allowance at a flat rate of Rs. 10 per day should be provided. In addition, he should get assistance for his travel by train from his institution to the training centre.

Although it is not possible at this stage to make a precise estimate of the number of short-term courses that each institute will conduct, the number of participants in each course and the duration of each course, financial estimates are, however, made on the following basis:-

It is assumed that each training centre will conduct each year 10 short-term courses, each of an average duration of eight weeks. Each course will cater for a group of 30 teachers. On this basis, the expenditure at each training centre in a year will be about Rs.2.50 lakhs that includes per diem and travel allowance for the teachers and other items of expenditure at the training institution.

(e) Curriculum development, preparation of instructional material including textbooks and laboratory development.

The training of a serving teacher either in summer institutes or through other programmes must centre round the curriculum for individual subject-fields of the degree course in engineering and the instructional materials and laboratory experience based upon the curriculum. In fact, the whole process of engineering education improvement from the point of view of both teaching and learning is mainly dependent upon continuous revival and updating of the curriculum. It is the total absence of any activity in this direction in a country that is responsible for the various defects in our technical education system at the University stage and also for the falling standards. It is also responsible for our teachers and students being solely dependent upon the text-books and other instructional materials produced abroad. The stage therefore has come when in the interest of improving our technical education system we must address ourselves with a sense of urgency to the problem of curriculum development for the engineering degree courses, to the preparation of instructional materials including textbooks and to the development of laboratory experience. This activity should be undertaken in an organised manner at selected centres that should establish close relationships with engineering colleges in their own areas. For this purpose, it is proposed that 25 curriculum development groups should be established immediately at the five Institutes of Technology or other centres that have the necessary expertise. These 25 study

groups may be distributed between the different branches of engineering in the following manner:-

Civil Engineering	3	Groups
Mechanical Engineering	3	"
Electrical Engineering	3	"
Electronics Engineering	3	"
Metallurgy	2	"
Chemical Engineering	2	"
Physics	3	"
Chemistry	3	"
Mathematics	3	"

Each study group should be in charge of a Professor on a full-time basis and it should be assisted by two full-time Assistant Professors and two Research Assistants. In developing the curriculum and instructional materials, the group should draw upon the services of specialists from other institutions on a consultancy basis and also draw upon the services of the regular faculty of the institution where it is located. The main tasks of the study-groups in each branch of engineering should comprise the following items:-

- (a) Development of curriculum for the concerned subjects.
- (b) Development of laboratory experience.
- (c) Study of appropriate learning situations and teaching methods.
- (d) Study of interaction between teaching and research.
- (e) Development of evaluation procedures including examination reform.
- (f) Study of interaction between industry, research and education.
- (g) Development of instruments.
- (h) Development of demonstration experiments.
- (i) Processing of information and data.
- (j) Analysis of equipment in relation to laboratories and training.
- (k) Integration of the educational process in relation to humanities, engineering and science.
- (l) Preparation of instructional materials, laboratory guides and text-books materials.

The study groups for each branch of engineering should demarcate the work to be undertaken by each group in relation to the subject-fields included in the degree course in that branch. It should hold regular meetings together to review the progress of work to exchange experiences and to develop the programme in a coordinated manner.

The materials developed by the study groups should be tried out in actual learning and teaching situations in selected engineering colleges, the response of teachers and students obtained and the materials refined and improved on a continuing basis. To be effective in terms of an all-out effort, appropriate arrangements should be evolved for the wide dissemination of the materials to the faculty of all engineering institutions. The summer institutions should be utilised for evaluating the materials and for the identification of the problems on which further work needs to be done.

The approximate expenditure on each study group is about 1,50,000 per year. The total annual expenditure on all the 25 study groups is about Rs. 37,50,000. A tentative basis on which these estimates have been made is indicated in the enclosure.

TENTATIVE ESTIMATE FOR EACH
CURRICULUM DEVELOPMENT GROUP (ANNUAL)

Salary and allowances of a full-time Professor	Rs. 20,000
Salary and allowances of two full-time Assistant Professors.	Rs. 30,000
Salary and allowances of two full-time Research Assistants.	Rs. 20,000
Salary and allowances of two Stenographers.	Rs. 10,000
Honorarium for five visiting specialists.	Rs. 10,000
TA, DA etc., for the visiting specialists (100 days at Rs.20 per day for DA and Rs.1,000 as TA)	Rs. 15,000
Seminars and workshops	Rs. 20,000
Stationery, postage, printing and materials for laboratory development.	Rs. 25,000
Total:-	----- Rs.1,50,000 -----

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- (a) REORGANISATION OF POLYTECHNIC DIPLOMA COURSES.
- (b) FACULTY DEVELOPMENT FOR POLYTECHNICS.
- (c) CURRICULUM DEVELOPMENT AND PREPARATION OF INSTRUCTIONAL MATERIALS FOR POLYTECHNICS

Characteristics of Technician Training.

In between engineers, scientists and managers at one end of the manpower spectrum and skilled workers and operatives at the other, there is a group of technical personnel that merits special attention for the special role that it plays. This group comprising many jobs or position titles, like technician, supervisor, foreman, overseer, section officer, technical assistant, shift incharge and so on, is directly responsible for the application of known technology to a wide range of field operations in production and construction, testing and development; installing and running engineering plant; drafting and designing products; estimating costs; selling and advising customers on the use of engineering or scientific equipment. In many instances, the technician acts as a liaison between the engineer and skilled craftsman to interpret the engineer's plans and designs, determine the type of production and construction techniques to be adopted and choose the tools and machines best suited to specific jobs. A host of other semi-professional functions of an engineering or scientific nature are identified with the technician who carries them out largely upon his own initiative and under only the general supervision of a professional engineer or scientist.

The importance of technicians, particularly to a developing country like ours, cannot be over-emphasized. In the short run, critical shortages in respect of engineers and scientists can be met by adopting or adapting technologic know-how from developed countries and importing the capital equipment needed by industry. A shortage of technicians, however, cannot be made good by these methods because the imported technology and capital equipment can be used by the people of the developing country only when they are adequately trained for the purpose. Therefore, it is imperative for all developing countries to train and develop their own indigenous personnel as competent technicians. In the last analysis, the pace and direction of the economic progress of developing countries will largely depend upon how far they solve their technicians' problem.

These considerations demand that we must evolve a coherent system of technical education designedly to train the technicians and other types of middle level personnel needed by industry. In planning for this, however, we must remember that the training of a technician and his professional development is not a course; it is a long process that takes place partly in a technical institute and partly in industry. The purpose of the technical institute curriculum is to give the future technician a sound broad-based theoretical knowledge of a chosen engineering field that helps him to understand the basic principles of underlying design, construction or production processes and

communicate his ideas scientifically, mathematically and linguistically. The curriculum must mould and develop the attitudes and aptitudes of the student toward optimum proficiency and productive capacity for immediate employment. The education given in a technical institute according to this curriculum must be cross-fertilized with actual practical experience in industry to expose the technician-trainee to actual working methods, techniques and skills relevant to his field of speciality in drafting design and development of products and engineering plants, in installing and operating equipment, in construction, in estimating costs etc. In addition, the trainee should be made to observe and understand how the engineering principles and their applications are translated into practical operations and processes in the design office on the shop floor and in the field. In this process, he should acquire sufficient occupational competence to be able to perform the same professional functions independently when employed on the job.

To coordinate theory with practice, to relate teaching to work in industry and to elaborate the complementary functions of technical institutes and industry - all this is the heart of the problem of technician training. A constant concern of all developing countries in relation to manpower planning should be how to develop a vigorous system of technical education to meet their manpower needs, that articulates the joint and cooperative effort of technical institutes and industry. A purposeful system of industrial apprenticeship

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that, on the one hand, industry accepts as its primary responsibility and, on the other, technical institutes regard as an integral part of the total process of education is our primary need today.

The development of a curriculum for technician-training is not just an academic exercise. It takes in a number of important practical aspects like the present status of technology in the country and its future needs, the precise functions of a technician within the overall social and economic structure of industry, the pattern of employment in each type of industry and relationship between engineers, technicians and skilled workers, the level of technical, professional competences demanded of them and the position of technical education within the country's educational system. These are among the factors that determine the manpower spectrum of the country and so the curriculum for technician-training reflects the sum total of all the aspects of the manpower situation in our developing economy.

For his optimum development, the technician is best served by an educational programme that is intimately related to, but differs from the programme most effective for the engineer. It also differs from the educational programme most effective in developing or enhancing the skills and know-how of the craftsman. The Engineering technician does not need the depth or the range of mathematical or scientific understanding required by the engineer.

What the technician does need is a knowledge of the same subject matter with appropriate communication skills and mathematical competence. To achieve the necessary results, an educational approach is required that is comparable in quality and general level with the university-collegiate engineering programme but that differs from it in emphasis. For it implies the practical application of established scientific principles rather than the development of new design concepts or the extension of existing knowledge.

These two aspects have a direct and important bearing on the need to establish a correct functional relationship between engineers and technicians and improve, the status of technicians. For the optimum use of their talents and professional training, we must move engineers to positions of creative responsibility for research and discovery of new materials and processes and development of new engineering designs. We must increasingly make us of technicians for those tasks that were formerly believed to be the realm of the engineer. We must open up for them new avenues of professional advancement. For positive uncompromising results, the training of a technician must be founded in an educational approach totally different from, and more academically vigorous and technical than the skill-proficiency programme designed for the training of the craftsman and commonly represented by the vocational-trade or vocational-technical programmes. It must lie much

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closer to professional levels of engineering than to the trade-skill and craft level of vocational education. Only then shall we be in a position to counter effectively the familiar argument that the technician training course is the natural "dumping ground" for those who "can't make the grade" in the university-college type of engineering programme. These inter-related fields of human endeavour are equal in their importance to the whole social and economic professional structure. They, the people in them, and the people who should be in them to provide effective and satisfying balance of manpower distribution needed for our own way of life, deserve to be accorded inter-related status and recognition.

Our Polytechnic Diploma Courses.

Since independence and particularly in the last 10-12 years, we have expanded technical education on a big scale. In 1947, there were only 38 degree awarding engineering colleges producing about 1270 graduates and 58 diploma awarding polytechnics producing 1440 technicians. Today, the number of colleges has jumped to 135 and polytechnics to 279. The output of graduate engineers has increased to 15,540 and that of diploma holders 23,420. This big expansion notwithstanding the proportion of engineers and technicians trained by institutions has not undergone any drastic change. In 1947, the proportion was almost equal and today it is just 1:1.5. We know now that there is a serious imbalance in our technical education system.

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Also, that we are under-utilizing our graduate engineers in positions that could well be filled by properly trained technicians. In fact, according to a study carried out recently in some of our important engineering organisations, nearly 40 per cent of the technical positions at several levels of executive and supervisory responsibility are filled by graduate engineers whereas for those positions technicians would be adequate. Undoubtedly, in the initial stages of economic development of the country when we had to depend on technology adopted from advanced countries and imported "know-how" and capital equipment, our engineers were assigned those professional tasks that were carried out by technicians in advanced countries. Now that we have reached a stage when we should create our own indigenous technology and be self-reliant we should utilise our engineers more effectively in those positions of higher scientific and professional responsibility for which they are best suited and increasingly replace them by technicians at other levels. We have, therefore, proposed that in the course of the Fourth and Fifth Plans, the out-put of graduate engineers should be pegged down and that of technicians pegged up to reach a proportion of 1 engineer to 3 or 4 technicians. This decision demands that our polytechnic diploma courses should be thoroughly re-organised and upgraded and also adapted functionally to the duties and responsibilities of a technician.

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A perspective plan for re-organising technical education involves, among other things, an activity analysis of major titles or positions in different industrial sectors or engineering enterprises to identify the main subject-fields in which technical personnel is needed. The activity analysis must establish in depth and scope the precise nature of technical professional knowledge needed for different job titles and the supporting mathematical and scientific foundation. It must also correlate the job titles with the different levels of managerial, supervisory and group leadership responsibilities. In establishing these factors, we must study the actual situation in each area of technology by first-hand observation, by examining job descriptions by industry and by obtaining information and experience report from experts concerning the scope and depth of activities involved.

In identifying the subject-fields in which technicians should be trained we would do well to remember the changing nature of engineering itself. First, engineering was broadly divided into civil and construction engineering, mechanical engineering, electrical engineering, chemical engineering metallurgical engineering and mining engineering. While these broad divisions still exist as academic formation in a technical institute, the dividing lines between the several fields are becoming less and less sharp under the impact of scientific and technological advances. Also, modern industry

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is for its development increasingly dependent on an interdisciplinary approach to problems of design, construction and production as well as to the discovery of new materials and processes. What is even more significant is the collapse of the traditionally rigid boundaries between fundamental and applied sciences. For instance, the discovery of superconductivity and super-fluidity in solid state physics and the development of transistors have telescoped physics into electrical and electronics engineering. A new field of materials technology has grown that transcends the boundary between science and engineering, on the one hand, and on the other, the sharp distinctions between one branch of engineering from another. A surer understanding of the mathematical and physical basis of plasticity and elasticity and stress analysis has led to new design concepts and applications particularly in aeronautical engineering and structural engineering. Therefore, what our engineers and technicians need is not merely professional competence in selected fields of their speciality. They need depth, flexibility and a capacity for growth in directions in which we ourselves can today only visualize development. The business of an engineering education is to provide would-be engineers and technicians with foundations upon which they may build a career of genuinely professional stature that is responsive to both socio-economic change and scientific and technological advancement.

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Deficiencies of Our Polytechnic Courses and Remedial Measures Suggested.

Over the past years, thousands upon thousands of diploma holders have been trained by our polytechnics and employed in government departments, industry and in other professional organisations as middle level technicians with a wide range of designations, duties and responsibilities. There are today over 1,60,000 diploma-technicians in employment in our country. Recently, however, both employers and educationists have become critical of our polytechnic system of education and are arguing for a thorough re-organisation of the diploma courses. Their arguments are based on three considerations, (a) that the diploma courses are essentially theoretical in character and have little practical basis; (b) that the diploma courses are a poor imitation of the degree courses in content and standard and as such do not really serve the purpose of training middle level technical personnel; and (c) that the diploma courses as conducted at present are in the broad fields of civil engineering, mechanical engineering, electrical engineering and metallurgy and no attempt is made at specialisation in any one particular branch of a subject field, in which specialist technicians are required in industry.

Before considering how the diploma courses should be reorganised in relation to the needs of industry,

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it is necessary for us to examine critically the structure and the curriculum of polytechnic courses with particular reference to the three points mentioned above, and identify the main defects that need to be corrected. As for the first criticism that the diploma courses are purely theoretical in character, an analysis of the curriculum of the three-year National Certificate Course in civil, mechanical, electrical engineering (which is the model for diploma courses in all polytechnics) is given below-

ANALYSIS FOR NATIONAL CERTIFICATE
COURSE IN ENGINEERING

<u>Subjects</u>	<u>Mechanical</u>		<u>Electrical</u>		<u>Civil</u>	
	<u>Hrs.</u>	<u>%</u>	<u>Hrs.</u>	<u>%</u>	<u>Hrs.</u>	<u>%</u>
1. Basic Sciences	466	<u>13</u>	466	<u>13</u>	466	<u>13</u>
2. Humanities.	110	<u>3</u>	110	<u>3</u>	110	<u>3</u>
3. Engineering Sciences.	384	<u>11</u>	384	<u>11</u>	432	<u>13</u>
4. Engineering Specialities.	576	<u>17</u>	600	<u>17</u>	576	<u>17</u>
5. Workshop Practice or Field Work.	1152	<u>33</u>	1128	<u>33</u>	1176	<u>34</u>
6. Drawing.	648	<u>19</u>	648	<u>19</u>	624	<u>18</u>
7. Estimating & Costing.	120	<u>4</u>	120	<u>4</u>	72	<u>2</u>
	<u>3456</u>	<u>100</u>	<u>3456</u>	<u>100</u>	<u>3456</u>	<u>100</u>
1. Theory	1240	<u>35</u>	1288	<u>37</u>	1296	<u>37</u>
2. Laboratory.	504	<u>15</u>	480	<u>14</u>	408	<u>12</u>
3. Workshop/ Field Work.	1136	<u>33</u>	1112	<u>32</u>	1176	<u>34</u>
4. Drawing.	576	<u>17</u>	576	<u>17</u>	576	<u>17</u>
	<u>3456</u>	<u>100</u>	<u>3456</u>	<u>100</u>	<u>3456</u>	<u>100</u>

In the three-year diploma course, the so-called engineering theory accounts for only 35-37 per cent of the total curriculum time. The rest 63-65 per cent of the instructional time available is devoted to laboratory work, workshop/field work and for drawing. This compares favourably with similar technical courses conducted by institutions in USA, Germany, UK and other advanced countries. Therefore, the correct position is that our diploma courses do not suffer from an over dose of engineering theory with the inevitable sacrifice of practical work. The structure of our polytechnic curriculum provides for at least 65 per cent of the instructional time for practical work in the laboratory, the workshop, or field and on drawing. The main deficiency, however, is that the instruction given in the three-year courses is not backed up by adequate practical experience in industry that is vital for producing a finished technician who is fit to enter upon his professional responsibilities in an organisation. This deficiency is not integral to the polytechnic curriculum but arises out of the fact that we have not yet organised a first-rate system of apprenticeship in industry in elaboration polytechnic education. In Germany, for instance, every candidate who wishes to enter an ingeneurschule (which is the equivalent of our polytechnics for training middle-level technicians) must have completed a two-year apprenticeship in industry. The curriculum of the ingeneurschule is built upon the actual practical experience of candidates in industry. In Britain, a major part of the technical college programme for the middle-level technician is organised on a part-time basis for persons working as apprentices in industry. A number of colleges also

conduct sandwich courses in cooperation with industry in which a student spends stated periods in industry and in the institution in alternate layers. There is, however, increasing recognition in Britain of the need for full-time educational programmes in technical institutions preceded by organised apprenticeship in industry for the training of technicians. In the USA, the education of a technician generally takes place in a technical institute immediately after high school graduation and the graduates of technical institutes later go through a programme of apprenticeship organised by industry as an essential requirement for professional employment. In India, our industrial organisations and other employing authorities have yet to organise on an adequate scale programmes of apprenticeship for young persons after they have completed polytechnic diploma courses to condition them as technicians and backup the educational programmes of polytechnics. On the other hand, they demand of the polytechnics to produce technicians who are fully equipped with practical experience and are ready to be entrusted with professional responsibility. No polytechnic can meet this demand without the active cooperation of industry in organising and conducting an apprenticeship programme as an integral part of the total process of technician training. According to the studies conducted by the Institute of Applied Manpower Research, wherever large industrial establishments have recruited diploma-holders, the training given to them is mainly in-plant for about 2000-3000 hours to equip them adequately for supervisory positions. This again explains that the main deficiency in our polytechnic education is lack of adequate practical experience built into the system.

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In these circumstances, reorganisation of our polytechnic courses must proceed mainly in two directions. First, polytechnics and industry that are located near one another should cooperate in organising and conducting sandwich courses for training the correct type of technicians that industry requires. Some efforts in this direction have been made by certain institutions in Calcutta, Madras, Coimbatore, Bangalore and elsewhere, and the sandwich courses conducted by them according to reports have been very useful. Sandwich courses should become ultimately a general principle for all polytechnics that are located close to industry. Industry must be made to accept, as its legitimate responsibility, the organisation and supervision of apprenticeship training for polytechnic students and in organising the needed apprenticeship programme as an integral part of the total educational process of a technician. The Central Government should introduce appropriate legislation to ensure the participation of industry.

The Principle of Sandwich courses is applicable only to those institutions that are located close to industry. A large number of our polytechnics, however, are located in rural and semi-urban areas far away from industry. Since polytechnic education is an important form of diversified opportunity for high school leavers, it would not be reasonable for us to expect all these students to migrate to industrial centres for their education. Therefore, the present system of three-year diploma courses wholly institution-based would have to continue for those polytechnics till industry develops near them. For the diploma-holders coming out of those institutions, however, we must organise separately a programme of apprenticeship in

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selected industrial establishments as an essential preparation for professional employment. The present scheme of Practical Training of the Central Government should be made the joint responsibility of industry and the Government and reorganised to cater for the needs of those diploma holders who have graduated from the non-sandwich type of courses and who require such training as an essential preparation for professional employment.

It is through efforts primarily in these two directions that the absence of professional practical experience in our diploma courses could be adequately remedied.

As for the second criticism, that our polytechnic diploma courses are a poor imitation of degree courses, the analysis of the structure and curriculum of the diploma courses do not support the criticism. The curriculum of the degree course provides for 60-64 per cent of the instructional time for theory and only about 36-40 per cent of the time is devoted to laboratory work, workshop, drawing and design work. Since the education and training of a technician is distinct and different from that of a craftsman or a skilled-worker and since the technician has to perform duties and responsibilities intermediate between the engineer and skilled worker, it is clear that the curriculum of our diploma courses should satisfy the characteristics that have been outlined earlier in this note. Considered from that point of view, the standard and content of our diploma courses are not unsatisfactory. The deficiency, however, lies in the way in which the subjects of the diploma courses are taught, the level at which they are taught and the method in which engineering theory is related to professional

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practical work. This deficiency is not, however, inherent to the structure and curriculum of the diploma courses but has arisen mainly because the teaching and learning processes in our polytechnics are still defective. It is related to the quality of the faculty of polytechnics and their performance. It is also related to the calibre and motivation of our students. These aspects will be dealt with in detail later in this note.

The third criticism against our diploma courses is that the courses as conducted at present are in the broad fields of civil engineering, mechanical engineering, electrical engineering and in metallurgy and that there is no attempt at diversification or specialization in any one particular branch of a major subject field to train specialist technicians. It is true that the diploma courses are in the broad fields of civil, mechanical and electrical engineering, metallurgy etc., but, the pattern of employment of technicians in the major sectors of our national economy also is generally the same. Take civil engineering. In this field the main employers are the Public Works Department of State and Central Governments. Till recently, the Public Works Departments were generally in charge of building construction, roads, highways and bridges, public health engineering and irrigation and hydraulic structures. An engineer or a technician employed in these organisations was required to have a broad-based engineering education covering all these activities and his main duties related to design and drafting, estimating and planning, surveying, supervision and inspection and maintenance of work. Once he entered the Department, he moved in course of time from one type of civil engineering works to another, from building construction to roads, highways and

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bridges to public health engineering to irrigation and hydraulic structures. He was not required to be a specialist in any one particular branch; and as he moved up on the professional ladder his executive or supervisory responsibilities extended over the whole field of civil engineering, design, construction and maintenance. Accordingly, a diploma holder was required to have a broad-based education in civil engineering and his professional experience in the Department during his service covered all specialities of civil engineering. Although recently several State Governments have divided the omnibus responsibilities of their Public Works Departments into major branches and established separate departments for roads, highways and bridges for irrigation and hydraulic structures and for public health engineering, the pattern of employment of graduate engineers or diploma holders cuts across the departmental structure in the State Governments. As a corollary, all the Departments concerned demand a diploma-holder with a broad-based education in civil engineering, and not particularly a specialist-technician either in building construction engineering or in roads highways and bridges or in public health engineering or in irrigation and hydraulic structures. Therefore, unless the pattern of employment in Government Departments in charge of civil engineering works, the recruitment procedures followed in the departments and the avenues of professional advancement for technical personnel undergo a radical change vis-a-vis engineering specialities it is undesirable for polytechnics to diversify their civil engineering courses and to make them strictly functional in relation to specialities in this field.

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The same is true of electrical engineering. In this field, the major employers are the Electricity Departments of State Governments and other authorities in charge of power generation, transmission and distribution. A diploma-technician's duties include planning and loading survey, design and drafting, inspection and testing, plant installation and maintenance and power transmission and distribution. He carries out these duties and responsibilities as he moves from section to section of the Department or of an electricity undertaking and therefore his education at the polytechnic level must again be broad-based covering all these various aspects. Therefore, polytechnics would be out of step with the pattern of employment and professional duties of technicians if they sought to diversify their electrical engineering curriculum for functional specialisation in narrow branches of electrical engineering. The diploma-holders graduating from polytechnics should not be exposed to too many uncertainties regarding their employment in electricity undertakings.

It is only when we come to the field of mechanical engineering, chemical engineering and metallurgy in which the main employer is manufacturing industry, that diversification and functional specialisation seems justified. Depending upon their products of manufacture and the processes adopted individual concerns demand that the prospective technician should have education and training in particular engineering specialities. A technician entering manufacturing industry in this manner is generally confined in his professional work to his own particular field of speciality and advances mainly in that field. He rarely moves from one branch of industry to another

Nor, does he transfer himself from one major department to another within the same organisation. The only reason for our polytechnics not diversifying their curriculum in relation to the functional specialities required by industry is that there is lack of coordination between industry and institutions on the one hand, and on the other, our institutions are unable to pre-determine the particular type of industry which their diploma holders will join. There is also the fact that a large number of diploma-holders move from one part of the country to another in search of professional employment and their mobility is facilitated by a broad-based engineering curriculum like the one offered at present by polytechnics.

The past experience notwithstanding, the stage has been reached when our polytechnics in close consultation with industry should carry out an analysis of the functions, fields of activity and typical job positions available, should identify various technician specialities and should reorganise their curricular offerings to suit those specialities. In doing so, however, they should bear in mind the pattern of employment in our major sectors of engineering activity, the need for the mobility of technicians both vertically and horizontally and the immediate and future employment opportunities available for them. To facilitate reorganisation of polytechnic education on these lines, a representative analysis of the functions, fields of activity and types of job positions for technician specialities has been carried out in consultation with the Institute of Applied Manpower Research and it is given at Annexure-I. The functions indicate broadly the scope of training of the polytechnic curriculum with reference to a major fields of

activity in civil engineering, mechanical engineering, electrical engineering, Chemical engineering and in metallurgy. Each field of activity represents a major engineering speciality in which technicians are required to carry out stated functions. To discuss the possibilities of diversifying diploma courses in each branch of engineering:

(a) Civil Engineering

Depending upon the pattern of employment in State engineering departments and in private construction industry, the four specialities that could be offered in the polytechnic curriculum are :-

- (i) Building Construction Engineering
- (ii) Roads, Highways and Bridges
- (iii) Public Health Engineering
- (iv) Irrigation and Hydraulic Structures.

Before any of these specialities is started as a part of the civil engineering curriculum, each polytechnic should ensure in consultation with the employing authorities concerned that there is an adequate demand for specialist-technicians trained by them. Second, training in each speciality should be a judicious combination of theory and practical experience in the field of the sandwich type. Third, the curriculum should give a broad-based education in civil engineering and training in a particular speciality should be built on this broad base. We must ensure that if the diploma-holder does not get a suitable job in his speciality, he does not become unemployable as a technician in the broad field of civil engineering as at present, and that his horizontal mobility is not impeded.

- (b) Mechanical Engineering
- (i) Automotive engineering
 - (ii) Production process Technology including metal cutting;
 - (iii) Foundry and Forge Technology
 - (iv) Refrigeration and air-conditioning
 - (v) Power Plant Engineering - Thermal and Hydraulic.
- (c) Electrical Engineering
- (i) Electrical machinery manufacture
 - (ii) Instrumentation and control
 - (iii) Power generation and distribution system
 - (iv) Communication system.
- (d) Chemical Engineering
- (i) Fertilizer industry
 - (ii) Heavy Chemicals
 - (iii) Pharmaceuticals
 - (iv) Agro-Chemicals.
 - (v) Petroleum and Petro-Chemicals
 - (vi) Ferrous and non-Ferrous Metallurgy Industry.
- (e) Metallurgy
- (i) Process Metallurgy
 - (ii) Mechanical Metallurgy including Heat Treatment.

Before any of these specialities is started as a part of the mechanical/electrical/chemical/metallurgical engineering curriculum, each polytechnic should ensure in consultation with employing authorities concerned that there is an adequate demand for specialist-technicians trained by them.

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Training in each speciality should be a judicious combination of theory and practical experience of the sandwich type. The curriculum should give a broad-based education in the major engineering field and training in a particular speciality should be built on this broad-base. We must ensure that if the diploma holder does not get a suitable job in his speciality he does not become unemployable as a technician in the broad field of mechanical/electrical/chemical/metallurgical engineering as at present and that his horizontal mobility is not impeded.

To meet the full requirements of education of a technician including his professional practical experience in a chosen speciality, the sandwich type of course to be conducted by a polytechnic would have to be for a minimum period of four years. Flexibility, however, should be allowed to each institution to decide in consultation with the cooperating industry at what stage of the course should the professional practical training part should be integrated with the whole system of his education process. Flexibility also should be allowed to each institution to decide whether the professional practical training should be organised in one stretch or given in convenient instalments at appropriate stages. The integrity of the sandwich course is best maintained by establishing a close relationship between engineering theory and its application to actual construction, production, design and maintenance of plant and equipment. The only guarantee is how a technical institution and an industrial organisation cooperate with each other to produce a technician who is capable of not only meeting the needs of today but also the challenges of tomorrow.

CONCLUSIONS

(a) In the manpower spectrum, the Technician plays an important role. His main functions include the application of known technology to a wide range of field operations in production and construction; testing and development; installing and maintaining engineering plant; drafting and designing products; estimating costs; selling and advising customers. The technician also serves as a liaison between the engineer and skilled craftsman to interpret the

engineer's plans and designs, determine the type of production and construction techniques to be adopted and choose the tools and machines best suited to particular jobs.

(b) The training of a technician is essentially an educational process that must be cross-fertilised with actual practical experience in the field. The polytechnic curriculum must give the future technician a sound, broad-based theoretical knowledge of a chosen engineering field that helps him to understand the basic principles underlying design, construction or production processes and to be able to apply that knowledge with confidence in actual practical situations in industry. To co-ordinate theory with practice, to relate teaching to professional work and to establish a functional relationship between the engineer and technician is the joint and co-operative enterprise of technician institutions and industry.

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(c) The present three-year curriculum offered by our polytechnics in the main branches of engineering do meet the essential educational needs of a technician, but their main inadequacy is lack of in-built practical experience upon which his professional development could be built. The inadequacy must be removed by reorganising the courses to the sandwich type at those institutions that are located close to industry. To that end, industrial organisations must be made to co-operate with technical institutions and to accept a purposeful system of apprenticeship for the students as their primary responsibility.

(d) Diversification of the subject-fields of polytechnic diploma-courses and specialised training in different technician specialities are important, but they must be organised only after a careful analysis of the functions, fields of activity and typical job positions available in industry, on a continuing basis. We must ensure that before a particular technician speciality is offered suitable jobs for the technicians trained are available and that their free mobility in a broad field of engineering is not impeded. Functional specialisation must be built upon a broad-based engineering education to ensure the future employability of the technician in a changing world of technology.

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To facilitate an organised move in this direction at selected polytechnics certain technician specialities have been identified in consultation with the Institute of Applied Manpower Research. This is purely illustrative. Training in each speciality should take off from a sure educational foundation in the concerned main branch of engineering and should integrate the relevant practical experience in industry within the total system.

(B) FACULTY DEVELOPMENT FOR POLYTECHNICS

Our Plan for re-organising and improving polytechnic education will succeed^{only} to the extent that the teaching faculty of the institutions are continuously trained and motivated for the new task. It is the quality of teachers that in the final analysis makes for the success of an institution. This is even more sharply applicable to a polytechnic where the nature of studies demand not only academic excellence but also professional competence from the teacher. The supply of an adequate number of teachers of the right calibre and of proper qualifications as well as their constant involvement in industrial or professional activity are the two aspects which are important in the context of building a strong dynamic teaching faculty that is responsive to the needs of industry as well as to technological advances.

Unfortunately, the present position in our polytechnics leaves much to be desired. In addition to large numbers of vacancies that persisted for a long time in many institutions, the quality and standard of the teachers available have not come up to the expected level. Although in the last three-four years the vacant positions have been largely filled and the present shortage does not exceed 20 per cent, the quality of the staff remains the same. A large number of teaching positions are held by fresh graduates with little or no industrial and teaching experience.

Even among the older staff that has been serving the institutions for a long time the only accomplishment is just teaching experience without the leavening of industrial experience and contact with the practice of engineering in construction, in production, in maintenance of plant and equipment or in engineering design work. All these and many more deficiencies that have impeded the progress of polytechnic education in our country need to be removed on a priority basis. That is the primary task that we have before us in the Fourth Plan.

To train graduate-engineers and diploma-holders adequately for teaching positions in polytechnics, the Central Government has established four Technical Teacher Training Institutes at Calcutta, Madras, Bhopal and Chandigarh. These Institutes have just started functioning in close cooperation with State Departments of Technical Education and polytechnics. Each Institute is designed to cater for 60 fresh admissions, each year, of engineering graduates and diploma-holders who wish to prepare themselves for the teaching profession. The duration of the course as prescribed at present is 18 months for engineering graduates and 30 months for diploma-holders. The main emphasis in the training of a graduate-teacher is upon equipping him with relevant practical experience in industry vis-a-vis the subject-fields in which he wishes to be a teacher and upon introducing him to the methodology of

teaching work and laboratory experience. For the diploma-holder, the three main elements of the training programme are: practical experience in industry, study in depth of particular subject-fields of his teaching interest and methodology of teaching. So far, the Institutes have trained **about** graduate teachers and teachers with diploma qualifications. Admissions to the Institutes at present are restricted to those candidates for polytechnics and are assured of employment as teachers after the training. Since, however, the Institutes are less than five years old and have trained so far only a limited number of teachers, it is too early to assess the impact of the Institutes on improving the quality and standard of our polytechnic faculty. There is, however, no gainsaying the fact that the programme of training as visualised at the Training Institutes will in the long run make for great improvement in the quality of the staff of polytechnics. Nevertheless, the Institutes should examine the training programme on a continuing basis and improve it in response to the felt needs of technical institutions.

The total faculty strength in all the 280 polytechnics is estimated at about 9000 at the level of instructors, lecturers and heads of departments. The main problem is how to train this large body of teachers and equip them with the necessary academic and professional competences to function as better teachers. Even when all the four

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Technical Teacher Training Institutes are functioning on full scale they will not be able to produce more than 250-300 fully trained teachers each year. At this rate, more than three decades are required to train all the teachers now serving in our polytechnics. It is inconceivable that we should wait for such a long time to build up the faculty of our institutions on an adequate basis. Other types of programmes that can give us quick results are needed. The two most important of such programmes are short-term intensive in-service training in the various aspects of polytechnic education and relevant practical training for them in industry on an organised basis.

(i) Short-term in-service training course for teachers.

Each year we are conducting through the agency of AFTI (now ISTE) about 15 summer institutes for polytechnic level teachers with an average enrolment of 600 teachers. The main objective is to expose the teachers to new methods of teaching their respective subject-fields and to give them an opportunity to share their experiences. This has been a worth-while experience for serving teachers and it has given a new dimension to faculty development. The programme should not only be continued during the Fourth Plan period but also expanded to provide the widest opportunity possible to serving teachers to replenish their knowledge. To that end, we must increase the number of institutes to 30 in the next three or four years so that th

programme could cater for at least 1000 teachers each year.

Summer Institutes alone, however, will not meet all the needs of faculty development for polytechnics. For instance, a serving teacher needs to know better how to organise laboratory work for students in his subject-field; he needs to be sure of the aims and objects of laboratory work, the type of experiments to be set, the type of instruments to be used and so on. He also needs to know how to relate laboratory practical work to theory. Some serving teachers need to know in detail how to teach their subjects or speciality as an integral part of the total curriculum for the diploma course. They also need to develop an innovative or creative approach to their teaching. Others need improvement in other directions depending upon their own inadequacies and experience. The problem of faculty development and institutional improvements through the faculty forms a broad spectrum. This is precisely the area in which we must make a concentrated effort. There is also the problem of faculty obsolescence which even in advanced countries is assuming serious proportions. Further, when we are embarking upon diversification of our diploma courses and introducing training in technician specialities, the teachers who are to conduct the courses must be trained adequately for their new responsibilities. These needs can only be met by organising designedly at the four Teacher Training Institutes and at least at eight other

selected polytechnics a wide range of in-service programmes of varying duration. To press on with this activity along correct lines, each centre should set up a standing committee consisting of its senior faculty members and selected professors from engineering colleges to advise on the specific programmes to be conducted from time to time according to the felt needs of our polytechnics.

A serving teacher coming to a training centre for short-term faculty development programmes should be assisted for his expenditure on lodging and board at the training centre. An allowance at a flat rate of Rs. 10 per day should be provided. In addition, he should get assistance for his travel by train from his institution to the training centre.

It is assumed that each training centre will conduct each year 10 short-term courses each of an average duration of 8 weeks. Each course will cater for a group of 30 teachers. On this basis, the expenditure at each training centre in a year will be about Rs. 2.50 lakhs that includes per diem and travel allowance for the teachers and other items of expenditure at the training centre.

Each training centre should have in addition to its regular faculty, additional experts on a whole-time basis to design the training programmes according to the felt needs to identify the problems of faculty development on a continuing basis and to participate effectively in

organising and conducting the specific programmes. A minimum of eight additional faculty positions at the level of Assistant Professors (scale Rs.700-1250) two for each branch of engineering are needed for each training centre.

(ii) Practical Training in Industry for Polytechnic Teachers.

If the main inadequacy of our polytechnic courses is the absence of in-built practical industrial experience, the same inadequacy is reflected in the faculty of our polytechnics. Proposals have already been made earlier in this note, for making good the deficiency in the polytechnic curriculum through sandwich courses that include organised apprenticeship programmes. A similar effort is urgently needed for equipping the faculty with practical experience that is relevant to their teaching specialities. Another organised programme of apprenticeship in industry for serving teachers must be introduced.

For this purpose, we must select in each region first rate industrial concerns or other suitable technical organisations where the type of practical training that is needed for teachers could be best organised. The programme of training should be broad-based

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for the relevant branch of engineering and it should also include technician specialities for those individual teachers who are required to teach those specialities in the polytechnic curriculum. The Boards of Apprenticeship that have been set up by the Ministry recently would be the appropriate agencies for organising the programme in their respective regions. A tentative estimate is given below:-

(i) Number of training centres:

For each region:	3 centres for Civil Engg.
	3 centres for mechanical Engg.
	3 centres for electrical Engg.
	1 centre for metallurgy
	1 centre for chemical industry

Total number of Centres for all regions: ..	44 centres
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(ii) Total number of trainees 580
each year - 15 trainees
at each centre for civil,
mechanical and electrical
engineering and five
trainees for metallurgy
and chemical industry.

(iii) Value of stipends at Rs. 26.50 lakhs/year
Rs.300 per month for
12 months + expenditure
on train fare Rs.100/-
and other incidentals
+ one supervisor for each
training centre at
Rs.1000 per month.

Contd.....34/-

(C) CURRICULUM DEVELOPMENT, PREPARATION
OF THE CURRICULUM MATERIALS
TEXTBOOKS AND LABORATORY DEVELOPMENT

The training of a serving teacher either in summer institutes or through other programmes must centre round the curriculum of our polytechnic courses and the instructional materials and laboratory experience developed upon the curriculum. In fact, the whole process of polytechnic education improvement from the point of view of both teaching and learning is dependent mainly upon a continuous revival and updating of the curriculum. It is the total absence of any activity in this direction in our country that is responsible for the various defects in our polytechnic education system and also for the falling standards. It is also responsible for our teachers and students being solely dependent upon textbooks and other instructional materials produced abroad. The stage therefore has come when in the interest of improving our technical education system, we must address ourselves with a sense of urgency to the problem of curriculum development for polytechnic courses, to the preparation of instructional materials including textbooks and to the development of laboratory experience. This activity must be undertaken in an organised manner at selected centres that should establish close relationship with polytechnics in their own areas and with industry. It is proposed that

28 curriculum development groups should be established immediately at the four Technical Teacher Training Institutes and at other selected polytechnics that have the necessary facilities. These 28 groups may be distributed between the different branches of engineering in the following manner:

Civil Engineering	4	Groups
Mechanical Engineering	4	"
Electrical Engineering including Electronics	4	"
Metallurgy	2	"
Chemical Engineering	2	"
Physics	4	"
Chemistry	4	"
Mathematics	4	"

Each study group should be incharge of a Professor on a full-time basis and he should be assisted by two full-time Assistant Professors and two Research Assistants. In developing the curriculum and instructional materials, each group should draw upon the services of specialists from other institutions on a consultancy basis and also draw upon the services of the regular faculty of the institution where it is located. The main tasks of the study

group in each branch of engineering/science should comprise the following items:

- (a) Development of curriculum for the concerned subjects.
- (b) Development of laboratory experience.
- (c) Study of appropriate learning situations and teaching methods.
- (d) Study of interaction between teaching and practical experience.
- (e) Development of evaluation procedures including examination reform.
- (f) Development of instruments and demonstration experiments.
- (g) Processing of information and data.
- (h) Analysis of equipment in relation to laboratories and training.
- (i) Integration of the educational process vis-a-vis the humanities, engineering and science.
- (j) Preparation of instructional materials, laboratory guides and textbook materials.

The study groups for each subject-field should demarcate the work to be undertaken by each group vis-a-vis the subject-fields included in the polytechnic diploma course for that branch. They should hold regular meetings together to review the progress of work, to exchange experiences and to develop the programme in a coordinated manner.

The materials developed by the study groups should be tried out in actual learning and teaching

situations in selected polytechnics, the response of teachers and students obtained and the materials refined and improved on a continuing basis. Further, in consultation with experts in industry, the curriculum and instructional materials developed by the study groups should be related to the functions of a technician in actual working situations. To be effective in terms of an all-out effort, appropriate arrangements should be made for the wide dissemination of the materials to the faculty of our polytechnics. The summer institutes and other in-service training programmes should be utilized for evaluating the materials and for identifying the problems on which further work needs to be done.

The approximate expenditure on each study group is about Rs.1.50 lakhs per year. The total annual expenditure on all the 28 study groups is about Rs.41.0 lakhs. A tentative basis on which these estimates have been made is indicated in Annexure II.

Analysis of functions, fields of activity and typical job positions for identifying technician specialities in civil, mechanical, electrical and chemical engineering and in metallurgy.

Functions 1.	Fields of activity 2.	Typical job positions 3.	Major employ 4.
<u>I CIVIL ENGINEERING</u>			
1. Design and Drafting	1. Building construction	1. Junior Engineer.	1. Govt. Department Public Works, Irrigation Highway etc
2. Estimating & Detailing	2. Roads, Highway & Bridges.	2. Supervisor	2. Local bodies.
3. Surveying	3. Public Health engineering.	3. Surveyor	3. Private contract consulting firms
4. Supervision & inspection.	4. Irrigation & Hydraulic Structures.	4. Overseer	4. Industrial Project Administration.
5. Maintenance	5. Project construction.	5. Design draftsman.	5. Research & Educational Institutions.
6. Research & Development		6. Laboratory Technician.	
<u>II MECHANICAL ENGINEERING</u>			
1. Design & Drafting	1. Automotive industry	1. Machinshop Technician.	1. Private & Public Sector manufacture
2. Production Planning	2. Production Process Technology.	2. Foundry/Forge Technician.	2. Govt. Department Public Works, Irrigation Highway Indust.
3. Production Engineering	3. Refrigeration & Airconditioning.	3. Chargeman/Asstt. Foreman	3. Industrial Consultants.

1.	2.	3.	4.
1. Production Control	4. Power Plant Engineering Thermal & hydraulic	4. Supervisor	4. Public utilities.
2. Testing and Inspection		5. Junior Engineer	5. Research & Educational Institutions.
3. Machine maintenance.	6. Foundry & Forge Technology.	6. Production Technician.	
4. Research & Development		7. Planning Technician.	
5. Sales & Services		8. Methods Technician.	
		9. Industrial Engineering Technician.	
		10. Inspector.	
		11. Laboratory Technician	
		12. Quality control Technician.	
		13. Design craftsman.	

III ELECTRICAL ENGINEERING

1. Planning & load survey	1. Electrical machinery manufacture.	1. Junior Engineer	1. State Electrical Boards & Govt.
2. Design & drafting	2. Instrumentation & Control.	2. Supervisor	2. Private & Public Sector manufact
3. Inspection & testing	3. Power Generation & Distribution system.	3. Chageman/Asst. Foreman.	3. Industrial consultants.

1.	2.	3.	4.
4. Plant installation and maintenance.	4. Communication system	4. Laboratory Technician	4. Public utilities
5. Research & Development		5. Shift-in-charge (power station).	5. Research ^{of} Institutions.
6. Sales & services		6. Inspector	
		7. Designer-draftsman	
		8. Instructor.	

IV CHEMICAL ENGINE RING

1. Project engineering	1. Fertiliser industry	1. Junior Engineer	1. Private & Public Sector manufact
2. Design & Plant installation.	2. Heavy chemicals.	2. Supervisor	2. Industrial conc
3. Plant & process control	3. Pharmaceuticals	3. Shift-in-charge (Production).	3. Research ^{of} institutions.
4. Testing and inspection	4. Agro-chemicals	4. Operator Gr.I	
5. Plant maintenance	5. Petroleum & petro-chemicals.	5. Process technician.	
6. Research & Development	6. Ferrous & non-ferrous metallurgical industry.	6. Laboratory technician	
		7. Instructor.	

Contd....

V METALLURGY

- | | | | |
|---------------------------|--|--------------------------|---|
| . Process metallurgy | 1. Process metallurgy | 1. Process technician | 1. Privat and Pub
Sector metallur
indust. |
| 2. Physical metallurgy | 2. Mechanical metallurgy
including heat
treatment. | 2. Laboratory technician | 2. Resear. insti-
tutions. |
| 3. Research & Development | | 3. Technician (testing) | |

(This statement has been prepared in consultation
with the Institute of Applied Manpower Research)

ANNEXURE IITENTATIVE ESTIMATES FOR EACH CURRICULUM DEVELOPMENT GROUP (ANNUAL)

Salary and allowances of a full-time Professor	Rs.	20,000
Salary and allowances of two full-time Assistant Professors	Rs.	30,000
Salary and allowances of two full-time Research Assistants	Rs.	20,000
Salary and allowances of two Stenographers.	Rs.	10,000
Honorarium for five visiting specialists.	Rs.	10,000
T.A., D.A. etc., for the visiting specialists (100 days at Rs.20 per day for DA and Rs.1,000 as TA)	Rs.	15,000
Seminars and workshops	Rs.	20,000
Stationery, postage, printing and materials for laboratory development.	Rs.	25,000
Total:		<hr/> Rs. 1,50,000 <hr/>

NEED FOR STRUCTURAL FLEXIBILITY
IN ENGINEERING EDUCATION

1. As a sequel to the reorganisation of secondary education in 1954, the All India Council for Technical Education and the Inter-University Board jointly recommended that the first degree course in engineering and technology should be of five years' duration with HSSC or PUC as the minimum admission qualification. The University Grants Commission also accepted the recommendation. Following the recommendation, a majority of engineering colleges in our country have adopted the five-year integrated course for the first degree in engineering and technology. It is only in a few States like Uttar Pradesh and Punjab, and in the city of Bombay, where the higher secondary pattern of education has not been introduced, that the degree courses in engineering and technology are continuing as four-year courses with the Intermediate in Science as the minimum admission qualification.

2. For the introduction of the five-year integrated course, the Central Government and UGC, on the recommendations of AICTE, have given grants to engineering colleges for setting up the necessary teaching facilities. The bulk of the additional teaching facilities created are physics, chemistry and mathematics, and full-fledged departments for those subject-fields have been set up.

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The level of the science staff, class-room and laboratory facilities in those engineering colleges compare favourably with those available in good science colleges in our country conducting the B.Sc.(Pass) and B.Sc.(Honours) courses. The strengthening of science and mathematics teaching in the five-year integrated course is gradually making for a better standard of engineering education in our country.

3. According to the reports received, the five-year integrated degree courses have proved successful.

Selecting the best students available on a competitive basis after the Higher Secondary or PUC and putting them through a five-year course in an engineering institution is producing a body of engineers who are not only suitable for professional engineering work in the field (after the necessary apprenticeship), but are also good material for postgraduate courses at the Master's degree stage.

We, however, must not remain satisfied with whatever has been achieved, but prepare ourselves to meet the problems of tomorrow. Science and technology are advancing rapidly and the requirements of industry for specialists are constantly changing. Unless we are alive to these new situations, unless we are continually and by design adapting our technical education system, there is the danger of our perpetuating an inflexible academic formation that is out of tune with the current and future needs. To this end, we must consider what type of flexibility

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should be built into our technical education system and how to reorganise the first degree courses.

Sandwich Courses or Cooperative Engineering Education:

4. The theoretical content of our first degree courses compares favourably with the content of such courses elsewhere in the world. What they lack, however, is an adequate practical preparation for the young engineer for design, production and construction work on a professional plane. This deficiency is now being made up through an organised programme of apprenticeship for the young graduate as pre-service or in-service training in an industrial organisation. Since 1948, we have been organising such practical training programmes for young graduates each year in cooperation with industry. The number of training places has varied from year to year depending upon the employment situation in the country. In 1968-69, we have organised over 5800 training places for graduate engineers in all major fields. The apprenticeship programme alone, however, cannot solve the deficiency in our present courses. We must try other possibilities and, particularly the sandwich or cooperative type of courses, that have proved highly successful in Britain, USA and other countries. The Sandwich course aims at integrating within the same period engineering education with related practical experience in industry to produce a type of graduate who is readily useful for professional work for design, production or construction

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activity. During the sandwich course, the candidates alternate for stated periods between a technical institution and a cooperating industry and the whole programme is so organised that a coherent relationship is established between engineering theory and practice.

5. A large number of our engineering colleges are situated close to new and developing industry like mechanical engineering industry, electrical and electronics industry, metallurgical industry, and chemical industry. It seems desirable for some of these colleges, at least on an experimental basis, to organise and develop sandwich courses in selected fields in cooperation with industry located close to them.

6. Although the All India Council for Technical Education and other educational authorities have recommended from time to time sandwich courses of the above type for the first degree in engineering, not much progress has been made in this direction partly because of lack of initiative on the part of our institutions and industry, and partly because of resistance by some universities to innovations and changes in the technical education system. Now that we have serious unemployment among engineers, and industry also is critical of the type of graduates who are available, we must institute sandwich courses at selected engineering colleges in cooperation with industry. No large financial outlays are required for this programme since all the needed facilities are

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already available in our engineering institutions and in industry. All that is required is a change in attitude on the part of both the faculty of our institutions and those who are in charge of industrial enterprises. A dialogue between them should be opened on a selective basis wherever there is awareness of the problems of technical education and willingness to try new methods. For this purpose, the following institutions are suggested for undertaking sandwich courses in selected fields shown against them in cooperation with local industry:

Southern Region.

- | | |
|---|--|
| 1. Indian Institute of Science, Bangalore. | Machine tool design and construction, aeronautics, and electronics. |
| 2. University Engineering College, Bangalore. | |
| 3. Indian Institute of Technology, Madras. | Chemical industry, metallurgy, electrical industry, mechanical engineering, textile industry and leather industry. |
| 4. Guindy Engineering College, Madras. | |
| 5. AC College of Technology, Madras University. | |
| 6. PSG College of Engineering, Coimbatore. | Mechanical Engineering industry, textile technology and chemical industry. |
| 7. Coimbatore Institute of Technology. | |

Western Region.

- | | |
|--|---|
| 1. Indian Institute of Technology, Bombay. | Metallurgical industry, mechanical engineering industry, electrical industry, electronics, textile industry, and chemical industry. |
| 2. Victoria Jubilee Technological Institute, Bombay. | |

Contd....

Western Region (Contd)

- | | |
|----------------------------------|--|
| 3. Baroda University,
Baroda. | Electrical industry, chemical industry, textile industry, and mechanical engineering industry. |
|----------------------------------|--|

Eastern Region.

- | | |
|---|---|
| 1. Indian Institute of Technology, Kharagpur. | Mechanical engineering, industry, electrical engineering industry, metallurgy, including foundry and forge and Chemical Industry! |
| 2. B.E.College, Sibpur. | Metallurgy and chemical industry. |
| 3. Jadavpur University. | Mechanical engineering industry, metallurgy and chemical industry. |
| 4. Regional Engineering College, Rourkela. | |
| 5. Regional Engineering College, Durgapur. | |

Northern Region.

- | | |
|---|--|
| 1. Indian Institute of Technology, Kanpur. | Chemical industry, metallurgical industry and mechanical engineering industry. |
| 2. Harcourt Butler Technological Institute, Kanpur. | |
| 3. Indian Institute of Technology, Delhi. | Textile industry, chemical industry, electronics, and mechanical engineering industry. |
| 4. Delhi College of Engineering, Delhi. | |
| 5. Government Engineering College, Chandigarh. | Machine tool design and fabrication, chemical industry and light engineering industry. |
| 6. Department of Chemical Technology, Punjab University, Chandigarh. | |
| 7. The details of the sandwich courses to be conducted and the organisational arrangements for training within industry and other aspects could be settled by the | |

Contd....

institutions concerned in consultation with the cooperating industry in their respective areas. Our Institutes of Technology, that are included in the above list, must take the initiative, establish cooperative relationship with industry, and involve other institutions in the programme of developing sandwich courses. The universities concerned should allow their colleges adequate academic freedom to experiment with the sandwich programme, and in fact, should help them to strike out a new path in engineering education that is relevant to industrial requirements.

Bringing science and technology together.

8. Although we have recognised for long the importance of bringing science and technology together and making them interact in our technical institutions, not much progress has been made in that direction except perhaps at the Institutes of Technology and, possibly, at a few other institutions. Most institutions seem to be just content with setting up departments of physics, chemistry and mathematics, and teaching those subjects in the curriculum of the five-year degree courses. This is not adequate. Much more needs to be done for promoting the interaction of science and technology.

9. The first attempt is to make by design a special provision for the admission of B.Sc. graduates with better scientific equipment to engineering courses. Although some institutions made attempts in this direction by admitting B.Sc. graduates to the normal five-year degree

courses, they gave them up because of certain academic and organisational difficulties. The chief difficulties were:-

- (a) the B.Sc. graduates could not be admitted to a stage higher than the second-year of the five-year degree course and, as a result, the period that these graduates took to complete the first degree was too long to be sufficiently attractive to the best among them;
- (b) because these graduates lacked sufficient preparation in workshop and drawing, and other basic engineering subjects that were taught in the first two years of the normal degree course, they had to take additional instruction in those subjects and make up the deficiency. It became a difficult exercise both for the students and for the institutions;
- and (c) when the B.Sc. graduates belonging to a maturer and higher age-group were mixed with younger students in the same class, there were problems of adjustment between the students.

No attempt, however, was made by the institutions to conduct a separate three-year degree course in engineering for graduates in science. The only exception is the Indian Institute of Science, Bangalore, that has been conducting for long such a course in electrical engineering and in electronics with considerable success. Later, a

special committee under the Chairmanship of Dr. S. Bhagwantam, recommended that special three-year degree courses in selected branches of engineering like aeronautics, electronics, instrument technology, chemical engineering should be conducted at selected centres for graduates in science. This recommendation has been accepted by AICTE, but few institutions are conducting such courses at present. The Education Commission also has emphasised the importance of upgrading science content of engineering education in our country and, to that end, it has recommended that special engineering degree courses should be instituted for science graduates.

10. The present five-year integrated course in engineering has, therefore, become inflexible from an educational standpoint. Irrespective of the stage at which an individual student matures and develops interest in engineering, he must join the first year of the five-year course after the higher secondary or PUC if he wishes to become a graduate-engineer. The present system does not permit, as for instance, a science graduate to enter the engineering course at a higher stage, obtain credits for the subjects already studied by him for the B.Sc. degree, and complete his engineering education in a shorter period. Late developers and those who come with a higher level of scientific preparation are not deliberately encouraged to join engineering courses.

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11. A large proportion of the students admitted to the first year of the five-year degree course are still in the age-group $15\frac{1}{2}$ - 16, and many of them are still immature for regular engineering education. Their preparation in science and mathematics at the school stage is grossly inadequate for entering upon any rigorous engineering studies. Therefore, the first two years and part of the third year of the five-year degree course is barely taken up for equipping the students in science and mathematics and for instruction in the basic engineering subjects. Such preparation in advanced countries is a part of school education and, therefore, their engineering institutions, ^{un}like ours, could concentrate on rigorous engineering studies right from the first year of the course. With our institutions it is generally the last two years of our five-year degree course that is wholly devoted to engineering studies on a professional plane. The time available, however, is insufficient for the institutions to attempt any kind of specialisation or study in depth of a particular subject-field. The courses, therefore, are very general and broad-based and do not develop any special knowledge or competence in a particular branch of engineering speciality that is of value to the graduate when he enters industry.

12. With the expansion of secondary education in all States, the demand for college education, particularly in science, is increasing, but the number of places available

in our science colleges, is limited and we are all hard put to it to expanding facilities for science courses at the university stage to meet the increasing demand. Science courses at the university stage, however, are a form of pure academic education, that do not develop in our students the capacity and skills to apply scientific knowledge for productive work in life. Therefore, a large number of our graduates like arts graduates, are unemployable unless they are re-trained for a particular vocation in life. There is a strong case for experimenting with a different approach to the B.Sc. degree course by combining science teaching with industrial skills that will help the prospective science graduate to become a useful technician at the middle level.

13. In view of these considerations, the following suggestions are made for reorganising structurally our engineering courses at selected institutions:

(a) At selected engineering colleges where admissions to the existing engineering courses have been reduced and where full-fledged science and mathematics departments have been set up and also at the Institutes of Technology, a new type of B.Sc. degree course, of three years' duration, may be organised for a limited number of students on an experimental basis.

(b) The curriculum of the new B.Sc. degree course should provide for the same content and standard of instruction in physics, chemistry, mathematics and

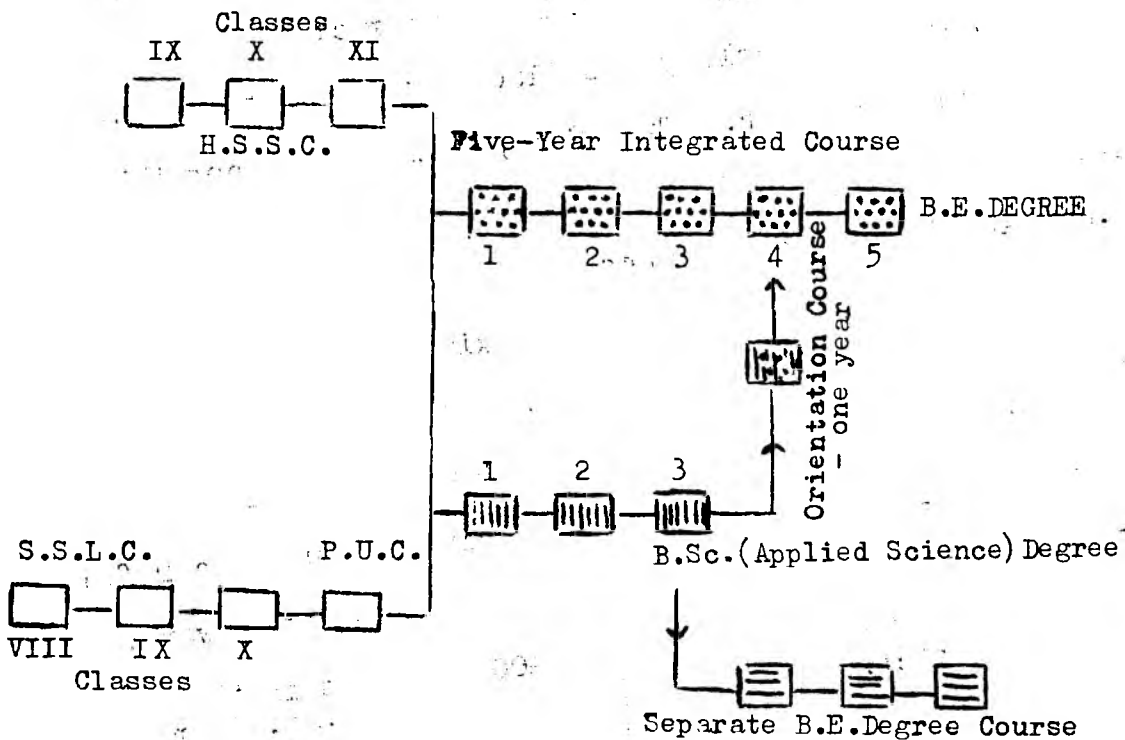
languages as in the conventional B.Sc. degree course conducted by science colleges. In addition, it should provide for instruction in certain basic engineering subjects like workshop, drawing, applied mechanics and strength ^{of} materials, and elements of electrical and mechanical engineering. An integration of fundamental sciences and engineering studies in this manner will produce a new type of graduates who in addition to having a broad-based science education equal to the normal B.Sc. degree, are equipped with a minimum of engineering knowledge and experience that might help them in their after life. The latter, however, will not make them professionally qualified engineers in any sense. To distinguish the new course from the conventional B.Sc. degree, the award may be styled as B.Sc.(Applied Science).

(c) On completion of the B.Sc.(Applied Science) course, a selected number of the new graduates who are interested in pursuing engineering studies further and qualify for the professional degree may be given an orientation course for a year in the same engineering institution and then admitted to the fourth year of the five-year integrated degree course in engineering. The orientation course should seek to fit them into the normal stream of the professional course by making good the major deficiencies vis-a-vis the first three years of the professional course.

Alternatively, a separate three-year degree course

in engineering may be organised for them in which by taking advantage of their better scientific preparation specialisation may be attempted in selected fields to train them for design or for other higher types of engineering work.

These suggestions are schematically represented in the diagram:



(d) Those B.Sc.(Applied Science) graduates who do not wish to proceed further for engineering studies but are interested in higher scientific studies should be eligible to join the M.Sc. degree courses in universities, on a par with B.Sc. graduates .

14. Is it possible to cover in the proposed three-year Applied Science degree course the same standard and content of science, mathematics and languages as in the conventional B.Sc. degree course plus basic engineering subjects? Yes. A normal science college offers a maximum of 800 hours of instruction each year for the B.Sc. degree course or a maximum of 2400 hours for the whole course. The minimum instructional load in an engineering college is 1100 hours and the maximum 1200 hours each year. Therefore, it should be possible for an engineering college to organise a balanced B.Sc.(Applied Science) course through an imaginative combination of the subjects and maximum utilisation of the instructional time available. Even in the teaching of physics, chemistry and mathematics, orientation could be given designedly towards engineering through a careful selection of problems and laboratory experimental work.

1.	Physics, Chemistry and Mathematics. Languages.	} } } } } } } } }	2400 hours(as in the B.Sc. degree course)
2.	Workshop Practice.		300 hours.
3.	Engineering drawing.		300 hours.
4.	Applied Mechanics and Strength of Materials.	} } } } } }	200 hours.
5.	Elements of Electrical and Mechanical Engineering.	} } } } } }	100 hours.

3300 hours or

1100 hours/year.

Contd....

15. Although the proposed Applied Science Course is in no sense a full-fledged or self-contained professional course, the graduates, because of their higher scientific preparation and a minimum of engineering knowledge will be useful for middle level technical positions like engineering aides, laboratory technicians, process control supervisors, sales assistants and so on. Further, depending upon the requirements of an organisation they could be trained on specific jobs and employed gainfully in the organisation wherever they are more useful than an ordinary B.Sc. graduate. There is a large variety of such positions in industry, design and development organisations, research laboratories, etc.

EDUCATION THROUGH S.I. UNITS.

SUMMARY: Paper by S/shri V.V.L. Rao and
I.V.V. Raghavacharyulu.

Because of its rational and coherent character and the facility it offers for greatly simplified calculations in science and technology, the SI System of units is slowly gaining acceptance as the international system of units. While reviewing the salient features of this latest form of the metric system, its advantages, problem areas and limitations, guidelines for expeditious introduction of SI Units in educational institutions are also suggested.

EDUCATION THROUGH SI UNITS.

Prof. V.V.L. Rao and Dr. I.V.V. RAGHAVACHARYULU, D.Sc.,
Institute of Mathematical Sciences, Madras-20.

The SI system of units, which has six fundamental units (the metre, the kilogramme, the second, the ampere, the kelvin and the candela) and a number of derived units (the watt, the volt, the ohm and the newton), is the latest form of the metric system. Its adoption for every-day scientific and engineering purposes will have far-reaching implications in almost all spheres of human activity. India had taken a statutory decision in December 1956 to go metric. If the initial reform in the basic units is to the MKS or RMKSA system only, then the full advantages of the change over will not be available unless subsequently a progressive advance is made towards the use of SI Units. It may be mentioned that more and more countries of the world are now adopting the metric system in the form of SI. Although India decided to change over to the metric system over 12 years ago, the introduction of the metric system in educational curricula has not progressed to the extent desirable. This paper discusses in detail, the implications of the SI system of units, its advantages, problem areas and limitations. Guidelines for introducing expeditiously the SI units in education at different levels are also suggested.

LEARNING IN SI:

Most of the countries including UK (with India, of course, leading by over 12 years) are converting their currencies to decimal coinage. It would, therefore, be natural for a child when introduced to this currency to expect that the other units would also reflect the same trend. Children easily recognise the simplicity involved in multiplying or dividing the numbers in powers of 10, namely, 10, 100, 1000 etc., which involves only the shifting of a decimal point. Hence the outstanding feature of metric system lies in making quantitative comparisons quite 'elementary'. By transfer of experience, it will be possible for the young student to learn

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simultaneously numbers, measurements and coinage (all decimal based). It is usually intended that children's learning should ensure that they understand what they are doing and why things happen as they do in mathematics. They will grasp the basic principles of mathematics involved more quickly if theory and application go together. The elimination of drudgery associated with calculations in mixed units, particularly during the early impressionable years, would help to promote interest in mathematics and science, thus attracting a large number of students to the study of these subjects.

An important advantage of SI is the elimination of the division of units into 'absolute' (or theoretical) and 'gravitational' (or practical) units. Previously, CGS units were used in science teaching and science laboratories and gravitational units in engineering and technology. This led to the situation where a civil engineer worked in terms of gravitational units, a mechanical engineer thought in terms of 'horsepower' (again a gravitational unit), while a housewife in UK was pre-occupied with stones, pounds (lbs), ounces and pints. All these developed a subjective feel in an individual towards the materials which were daily handled by him in terms of the various units that were forced on him without any rationale. If the SI units were introduced, the feel for them would become universal and comprehensive, thereby eliminating the gap that existed between the 'theoretical' and the 'practical' units. When a student embarks on specialisation studied in physics, he need not face any unnecessary difficulties as all the principal units in SI are defined in conformity with GIORGI's idea that they be universally applicable to all branches of physics, and such that no conversion factors are necessary while passing from mechanics to electrostatics or to electrodynamics. The introduction of SI will, in due course, unify the system of measurement through all fields of activity.

TEACHING IN SI:

It is interesting to note that the change to the SI system has coincided with an overall change in general education in the world. At a time when progressive teachers are introducing much new material into curricula and are using more imaginative methods of teaching, the number of teachers who think that it is not safe to reduce the practice of four rules for arithmetic in various units, is slowly dwindling. Thus, the change in units is helping to make room for the development projects such as the Nuffield Mathematics Project (NMP) and Nuffield Foundation Science Teaching Project, and Physical Science Study Committee in the USA (PSSC) - to introduce new kinds of mathematics, physics, chemistry, biology, etc. into the junior schools, thereby helping them to grasp basic principles, structures and applications at the same time without ignoring the enjoyment part of education.

The advantages to be gained in the secondary schools by adopting the metric system and, in particular, the SI units are many. For example, teachers of mathematics and mechanics now need not set the type of questions requiring odd conversion factors for change from one unit to another, involving use of numbers, such as 112, 550, 1760, 2240, and 4840 which used to occupy the precious quick access memory of pupils. Now, questions that lay emphasis on the conversion factors from one set of units to another ^{have} given way to those which stress the basic principles of the subject. This is a result of the introduction of SI units, which is intended to eliminate this misplacement of emphasis and to reduce the artificiality of questions thus making smaller demands on the students' learning capacity. However, it is pertinent to point out that even while making use of SI units, time-wasting exercises could still be set. To prevent this, the teachers themselves may have to be given special orientation course in the rational use of SI units.

While using the old practical units in a class room a teacher had to take special precautions in getting correct answers to problems in elementary dynamics, which might otherwise be g or g^2 times too big or too small. Such incorrect answers necessitated a thorough check of the entire solution to find where ' g ' had been incorrectly omitted or introduced. This difficulty could be eliminated by using SI units because the teacher now would need to remember and to teach only in 'absolute units', that is:

$$P(\text{newton}) = m(\text{kg}) \times a (\text{m/s}^2)$$

instead of:

$$P (\text{kgf}) = \frac{w(\text{kg}) \times a(\text{m/s}^2)}{g(\text{m/s}^2)}$$

This would make things simpler both for the teacher and for the student. This can only be achieved if we ungrudgingly change over habits of a lifetime to give to future generations a simple system of units.

It has been recognised that during the transition period there should be stress on the change of attitude; to think metric and not to lay emphasis on a set of conversion tables. The teachers especially those in primary schools now have a singular opportunity for making the study of abstract subjects, such as the mathematics and science, an enjoyable experience. This may best be achieved by the immediate introduction of a 'Metric Play Set' perhaps a wisely designed 'toy-shop' complete with weights and measures and coins, all in metric units. Such a device, which a child could even take home for the benefit of the parents, could offer a powerful incentive for promoting acquaintance with SI units.

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Summer and short term courses in schools and colleges would offer special opportunities to teachers to become used to the new units. To make them rapidly acquainted with the unified and rational system of units, teachers should be provided with clear and well considered briefs. Educational institutions, such as the Regional Colleges of Education and National Council of Educational Research and Training which conduct 'summer institutes' and in-service programmes can do a lot in this regard. By shifting from the use of MKS or CGS units to SI units in these programmes, they could help the teachers to acquire a feel for the new system and this is a pre-requisite for a gradual change to SI. The combined involvement of teachers and students is necessary for better appreciation of the role of mathematics and science in society.

TUNING THE PUBLIC TO SI:

The public must be made aware that SI represents a single international language of units for all purposes, education, industry, business etc. To educate the general public on the practical application of SI in daily life, a massive publicity campaign should be launched covering even such persons as housewives and restaurant managers. It should be made known that gold and precious stones will be quoted only in grammes and not in ounces or carats or points and that a man's weight would be expressed in kilogrammes, his height in metres and his body temperature in celsius ($^{\circ}\text{C}$). One will have to buy sweets, bread, sugar etc. in terms of 100, 200, 500 grammes etc. The concept of weight will have to yield place to the concept of 'mass'.

Similarly, in the case of speed or velocity, one should get the same feel of values like 50 km/h as one got with velocities like 30 miles/hour (see Table 1). A newton approximately is the weight of a full-sized apple or that of a knife and fork. It is a unit of force or weight. In trade, it is not the kg-weight which has been utilised as unit of quantity for goods, but the kg-mass (since no correction is necessary for variation of gravity from one place to the other as universally calibrated 'weights' are utilised in beam balances). The appreciation of metric masses may present some difficulty to the trader as well as to the public in their day-to-day business transactions, especially during the period of change-over. Further, in SI, 'pressure' is to be mentioned as so many 'newtons per square millimetre' instead of so many 'pounds per square inch'. After 'force', the most important quantity is work or energy. The unit of energy in SI is the newton-metre or joule. This is the quantity of energy lost by a 100 gram mass rolling off a table, one metre high, on to your toe. It is also the heat released by a small drop of boiling water cooling on your skin, or the energy released by a small torch bulb (one watt) burning for one second. Thus, joule is the unit for mathematical, electrical, thermal, chemical and other forms of energy. In the transition period, appreciation of

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quantities by the general public is a great problem. During this period young students may be in a position to help their parents and the public in their adjustment to SI units.

ATTITUDE OF ADMINISTRATION:

The time for calculation of a typical problem in mechanics using SI units will only be about one sixth of that for the same problem expressed in the old system of units - FPS, CGS etc. This is a significant advantage. Considering similar situations, it has been estimated by Dr. E.G. Tagg, Director of the Accelerated Teaching of Higher Level Mathematics Project at the University of Lancaster, UK, that each year the time saved in schools by using SI units might be about 2×10^9 child-hours or about 6×10^7 teacher-hours. This would result in savings of about 100 million hours/a year. Countries, such as India with free and compulsory primary and secondary education in which very large number of children are enrolled, the savings from adopting SI will run into hundreds of millions of rupees. (There were 24,000 secondary schools and 406,000 primary schools in India upto 1966).

Before SI is accepted from educational point of view, a significant change is necessary in the general attitude towards education. In developed countries, the number of people who receive higher education is much larger compared to that in the developing countries. That is the reason why any change to SI is slower in these countries particularly as the concerned administrators are familiar only with the old system of units. To ensure that the proposed change takes root expeditiously it is necessary to ensure availability of qualified personnel.

Otherwise, it has adverse effects on the implementation of the policy decision of the government in adopting SI. For example, the Government of India in its then Ministry of Commerce and Industry in 1960 had called a Conference of the Principals of Technical Institutions to consider the adoption of metric system (not SI) in higher technical education. The conference had unanimously recommended the adoption of metric system in the first and second year classes from the academic session in 1962-63, in the third and fourth year classes in 1963-64 and in the fifth and final year classes in 1964-65.

Unfortunately, all the engineering colleges in India did not strictly adhere to this phased programme inspite of the efforts made from time-to-time by the All India Council for Technical Education (AICTE). Now, as SI has finally emerged as the metric system for world-wide adoption, the various central institutions as well as the State Directorates of Public Institution/Technical Education or their equivalents

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should take care to see that all technical subjects are taught and examined only in SI atleast from 1970-71.

Mathematics should be looked upon as a language for expressing ideas as simply as possible and promoting clear a logical thinking. Discarding the FPS system suffering from complicated and adhoc relationships among units, and the extension of the metric system to the SI, based on the decimal notation, is synonymous with adopting a simpler international mathematical language of units. There is a tendency among children to give up learning mathematics as soon as possible perhaps because some parents might have confessed to their children that they themselves were never any good at mathematics and yet they had succeeded in life!

REFORM BY EXAMINATION BODIES:

A specific and phased programme of reforms for introducing SI units in various subjects of primary and secondary education to start with and later at degree and higher levels, especially in science, engineering and technology is given below:

Mathematics and Physics: In matriculation and its equivalent examination (SSLC) every country should resolve to use exclusively the metric (SI) units from 1970 or 1971. The implication of SI units, namely, using the multiples of units limited to $10^{\pm 3}$ for prefixes and suffixes must be clearly borne in mind with slight alterations while using for example, cm, cm³ and 100g as basic units temporarily.

Use of Newton and Joules: Those science teachers, who teach in CGS units, use dyne and erg as the units of 'force' and 'work' respectively. Of course, they are also familiar with joule as the practical unit of energy being equal to 10^7 ergs. They can easily introduce newton as being equal to 10^5 dynes. It will become much simpler for the examinee if he confines himself to a single unit of force and single unit of work (or energy). It is to achieve this objective that immediate adoption of newton and joule for force and energy (or work) respectively is recommended. As an interim measure, for one to two years, force can be expressed in the examination papers both in newtons and dynes and work or energy in both Joules and ergs.

Calorie: In UK majority of physics teachers in schools favour heat to be expressed only in joules instead of calories and specific heat as 'joules/gramme celsius'. However, it is very difficult to abolish the use of calorie from the school stages, because many physics teachers firmly believe that for a thorough grasp of the principle of conservation of heat energy, they have to use the historical development of the concept of the mechanical equivalent of heat and therefore express the specific heat not only in

joule/gramme celsius, but also in calories/gram/°celsius. Perhaps, kilocalorie, instead of calorie, corresponding to kilogramme, the unit of mass, can be used for sometime.

Chemistry: Few changes are necessary in this discipline, because the normally used units, those of mass, volume and heat, namely, g, ml and °C are already in SI. However, one must remember that another unit 'kilogrammemole' is proposed as the seventh basic unit in SI, in the field of chemistry and chemical engineering.

Geography: For the next few years, temperature may be expressed both in °Centigrade and °Fahrenheit, but soon it should be mentioned only in °Celsius. Similarly for tabulating the date of rainfall only millimetres(mm) and not inches, should be used. In maps, only the appropriate metric scale should be used by map-makers such as the Survey of India.

Humanities: There should be a gradual introduction of metric (SI) units in the question papers in commerce, economics, etc. to/completed by 1971.

Domestic and Home Science Subjects: Most examination boards have not done much to replace gallons, pounds, ounces, pints, etc. by the corresponding metric SI units. Housewives and government institutions should be persuaded through propaganda to achieve this aim.

The Director of Public Instruction and Technical Education under the Ministry of Education (Government of India) and the States should forthwith set up small working groups on SI units for primary and secondary schools and polytechnics and submit their findings and recommendations to such national bodies as the National Institute of Science of India and the Indian Standards Institution (ISI) and forward the final proposals to all the recognised examination boards. If the Boards adopt SI, the schools will automatically change to SI.

Recalling the adage: 'If everyone waited for someone to move, nothing would move', it is suggested that specific target dates for certain subjects would be most effective to force the pace. This work of exclusive use of metric (SI) units by all examination boards in India should be completed as early as 1971.

COOPERATION FROM PUBLISHERS AND AUTHORS:

In the text-book publishing industry, the first axiom is that given a sufficiently specific and substantial market, publishers should always try to meet the demand. The publishers want a definite idea of time when text-books in mathematics, science, engineering and technological subjects are required

in SI units. The authors also should have authentic data on the correct use of SI units, including standardized symbols and abbreviations for various quantities collected from standards organisations namely, ISI, International Standards Organisation (ISO), and the International Electro-technical Commission (IEC).

The Publishers view that an early investment in metric books is bad business and to be too late in the market would be bad-service to the customer. The publisher feel that so far there has been insufficient information from the Education Ministry, All India Council for Technical Education (AICTE) State Governments, etc. to enable them to chalk out clear-cut publishing programme in 'SI' units with any confidence.

In the text books, during the change-over period, emphasis should be placed on thinking metric (with a proper "feel") and not merely on conversion with such factors as one inch = 2.54 cm. Initiation into SI units should be started at all levels simultaneously by drawing examples from everyday life. Besides, two other ways of producing text books in SI Units are:

(a) writing new text-books incorporating SI, and (b) revision of good and popular existing text books and converting them to SI versions. The publication of the new text-books is necessary because methods of teaching such subject as electricity and magnetism, electrical engineering and electronics demand a radically new approach owing to the rationalised MKSA units, which have been absorbed by the SI units. The revision of published books may demand for considerable attention on the part of the authors, who either may not be willing due to their pre-occupation or be able to tackle the rather tedious work involved. Even granting that there are such willing authors or collaborators, they need sufficient time for the job and the publishers too would need time for carefully producing the revised versions.

In India, during the past decade, a few text-books particularly in physics and engineering were published in MKS or MKSA units. But many books in civil, hydraulic and mechanical engineering (except in electrical engineering and electronics) unfortunately use gravitational MKS units. This is wholly contrary to the very spirit of SI units. In UK, besides text-books in metric units, publishers have already ventured even into SI units.

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The Union Ministry of Education and the Educational Departments in the States should set up information centres and periodically give information to Indian publishers about the topics (syllabus) and the approximate number of copies of text-books in SI units required in different states. Similarly, other examination bodies, and the professional institutions, such as the Institution of Engineers (India), the Institution of Tele-communication Engineers (India) and the Aeronautical Society of India, should also publish periodically syllabi and indicate an approximate demand of recommended books written in SI units in various subjects for their respective examinations. This would create a definite requirement outside the Governmental agencies. It might be difficult for the State Governments with the limited machinery at their disposal to cope with this task. Therefore, the co-operation of competent personnel, well-versed in SI units and their use, should be sought for this highly responsible work.

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