

**INDIAN INSTITUTE
OF
TECHNOLOGY
MADRAS**

INDIAN INSTITUTE
OF
TECHNOLOGY
MADRAS

ELEVENTH ANNUAL REPORT
1969 - 70

CONTENTS

	PAGE
The Council of the I. I. Ts	1
The Board of Governors	3
The Finance Committee	4
The Buildings and Works Committee	4
The Senate	5
Report by the Director	7
Appendix—A	
Aeronautical Engineering	21
Applied Mechanics	22
Chemistry	23
Chemical Engineering	25
Civil Engineering	27
Electrical Engineering	28
Humanities and Social Sciences	29
Mathematics	30
Mechanical Engineering	31
Central Workshops	32
Metallurgy	33
Physics	34
Library	37
Annexure B—	
Admissions to the courses of study and Student Population for the 1969—70 Session	39
Annexure C—	
Sixth Convocation of the Institute	40
Annexure D—	
Number qualified for the Degrees/Diplomas at the end of 1969—70	44
Annexure E—	
Pattern of Graduation	45
Annexure F—	
Alumni Association and Students Placement Centre	45
Annexure G—	
Institute Gymkhana	47
Annexure H—	
National Cadet Corps	49
Annexure I—	
Institute Dispensary	51

Visitor : THE PRESIDENT OF INDIA

The Council of the Indian Institutes of Technology

Chairman :

Dr. V. K. R. V. Rao, Minister for Education and Youth Services,
Government of India, New Delhi.

Members :

Sri Biren Mookherjee, Chairman,
Board of Governors, I.I.T., Kharagpur.

Sri G. L. Mehta, Chairman,
Board of Governors, I.I.T. Bombay.

Sri H. V. R. Iengar, Chairman,
Board of Governors, I.I.T., Madras.

Sri Padampat Singhania, Chairman,
Board of Governors, I.I.T., Kanpur.

Prof. M. S. Thacker, Chairman,
Board of Governors, I.I.T., Delhi.

Prof. R. Choksi, Chairman,
Council of the Indian Institute of Science, Bangalore.

Dr. D. S. Kothari, Chairman,
University Grants Commission, New Delhi.

Dr. Atmaram, Director-General,
Council of Scientific and Industrial Research, New Delhi.

Brig. S. K. Bose, Director,
I.I.T., Kharagpur.

Prof. Mhatre, Ag. Director,
I.I.T., Bombay.

Dr. A. Ramachandran, Director,
I.I.T., Madras.

Dr. P. K. Kelkar, Director,
I.I.T., Kanpur.

Prof. R. N. Dogra, Director,
I.I.T., Delhi.

Dr. S. Dhawan, Director,
Indian Institute of Science, Bangalore.

Representatives of the Central Government :

Dr. B. D. Nag Chaudhuri,
Member (Education & Science)
Planning Commission,
New Delhi.

Sri S. R. Mehta,
Financial Adviser,
Ministry of Finance,
New Delhi.

Sri G. K. Chandiramani,
Secretary,
Ministry of Education & Youth Services,
New Delhi.

Representatives of Parliament :

Sri Kartik Oraon,
Member,
Lok Sabha,
New Delhi.

Sri Suraj Bhan,
Member,
Lok Sabha,
New Delhi.

Sri Arjun Arora,
Member,
Rajya Sabha,
P.B. No. 451, Kanpur.

Representative of the All India Council for Technical Education :

Prof. P. J. Madan,
Pro-Vice Chancellor,
Baroda University,
Baroda.

Nominees of the Visitor :

Sri G. Pande,
7, Park Lane,
Lucknow.

Dr. M. N. Dastur,
31, Chowringhee Road,
Calcutta.

Sri Chalapathi Rao,
Chairman, Heavy Engineering Corporation,
Ranchi.

Dr. H. N. Sethna,
Director, Bhaba Atomic Research Centre,
Bombay.

Sri S. M. Patil,
Chairman & Managing Director,
Hindustan Machine Tools Ltd.,
Bangalore.

Secretary :

Sri G. N. Vaswani,
Deputy Educational Adviser (Tech.),
Ministry of Education & Youth Services,
Government of India,
New Delhi.

The Board of Governors

The Board of Governors met three times during the year. The following were the members of the Board :-

Chairman :

Sri H. V. R. Iengar,
Chairman, The E.I.D.—Parry Group,
Madras.

Nominees of the State Governments :

Dr. B. L. Shanthamallappa,
Director of Technical Education,
Government of Mysore,
Bangalore.

Sri S. Peer Mohammed,
General Manager,
ALIND, Kundara, Kerala

Sri T. R. Doss,
Director of Technical Education,
Government of Andhra Pradesh,
Hyderabad.

Sri P. Sivalingam,
Director of Technical Education,
Government of Tamil Nadu, Madras.

Nominees of the Council :

Sri C. B. Cariapa,
General Manager,
Bharat Heavy Electricals Ltd.,
Unit : Ramachandrapuram,
Hyderabad.

Prof. V. K. Gokak,
No. 521, Rajamahal Extension,
Palace Upper Orchard,
Bangalore.

Sri A. K. Kaderkutty,
The Western India Plywoods Ltd.,
P.O. Baliapatam,
Cannanore District, Kerala.

Dr. Y. Nayudamma,
Director,
Central Leather Research Institute,
Madras.

Director :

Dr. A. Ramachandran,
IIT, Madras.

Nominees of the Senate :

Dr. P. C. Varghese,
Professor and Head of the Department of Civil Engineering,
IIT, Madras (till 31-12-69).

Dr. D. Venkateswarlu,
Professor and Head of the Department of Chemical Engineering,
IIT, Madras. (from 1-1-70)

Dr. Hans Wagner,
Professor, Department of Applied Mechanics,
IIT, Madras.

Secretary :

Sri C. V. Sethunathan,
Registrar, IIT, Madras.

The Finance Committee

Chairman :

Sri H. V. R. Iengar,
Chairman,
Board of Governors.

Members :

Sri G. K. Chandiramani,
Secretary,
Ministry of Education & Youth Services,
Government of India,
New Delhi.

Dr. (Miss) Kaumudi,
Deputy Financial Adviser,
Ministry of Finance,
New Delhi.

Dr. B. L. Shantamallappa,
Director of Technical Education,
Government of Mysore,
Bangalore.

Sri C. B. Cariapa,
General Manager,
Bharat Heavy Electricals Ltd.,
Hyderabad.

Dr. A. Ramachandran,
Director,
IIT., Madras.

Secretary :

Sri C. V. Sethunathan (Registrar).

The Buildings and Works Committee

Chairman :

Sri H. V. R. Iengar,
Chairman,
Board of Governors.

Members :

Dr. A. Ramachandran,
Director,
IIT., Madras.

Sri V. Narayanan,
Superintending Engineer,
C.P.W.D., Madras.

Dr. P. C. Varghese,
Head of the Department of Civil Engineering,
IIT., Madras.

Sri D. Henry David,
Chief Engineer (Buildings),
P.W.D., Madras.

Sri C. S. Subramaniam,
Executive Engineer,
IIT., Madras.

Secretary :

Sri C. V. Sethunathan (Registrar).

The Senate

The Senate met four times during the year. The following were the members :

Chairman :

Dr. A. Ramachandran (Director)

Members :

Dr. M. K. Achuthan	Dr. S. D. Nigam
Prof. M. Bantel (from 11-11-69)	Dr. K. A. V. Pandalai
Dr. P. Besslich	Dr. J. Plaehn
Dr. H. Bock (till 1-2-70)	Dr. E. G. Ramachandran
Prof. N. K. Datta	Dr. C. Ramasastry
Mr. H. J. Ebert	Dr. D. V. Reddy
Dr. (Mrs.) Edith Butenuth	Dr. G. Rouve
Dr. H. P. Gerken (from 7-8-69)	Dr. F. W. Rutloh (from 26-7-69)
Dr. T. Gopichand (from 29-1-70)	Prof. S. Sampath (Dy. Director)
Dr. Gottfried Butenuth	Dr. K. S. Sankaran (from 21-7-69)
Dr. M. C. Gupta	Dr. M. V. C. Sastri
Prof. R. K. Gupta	Dr. A. Seifert (till 23-2-70)
Dr. H. Heitmann (from 4-9-69)	Dr. V. Sethuraman
Dr. E. H. Hohmann	Dr. V. Sivaramakrishnan
Mrs. Ingrid Davids (from 27-1-70)	Dr. R. Srinivasan (from 24-7-69)
Dr. Jens-Ulrich Davids (from 27-1-70)	Dr. S. K. Srinivasan
Dr. Joachim Holtz (from 7-11-69)	Dr. V. Srinivasan (from 21-7-69)
Dr. A. Klein	Dr. K. Srinivasaraghavan (from 21-7-69)
Dr. N. Klein (till 31-3-70)	Dr. P. C. Varghese
Dr. J. C. Kuriacose (from 21-7-69)	Dr. R. Vasudevan (from 2-7-69)
Sri S. S. Mani	Dr. P. Venkata Rao
Dr. G. Mennig (from 7-5-70)	Dr. V. C. Venkatesh (from 21-7-69)
Dr. H. W. Meyer	Dr. D. Venkateswarlu
Dr. B. S. Murthy	Dr. M. Venugopal
Dr. V. G. K. Murthi	Dr. H. Wagner
Prof. R. G. Narayanamurthi	Dr. H. W. Wagener
Dr. L. Narjes	Dr. H. E. D. Zuern
Sri V. S. Nazir Ahmed	

Nominees of the Chairman, Board of Governors :

Prof. T. Balakrishnan Nayar,
Madras.

Dr. P. L. Bhatnagar,
Vice-Chancellor, Rajasthan University, Jaipur.

Dr. G. S. Laddha,
Director, A. C. College of Technology, Madras.

Secretary :

Sri C. V. Sethunathan (Registrar).

REPORT BY THE DIRECTOR

I have pleasure in presenting the Eleventh Annual Report (1969-70) of the Indian Institute of Technology, Madras.

I. From the outset this Institute has sought to distinguish itself by the stress that it would lay on the acquisition of technical skills and design-consciousness by all those whom it trains and by its Faculty-members who besides doing high - grade academic work in their chosen disciplines will get involved in grappling with the live and challenging problems of the country's industrial establishments in relevant areas.

During the first ten years of its growth and development, the Institute has endeavoured to fulfil these objectives. Its graduates are received well outside - in academic institutions, research laboratories and industrial establishments, in India and abroad. Its staff-members are busy implementing a continually updated programme of instruction in the various disciplines of science and engineering and initiating research and development work in areas that are important in the context of our national needs. Consultancy and interaction with the work of industrial undertakings - on an institutional as well as individual basis-are receiving increasing attention. It is recognized that a significant part of the Institute's work will lie in this area.

II. During these few years, the emphasis has been on increasing the Post-graduate students strength so as to attain the ratio 1 : 2 between Post-graduate and Under-graduate students keeping the overall strength round about 2000. During the year under report there were 1281 Under - graduates, 643 Post-graduates and Research scholars with a total of 1924 and a P.G : U.G. ratio of 1 : 2. It can hence be stated that the Institute has reached the stature of a major centre for higher technological education at the Post-graduate level as has been intended by the Government of India in declaring the Indian Institutes of Technology as Institutes of national importance.

III. The Institute strove its best during the year under Report to initiate work and implement as best as it could the various suggestions contained in the Chairman's address and in the discussions of the several members of the Council during the last meeting. The progress made in this regard is detailed below :

1. Long-range Inter - Institutional relationship :

Proposals have been received for exchange of faculty members between the Indian Institute of Science, Bangalore, I.I.T. Kanpur and this Institute. To promote this activity, necessary provision has been made in the Budget. Professor J. P. Ghosh from I.I.T. Kharagpur (Department of Naval architecture-specialist in Hydro-mechanics) was with the Institute for about 4 weeks in connection with the Towing Tank in the Hydraulics Laboratory. One or two faculty members are expected to join in the semester commencing in January 1971.

Relationship has been established between the Structural Engineering Centre at Madras, the Central Leather Research Institute, Space Science and Technology Centre, Thumba, National Aeronautical Laboratory, Bangalore and this Institute. Some staff members of S.S.T.C. and the Structural Engineering Centre at Madras have been registered for research work in this Institute. These staff members work under joint guides, one from the organisation where they are working and one from the faculty of this Institute. Under this programme, which has been initiated only this year, staff members from these organisations will spend two semesters at the Institute and spend the remaining period in their own respective organisations for continuing the research. This programme also envisages research scholars from the Institute doing their research work in such Laboratories.

A special Instruments Laboratory being set up at this institute with a large number of sophisticated scientific instruments like the Mass Spectrometer is being made available to research workers from other Educational Institutions and Research Institutions in this region.

2 Assistance to Industry:

A report on assistance to Industry in the form of consultancy, fabrication, development and sponsored projects is annexed.

Some of the important private industries, public sector / autonomous undertakings with whom the several Departments of the Institute have interacted are indicated below.

<i>Private Industries</i>	<i>Public Sector/Autonomous Undertakings</i>
K. C. P. Ltd., Madras.	Madras Atomic Power Project
English Electric Co. Ltd., Madras.	National Buildings Organisation Neyveli Lignite Corporation

<i>Private Industries</i>	<i>Public Sector/Autonomous Undertakings</i>
Ashok Leyland Ltd., Madras.	Defence Metallurgical Laboratory, Hyderabad
India Cements Ltd., Madras.	
India Pistons Ltd., Madras.	Heavy Vehicles Factory, Avadi
E.I.D.-Parry Ltd., Madras.	Research, Design & Standards Organization, Lucknow
Metal Box Co. Ltd., Madras.	
Easun Engineering Co., Madras.	Indian Standards Institution
Binny's Engineering Works, Madras.	Structural Engineering Research Centre
	Integral Coach Factory, Madras
Best & Co., Madras.	Central Leather Research Institute
Shaw Wallace & Co., Madras.	Madras Fertilizers Ltd.
	Space Science & Technology Centre, Trivandrum
	N.M.L. Foundry Station, Madras
	Bharat Heavy Electricals, Trichy & Bhopal
	Southern Railways
	Surgical Instruments Plant, Madras
	Central Electro-Chemical Research Institute, Karaikudi

3. Sponsored Research Schemes / Projects :

The Institute has currently a good number of sponsored Research schemes/projects financed by organizations like C.S.I.R., Defence Ministry, Department of Atomic Energy, Space Science and Technology Centre, American Chemical Society etc. A list of such schemes is given below :

Department of Aeronautical Engineering

1. Design and development of an Air Heater for the Space Science and Technology Centre, Trivandrum.

Department of Chemistry

A. C. S. I. R. Schemes :

1. Catalytic Alkylation of Phenoles
(Principal Investigator : Dr. C. N. Pillai)

2. Mechanistic studies on the activities of semi-conductor oxide catalysts—(Principal Investigator : Dr. J. C. Kuriacose)
3. Studies on Photo-Chemistry of aromatic hydrocarbons (Principal Investigator: Dr. V. Ramakrishnan)
4. Hydride Transfer reactions (Principal Investigator: Dr. C. N. Pillai)
5. Mechanisms of Photo-chemical reactions involving triplet states (Principal Investigator: Dr. V. Ramakrishnan)

B. American Chemical Society-Petroleum Research Fund

1. Catalysis on oxide catalysts (Dr. M. V. C. Sastri)

C. Bristol Laboratories, New York:

Research work on compounds synthesised for physiological activity (Dr. S. R. Ramadas)

D. P. L. 480 :

1. Study of Transition metal oxides with special reference to their catalytic properties (Dr. M. V. C. Sastri and Dr. V. Srinivasan)
2. The use of platinum metal complexes as catalysts in homogeneous hydrogenation (Dr. M. M. Taqui Khan, Visiting Professor)

Department of Chemical Engineering

C.S.I. R. Scheme :

Investigation on promotion of dropwise condensation of steams (Principal Investigator : Dr. T. Venkatram)

Department of Civil Engineering

C. S. I. R. Schemes :

1. Bond resistance of deformed bars made in India (Principal Investigator: Dr. D. J. Victor)
2. Study on underwater concrete (Principal Investigator : Dr. P. C. Varghese)

3. Behaviour of concrete flexural members reinforced with Indian deformed steels (Principal Investigator : Dr. P. Srinivasa Rao)
4. Experimental studies on flow around bends in open channel (Principal Investigator : Dr. V. Sethuraman)
5. Investigation on rockfill dams for through and overflow (Principal Investigator : Dr. V. Sethuraman)

Department of Electrical Engineering

A. C. S. I. R. Schemes :

1. Studies of radio-wave absorption in the lower ionosphere at Madras (Principal Investigator: Dr. M. Mukunda Rao)
2. A fast acting excitation controller for alternators in power stations (Principal Investigator : Dr. A. Kuppurajulu)

B. Department of Atomic Energy - Government of India :

Design and construction of a demonstration digital computer
(Principal Investigator : Shri S. Raman)

Department of Mathematics

Department of Atomic Energy - Government of India :

Invariant tensor properties of crystalline materials (Dr. S. D. Nigam)

Department of Mechanical Engineering

C. S. I. R. Schemes :

1. Investigations on crankshaft vibrations and development of vibration dampers for I. C. Engines (Principal Investigator : Dr. B. S. Murthy)
2. Investigation on the concentration of the unburnt hydrocarbons in closed vessel combustion (Principal Investigator : Dr. M.C. Gupta)

*Department of Physics***A. Ministry of Defence :**

Fabrication of microwave test bench especially Klystron
(Principal Investigator : Dr. J. Sobhanadri)

B. C. S. I. R. Scheme :

Studies on nuclear quadrupole resonance in certain ionic crystal
containing chlorine (Principal Investigator : Dr. J. Sobhanadri)

4. Union Catalogue of Periodicals :

This Institute has undertaken the responsibility to prepare a Union Catalogue of all Periodicals subscribed for by the five IITs and the IISc, Bangalore. The Librarian of this Institute has already obtained necessary information from these Institutions and it is hoped that the catalogue will be ready by the middle of next year.

5. Design and fabrication of laboratory apparatus and equipment :

A brochure furnishing information regarding equipments, transducers-instruments and apparatus that have been designed and fabricated in the several Departments of this Institute has already been brought out and circulated, and this has stimulated interest among the scientific and technical equipment industry.

A photographic exhibit of all items designed, developed and fabricated by the various Departments of this Institute was organised. The members of the Reviewing Committee were shown round this photographic exhibition; along with this exhibition some of the instruments, transducers and apparatus developed were also exhibited.

6. Responsibilities of I. I. Ts. in improving engineering education—Faculty development, Curriculum development, In-service training, Summer Institutes, Short term courses etc. :

A. The Institute conducted the following programmes for faculty development of Engineering College teachers :

i) Short course on Instrumentation

– December 1969

- ii) Refresher course on S.I. Units - December 1969
- iii) Advanced Summer School in Measurement Techniques in Mechanical Engineering - June 1970
- iv) Sequential Summer Schools in
 - a) Civil Engineering
 - b) Electrical Engineering and
 - c) Mechanical Engineering
 } Summer 1970

B. The Institute also conducted the following programmes for Industries.

- i) Short-term course in Basic Chemical Engineering - December 1969
- ii) Seminar on problems of pre-stressing - Jan-Feb. 1970
- iii) Refresher course on Metrology - February 1970
- iv) Short-term course in Particle Size
 - Analysis I - March 1970
 - do Analysis II - July 1970
- v) Seminar on foundation problems in and around Madras - May 1970
- vi) Refresher course for Senior Executives in Pulp & Paper Technology - May 1970

As envisaged in the above schemes, this Institute has taken the responsibility for organising in-service training for serving teachers. The first programme on fluid mechanics is expected to commence in November 1970 for Engineering college teachers.

It is proposed to admit 12 serving teachers in Engineering Colleges for the Master's Degree programme and 6 for the Ph.D. programme in the academic year 1970-71. A curriculum development centre will be established during 1970-71 in Mechanical Engineering and another will be set up for Chemical Engineering in 1971-72.

7. Exchange of Professors between I.I.T. and West Germany.

This Institute has already, under an Agreement with the Government of the Federal Republic of Germany, a Faculty Exchange Programme. Under this Programme eminent Professors from the Technical Universities and Institutions in West Germany visit this Institute on short-term basis and

similarly senior Faculty Members from this Institute visit the Technical Universities and Institutions including industrial establishments in West Germany for short duration.

Eleven members of staff were deputed to West Germany under the Long term programme and 7 members of staff were deputed under the Short-term programme. The Director of the Institute visited the Universities and Industrial Establishments in West Germany in September-October 1969. 7 Professors from West Germany visited the Institute for short periods.

IV. AID UNDER INDO-GERMAN AGREEMENT

The Second Indo-German Agreement which was signed in June 1966 for the continuance of the aid for a further period of 5 years has helped in consolidating and intensifying of work in the 20 established laboratories under the First Indo-German Agreement. 5 new laboratories are getting aid under the Second Indo-German Agreement. Senior Indian members of the staff who have been trained as Counter-parts for the German experts have been gradually taking over the laboratories after the completion of the assignment of the German experts in the Institute.

Gift equipment from West Germany to the value of about Rs. 3.3 crores has been received by the Institute so far. Gift books to the value of about Rs. 4.7 lakhs have also been received. Equipment received during the year is for about Rs. 75 lakhs and books received during the year are for about Rs. 2 lakhs.

V. DEVELOPMENTS DURING THE YEAR AS PER PRIORITIES IN THE FOURTH PLAN

(A) New Courses of Instruction :

- (1) M.Tech. in Chemical Engineering with the following new electives:
 - (i) High Polymer Engineering
 - (ii) Process Dynamics and Control.

(B) Setting up of special facilities and services.

- (i) The Mass Spectrometer has been installed and commissioned.
- (ii) The electron microscope is being installed.

- (iii) Initial work for organising an Electronic Instruments, Servicing centre has been done.

(C) The work in the new laboratories in Physics has made good progress.

VI. RESEARCH WORK AND ALLIED ACTIVITIES :

The promotion of research work has been one of the major endeavours of all the Departments of the Institute. Besides full time scholars, junior faculty members are enrolled in programmes of work leading to the award of the Ph.D. degree. During the year under review, 20 scholars qualified for the Ph.D. degree, bringing the total number of recipients to 64 over the last six years.

A publication summarising the research and allied activities of the Departments and award of Doctorate degrees was placed before the Council.

The research work and allied activities of the several Departments in a summarised form are given in Annexure 'A' to this report.

VII. PUBLICATIONS AND RESEARCH PAPERS :

The Journal of Mathematical and Physical Sciences whose first number was released in November 1967 is being brought out regularly as scheduled. As envisaged, this Journal is proving to be a first-class publication medium in India for research papers of high calibre.

Shri. S. Ramani (Assistant Professor, Industrial Engineering), Dr. N. V. Koteswara Rao (Associate Lecturer, Mathematics Department) and Shri R. Nagarajan (Lecturer, Chemical Engineering Department) have published in June, 1970 the book entitled "Computer Programming with Industrial and Engineering Applications".

209 papers covering investigations carried out in Science and Engineering Departments were published during the year. 103 papers have been accepted for publication and 68 papers were presented at Conferences/Seminars.

VIII. PROGRESS UNDER 'CONSTRUCTION' :

During the year, the following buildings were completed.

I. *Instructional Buildings and Workshops :*

1. Machine Elements and Mechanical Handling Laboratory.
2. Hydraulics Laboratory
3. Electron Microscope Laboratory
4. Reprographic Section of Library
5. Special Instruments Laboratory (Central Services Unit)

II. *Residential Buildings :*

1. C1 type (V phase) quarters ... 2 blocks (12 Nos.)
2. D type (V phase) quarters ... 2 blocks (12 Nos.)
3. E1 type (V phase) quarters ... 3 blocks (18 Nos.)

Applied Chemistry Block is under construction and is expected to be completed in 1971-72.

The following works are being taken up in 1970-71 :-

I. *Instructional Buildings and Workshops :*

1. Improvements to Central Lecture Theatre
2. Central Electronic Instruments Servicing Centre.
(Central Services Unit)
3. Workshop type laboratory

II. *Residential Buildings :*

1. E type (VI phase) quarters ... 2 blocks (12 Nos.)
2. D type (VI phase) quarters ... 1 block (6 Nos.)

III. Miscellaneous Buildings :**1. Students' Activity Centre**

In the matter of quarters for the staff of the Institute, only less than 40 per cent of the staff have been provided with residential accommodation inside the campus. As has already been pointed out, this Institute is at a great disadvantage in this respect compared with other sister I.I.Ts.

IX. PATTERN OF EXPENDITURE :

During the year 1969-70 the Institute could avail of practically all the funds budgetted and projected for. A functional analysis of the expenditure in 1969-70 has been attempted.

The statement below gives the analysis for the year 1969-70 under :

1. Recurring - Pay and Allowances
2. Recurring - Departmental Expenses and other expenses including scholarships
3. Total Recurring expenses.
4. Non-Recurring - Equipments etc.
(Non-Recurring - Buildings - has not been included)
5. Total Recurring and Non-Recurring expenses.

ACTUALS—RECURRING AND NON-RECURRING EXPENDITURE 1969—70

(Rupees in thousands) (percentages of expenditure indicated within brackets)

S. No.	Head of Account	Departments Amount	Library Amount	Central Services Amount	Scholarships Amount	Other Academic provisions Amount	Faculty Development Amount	Co. curricular Activities Amount	Univ. Functions Amount	Services mnce & Amenities Amount	Indo-German Agreement Amount	Other Genl. Provisions Amount	Administration Amount	TOTAL Amount
1.	Recurring-pay and Allowances	4700.8 (66.1%)	200.3 (2.8%)	788.1 (11.1%)				42.0 (0.6%)		316.0 (4.4%)	1066.3 (15%)		7113.5	
2.	Recurring-Depart- mental expenses	996.8 (16%)	525.6 (8.5%)	177.9 (2.9%)	1267.7 (20.4%)	71.8 (1.1%)	10.3 (0.2%)	120.2 (1.9%)	181.0 (2.9%)	1814.5 (29.2%)	615.3 (9.8%)	24.1 (0.4%)	416.2 (6.7%)	6221.4
3.	Total Recurring expenses	5697.6 (42.7%)	725.9 (5.4%)	966.9 (7.2%)	1267.7 (9.5%)	71.8 (0.5%)	10.3 (0.1%)	162.2 (1.2%)	181.0 (1.5%)	2130.5 (16%)	615.3 (4.6%)	24.1 (.2%)	1482.5 (11.1%)	13334.9
4.	Non-Recurring (Equipments etc.)	2001.3 (89.1%)	23.6 (1.1%)	124.2 (5.5%)						69.5 (3.1%)			26.8 (1.2%)	2245.4
5.	Total-Recurring and Non-Recur- ring	7698.9 (49.4%)	749.5 (4.8%)	1090.20 (7%)	1267.7 (8%)	7.8 (0.5%)	10.3 (0.1%)	162.2 (1.2%)	181.0 (1%)	2200.0 (14%)	615.3 (4%)	24.1 (0.2%)	1509.3 (9.8%)	15580.3

III. *Miscellaneous Buildings* :

1. Students' Activity Centre

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3. Total Recurring expenses.
4. Non-Recurring - Equipments etc.
(Non-Recurring - Buildings - has not been included)
5. Total Recurring and Non-Recurring expenses.

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(Rupees in thousands) (percentages of expenditure indicated within brackets)

S. No.	Head of Account	Departments Amount	Library Amount	Central Services Amount	Scholarships Amount	Other Acade- mic Provisions Amount	Faculty Development Amount	Co. curricular Activities Amount	Univ. Functions Amount	Services mtee & Amenities Amount	Indo-German Agreement Amount	Other Genl. Provisions Amount	Administration Amount	TOTAL Amount
1.	Recurring-pay and Allowances	4700.8 (66.1%)	200.3 (2.8%)	788.1 (11.1%)				42.0 (0.6%)	316.0 (4.4%)	1066.3 (15%)			7113.5	
2.	Recurring-Depart- mental expenses	996.8 (16%)	525.6 (8.5%)	177.9 (2.9%)	1267.7 (20.4%)	71.8 (1.1%)	10.3 (0.2%)	120.2 (1.9%)	181.0 (2.9%)	1814.5 (29.2%)	615.3 (9.8%)	24.1 (0.4%)	416.2 (6.7%)	6221.4
3.	Total Recurring expenses	5697.6 (42.7%)	725.9 (5.4%)	966.9 (7.2%)	1267.7 (9.5%)	71.8 (0.5%)	10.3 (0.1%)	162.2 (1.2%)	181.0 (1.5%)	2130.5 (16%)	615.3 (4.6%)	24.1 (.2%)	1482.5 (11.1%)	13334.9
4.	Non-Recurring (Equipments etc.)	2001.3 (89.1%)	23.6 (1.1%)	124.2 (5.5%)						69.5 (3.1%)			26.8 (1.2%)	2245.4
5.	Total-Recurring and Non-Recur- ring	7698.9 (49.4%)	749.5 (4.8%)	1090.20 (7%)	1267.7 (8%)	7.8 (0.5%)	10.3 (0.1%)	162.2 (1.2%)	181.0 (1%)	2200.0 (14%)	615.3 (4%)	24.1 (0.2%)	1509.3 (9.8%)	15580.3

X. STAFF :

During the year under review, the Institute had the privilege of welcoming German staff members, assigned to the Institute under the Second Indo - German Agreement, as detailed below :-

1. Professors	: 5
2. Associate Professors	: 2
3. Senior Scientific Assistant	: 1

The following number of German staff members left for West Germany on completion of their assignments :

1. Professors	: 2
2. Associate Professor	: 1
3. Assistant Professor	: 1
4. Senior Scientific Assistants	: 5
5. Technical staff member	: 1

During the year, 6 Professors, 5 Associate Professors, 13 Assistant Professors, 12 Lecturers and 23 Associate Lecturers were appointed. These include the appointment of 6 Senior Technical Assistants as Associate Lecturers, 7 Associate Lecturers as Lecturers, 9 Lecturers as Assistant Professors, 5 Assistant Professors as Associate Professors, 13 Associate Professors as Professors. 2 Assistant Professors, 4 Lecturers and 7 Associate Lecturers resigned.

XI. REVIEWING COMMITTEE :

In exercise of the powers vested in him under Sub-Section (2) of Section 9 of the Institutes of Technology Act (59 of 1961), the President of India, in his capacity as the Visitor of the Institute, has appointed a Reviewing Committee to review the working of the Indian Institute of Technology, Madras, with the composition and terms of reference as below.

Composition

- | | | |
|----|--|-----------|
| 1. | Dr. P. L. Bhatnagar,
Vice-Chancellor,
Rajasthan University,
Jaipur. | Chairman |
| 2. | Dr. G. S. Laddha,
Director,
A. C. College of Technology,
Guindy, Madras. | Member |
| 3. | Shri G. R. Damodaran,
Principal,
P.S.G. College of Technology,
Coimbatore. | Member |
| 4. | Prof. G. S. Ramaswamy,
Director,
Structural Engineering Research
Centre, Roorkee. | Member |
| 5. | Shri M. V. Arunachalam,
Tiam House,
11/12, North Beach Road,
Madras. | Member |
| 6. | Shri M. S. Srinivasan,
Assistant Educational Adviser (T), S. R. O.,
Ministry of Education & Youth Services,
Madras. | Secretary |

Terms of Reference

- (a) To review the present progress of the Institute of Technology in the fulfilment of its broad objective as a Centre of Advanced studies and research in science, engineering and technology ;
- (b) To examine how far the Institute has inter-acted with other technical institutes with particular reference to courses of study, programmes of research and faculty development ;
- (c) To assess the overall impact of the Institute on the training of high grade engineers for the technological development of the country ;
- (d) To recommend the lines along which the Institute should be further developed for advanced studies and research, taking into account the developments that have taken place or are projected at the other Institutes of Technology and the Indian Institute of Science, Bangalore and
- (e) To report on any other aspect or aspects that are relevant to the overall functioning of the Institute.

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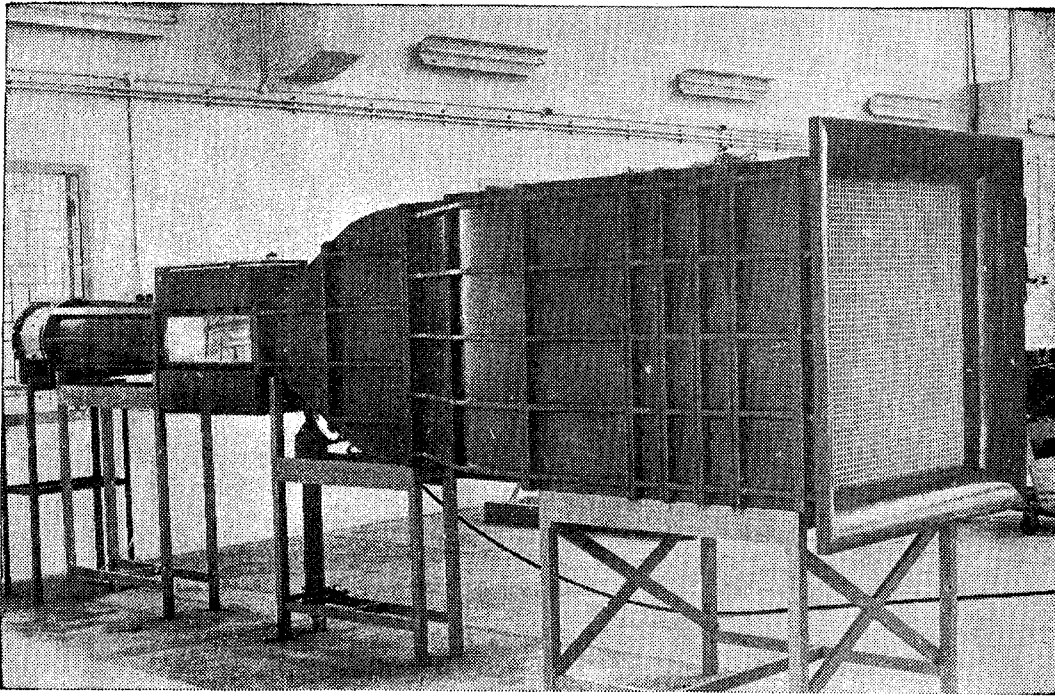
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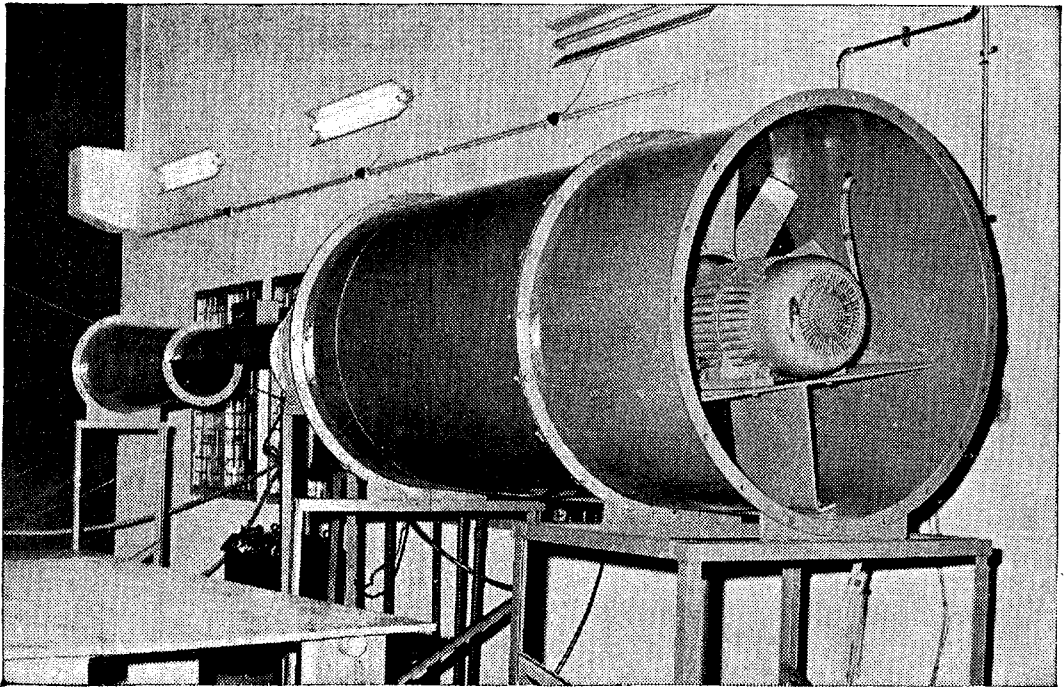
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SMOKE TUNNEL
(Department of Aeronautical Engineering)



AXI-SYMMETRIC SUBSONIC TUNNEL
(Department of Aeronautical Engineering)

ANNEXURE A

AERONAUTICAL ENGINEERING

The first batch of 10 M. Tech (Aero.) students with specialisation in the areas of Structural Mechanics, Aerodynamics or Propulsion are graduating in July 1970. The current developmental and research programmes in these areas are given below :

Developmental Programmes

Reasonable progress has been made both in Aerodynamics and Propulsion laboratories. Fabrication of Smoke Tunnel is complete. Fabrication of the Blow-down Supersonic Tunnel is expected to be completed shortly and the work on the Induction Tunnel has been taken up.

Most of the developmental projects for the propulsion laboratory such as the liquid and solid propellant rockets, subsonic ramjet, strand burner, supersonic combusting rig etc., are almost complete and are expected to be in operation shortly.

The work on Structures Laboratory has been completed. There are now thirtysix experimental set-ups of which 13 are on experimental stress analysis, 15 on beams, 5 on buckling of structures and the rest on general structural engineering.

Research work

(a) Structural Mechanics :

In collaboration with the Elasticity and Vibration Sections of Applied Mechanics Department, a volume entitled "Studies in Structural Mechanics" is expected to be ready by September 1970. The problem areas of active interest are: Filament Wound structures, Elastic and plastic stress analysis of plates and shells, Vibration of orthotropic shells, Thermal stress analysis, Creep stress analysis, thermal buckling, experimental and theoretical investigation of grid works, Composite beams, Orthotropic materials, Non-linear vibrations of beams, plates and shells, Elastic stability of conservative and non-conservative systems.

(b) Aerodynamics :

Stability problems of superposed fluids; Boundary layer stability-Non-linear problems in aerodynamics, Hypersonic flows;

(c) Propulsion :

Supersonic combustion, Solid and liquid propellant rockets, After-burning rockets, Ramjets and Scramjets.

APPLIED MECHANICS

During the year under review, the Department of Aeronautics and Applied Mechanics was divided into two separate Departments. The Department of Applied Mechanics made good progress in all the three areas viz. teaching, research and industrial liaison.

The first batch of 6 M. Tech. students in Engineering Mechanics graduated in August 1969 and all of them have found placements either in India or abroad. A new proposal for a M. Tech. programme in Mechanical Engineering with Machine Dynamics as the field of specialisation has been outlined. A number of undergraduate courses offered by this Department were changed to suit the new semester pattern. Currently 8 full time and 14 part-time students are working for their Ph. D. degree in this Department.

Research work :

The research work done by the Solid Mechanics section was mainly concerned with Stress Analysis and Vibration problems connected with Skew Plates, Grids, Single and Continuous Span Bridges, Conical Shells, Sandwich Structures, Spherical Shells, Ellipsoidal Shells, Rings, Composite Shells, Swept Back Aircraft Wings, Some Experimental Studies on Photo-plasticity and Random Vibration Studies on Elastic Structures. Theoretical and experimental works was continued in the fields of Rotor Dynamics, Instabilities of Rotors due to Oilfilm Action etc.

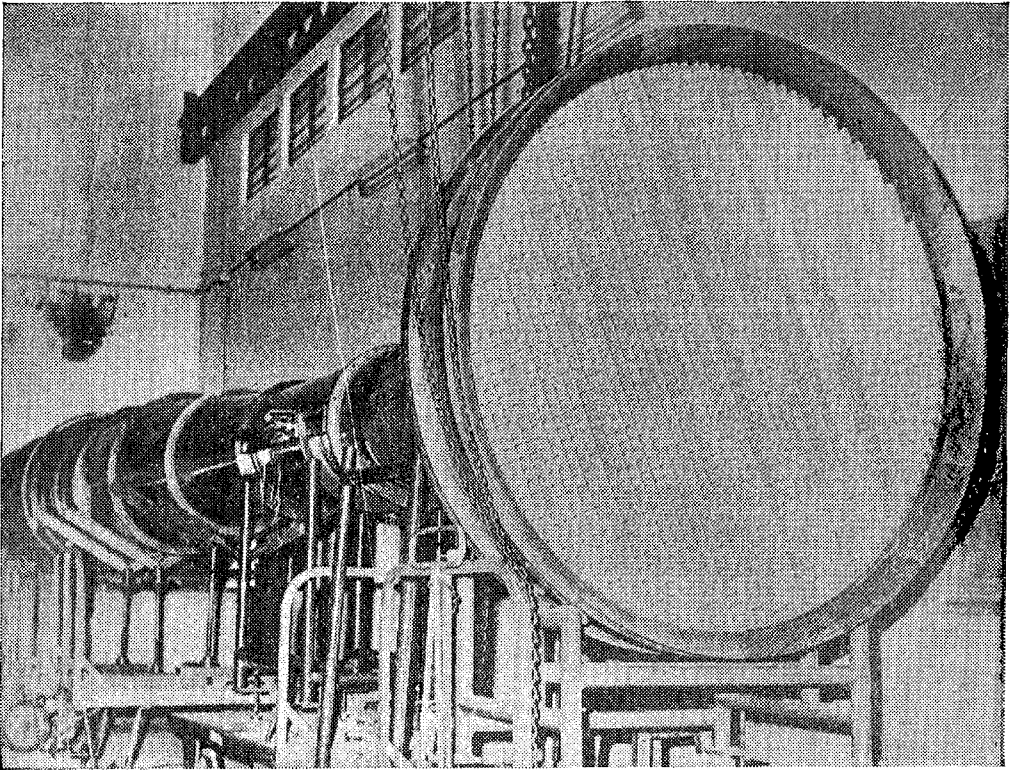
In the Fluid Mechanics section the projects were mainly concerned with the experimental and theoretical investigation of Incompressible-Turbulent Boundary Layer on a Flat Plate, Rotating Spheres, Nozzles and Diffusers. Work was also carried out on Swept Back Wings in Subsonic Flow, Aerodynamic Interference between Fuselage and Nacelles in the case of Rear-mounted Engines and Three-dimensional Turbulent Boundary Layers.

Design and Development :

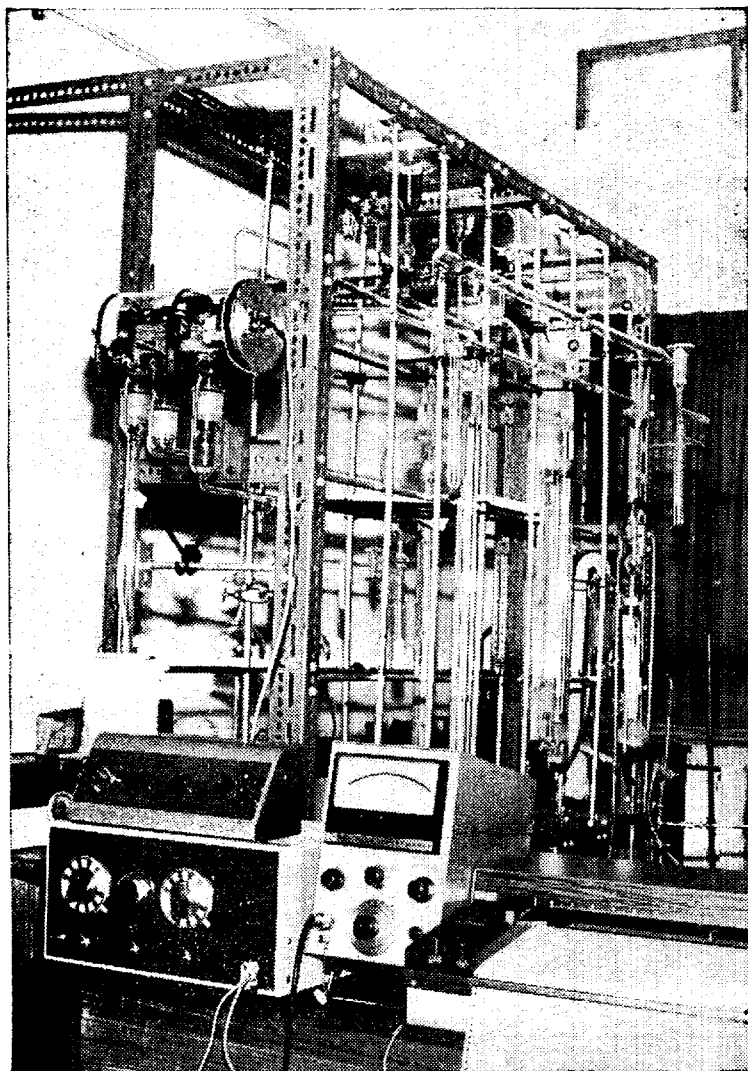
The following units were designed and developed in the various laboratories attached to this Department :

Biaxial Loading Frame, Combined, Tension-Torsion and Compression-Torsion Testing Machines, Winkler's Test set-up, Shock and Bump Testing Machine, Rotating Sphere Equipment and Hot Wire Probe.

The Wind Tunnel erection work including the calibration of the Six component Balance was completed.



DIFFUSER TEST BENCH
(Applied Mechanics)



VAPOUR ADSORPTION STUDIES ON SOLIDS BY
VACUUM MICROGRAVIMETRY
(Chemistry)

CHEMISTRY

Research Work

The Department was engaged in research in the following fields:

I. Heterogeneous Catalysis

1. Studies on reduction of iron oxide
2. The role of electronic and structural factors on the activity of ZnO MoO₃ catalyst
3. Studies on MoO₃ catalyst
4. Adsorption of binary gas mixtures on cobalt Fischer - Tropsch Catalys
5. Gravimetric adsorption studies
6. Adsorption studies by gas chromatographic method
7. Studies on the role of supports in mixed oxide catalysts
8. Hydrogen transfer reactions catalysed by alumina
9. The effect of alkali metal and amine poisoning on the activity and selectivity of alumina
10. Mechanistic studies on the activity of semi-conductor oxide catalysts

II. Chemical Kinetics and Homogeneous Catalysis

1. Mechanistic studies on catalyed substitution of aromatic compounds
2. Studies in the liquid phase halogenation of aromatic substrates
3. Homogeneous catalysis by metal complexes
4. Mechanistic studies of fast reactions by relaxation techniques
5. Studies in polymer chemistry

III. Photochemistry :

1. Mechanisms of photochemical reactions involving triplet states
2. Studies on photochemistry of aromatic hydrocarbons

IV. Electrochemistry

1. Inhibition studies of electrode reactions using polarography
2. Electrochemical reduction of oxygen and hydrogen peroxide in presence of surfactants.

V. Organic Chemistry

1. Carbonyl condensation reactions and decarboxylation of carboxylic acids catalysed by alumina.
2. Stereochemistry of the dehydration of alcohols over alumina
3. Hydrogen transfer reactions catalysed by Raney nickel
4. Studies on the synthesis of oxa-steroids.
5. Studies on the condensation of anisole with butyrolactone.

VI. Inorganic Chemistry :**a) Solid State Chemistry**

1. Thermal decomposition studies
 - . Kinetics of thermal decomposition of solids
3. Studies on Calcite
4. Solid state studies on uranium, chromium and thallium compounds
5. Decomposition of chromates

b) Co-ordination Chemistry

1. Chemistry of selenium and tellurium
2. Complexes of nitroquinoline and syn-di-6-quinoly-thiourea

3. Metal chelates of monosubstituted purines
4. Mixed-ligand-chelates of rare earth ions with EDTA and triphosphate
5. Interaction of tertiary phosphine, arsine, stilbine and bismuthine complexes of (RuII) with molecular oxygen
6. Metal chelates of thiamine and thiamine monophosphate
7. Metal complexes of riboflavine.

c) Analytical Chemistry

1. Analytical applications of Indo-oxine
2. Development of new analytical methods in inorganic analysis

VII. Nuclear Chemistry

Trace element analysis of biological materials by neutron activation analysis

VIII. Theoretical Chemistry

Force field calculations and normal co-ordinate analysis

During the period under review, twenty-two full time and six part-time research scholars (staff members) were working for Ph.D. Three had completed their Ph.D. programmes.

New constructions :

The construction of new Applied Chemistry Building has been taken up during the year and is making rapid progress.

CHEMICAL ENGINEERING

The Department of Chemical Engineering is active in the fields of research, collaboration with Indian Industry and assistance to other technical institutions, in addition to the teaching activities at undergraduate and post-graduate level.

In view of the spectacular developments in Chemical Engineering and related fields in industrially advanced countries, and the rising tempo of development of industries in our country, considerable changes were incorporated in the Curriculum of undergraduate and graduate studies. Subjects like Process Engineering and Process Control were introduced for

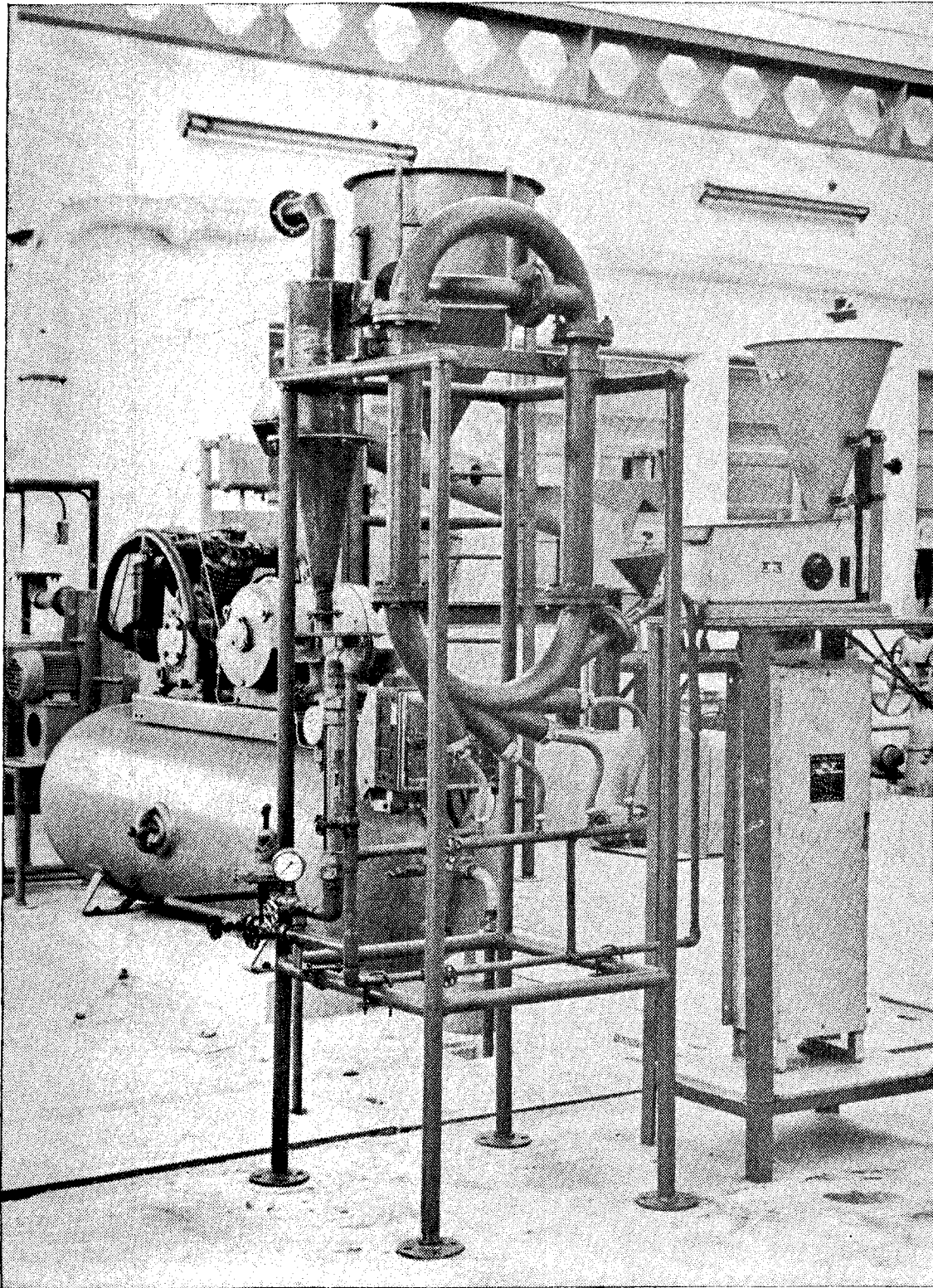
the B. Tech course. High Polymer Engineering has been started as an elective in the M.Tech Course. This course along with the one-year post-graduate diploma course in Chemical Engineering Practice, is aimed at bridging the Institute and the Industry closer to each other. This necessitated and led to close and fruitful collaboration between different disciplines in the Institute and with the Industries.

Three scholars were awarded the Ph. D. degree in Chemical Engineering for their theses on 'Packing Characteristics and Compaction of Solids', 'Granulation of fertilisers' and 'Beneficiation of Ores and Minerals'. Three more scholars submitted their theses for Ph. D. degree and are awaiting the reports. Currently thirteen scholars including staff members are working for the Ph. D. degree and six students are working for the M.S. degree in Chemical Engineering. 19 students and three technical teacher trainees qualified for the M. Tech degree, five students for the D.I.I.T., and 50 students for the B. Tech. degree. One of the students of the 5 year B.Tech. course, Shri R. Mutharasan has been awarded the second prize by the Acharya P.C. Ray Award Assessment Committee of the Indian Institute of Chemical Engineers for his project work on 'Production of Ammonia Synthesis gas by Steam Reforming naphtha, from among the project reports submitted from different Universities all over India.

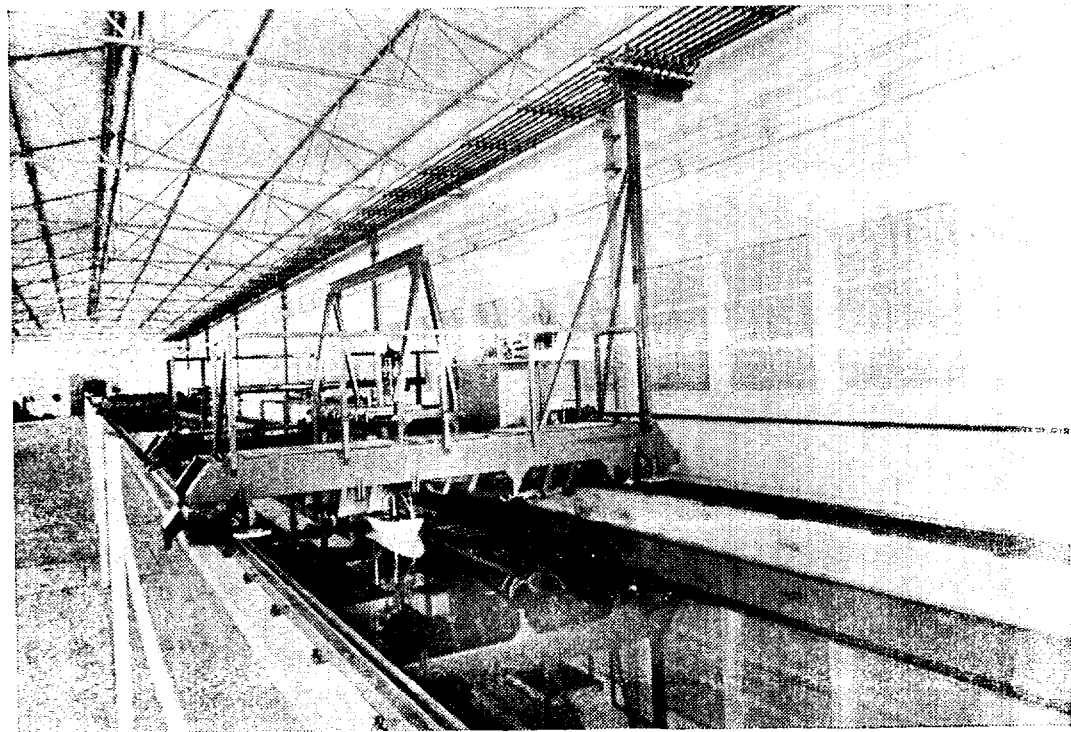
Research work :

The research activities of the department include (1) Compaction of solids (2) granulation and agglomeration of solids (3) size reduction of solids (4) mechanical separations (5) flow characteristics of solids (6) Mixing of Solids (7) mineral processing (8) non-Newtonian fluids (9) gas-liquid systems (10) fluid-solid systems (11) heat transfer and evaporation (12) mass transfer (13) equilibria studies and kinetics (14) chemical technology and (15) instruments and process control. Over 30 technical papers were published in reputed journals in India and abroad.

Dr. D. Venkateswarlu, Professor and Head of the Department has been chosen for the editorial board of 'The Chemical Engineering Journal' (London). Shri R. Nagarajan, of the Department was the co-author of the book, 'Computer Programming with Industrial and Engineering Applications' published by the M.M.C. School of Management, Bombay.



FLUID ENERGY MILL
(Chemical Engineering)



TOWING TROLLEY
(Civil Engineering)

Development Work :

A process for grinding waste mica to micron size range, without losing the lustre, for use as pigment and filter has been developed by Dr. M. Ramanujam and Dr. D. Venkateswarlu. Shri C. Sivaprasad Rao developed a process for producing thin layer chromatographic grade silica gel from superphosphate plants waste.

During the period under review, a set of test stands were received from West Germany for the Process Control Laboratory. A pilot-plant fermenter was the new addition to the Heat and Mass Transfer Laboratory.

CIVIL ENGINEERING

During the year the Department continued to offer courses leading to the B. Tech., M. Tech., and M. S. degrees in Civil Engineering. The number of students in the B. Tech. (Civil) was 110 and 35 in the M. Tech. (in the 3 branches). In addition, 2 scholars are working for the M. S. and 25 including part-time for the Ph. D. with various specialisations. At the end of the year, 21 were awarded the B. Tech., 20 M. Tech., and 2 the Ph. D. degrees.

The M. Tech. curricula for all the three branches, viz. Hydraulic Engineering, Soil Mechanics and Foundation Engineering and Structural Engineering, were thoroughly reviewed and recast for introduction from the session, 1970-71.

The Towing Tank in the Hydraulic Engineering Laboratory started functioning for the testing of ship models and calibration of meters. The Structural Engineering Laboratory building was completed and occupied. The machine foundation work is being carried out.

Research work :

In addition to the faculty research programme, the department had undertaken several projects for research sponsored by the outside agencies like the C. S. I. R., the N. B. O. etc.

The Sequential Summer School in Civil Engineering commenced in the Department in 1968-69, was continued, in the three branches of Civil Engineering viz. Hydraulic Engineering, Soil Mechanics and Structural Engineering.

ELECTRICAL ENGINEERING

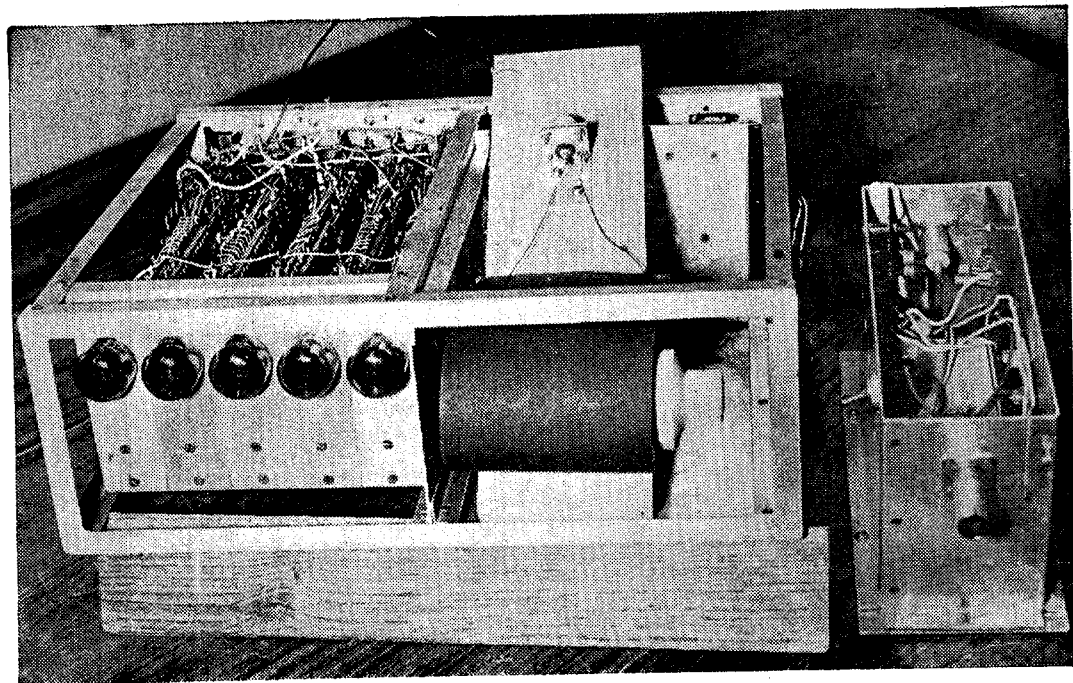
During the year under review, 93 students of the Department qualified for the B. Tech. degree and 23 students for the M. Tech. degree. One candidate was awarded the Ph. D. degree based on his thesis in the area of Linear Graph Theory applied to Electrical Networks.

In the context of diversification of courses and curriculum development, two new specializations for the M. Tech. degree, namely Radar Technology and Electric Traction and Drives were introduced during the year, bringing the total number of M. Tech. specialisations offered by the Department to six. The Department had also taken preliminary steps towards the starting of new specialisations of Control Engineering for the B. Tech. degree and of Computer Sciences for the M. Tech. degree.

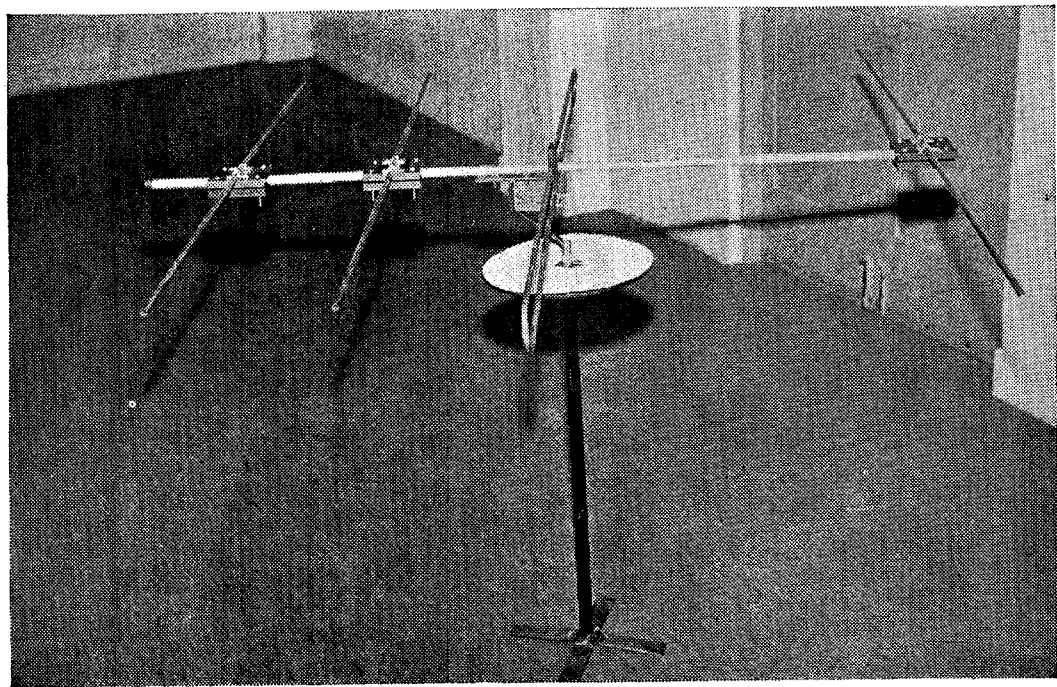
Research Work :

Research activity in the Department has maintained its growth in variety and volume. During the year about forty research papers from the Department were published in important technical journals in India and abroad, while some thirty more papers were accepted for later publications. The faculty members had also presented 17 papers at technical conferences. These included 8 papers presented at various International Conferences and Symposia, embodying significant new results in the areas of Signal detection, Networks, Speed changing induction motors and Power system stability and Instrumentation. The CSIR schemes, one on 'Fast response excitation controller for alternators' and the other on 'Radio wave absorption in lower ionosphere above Madras' had been initiated.

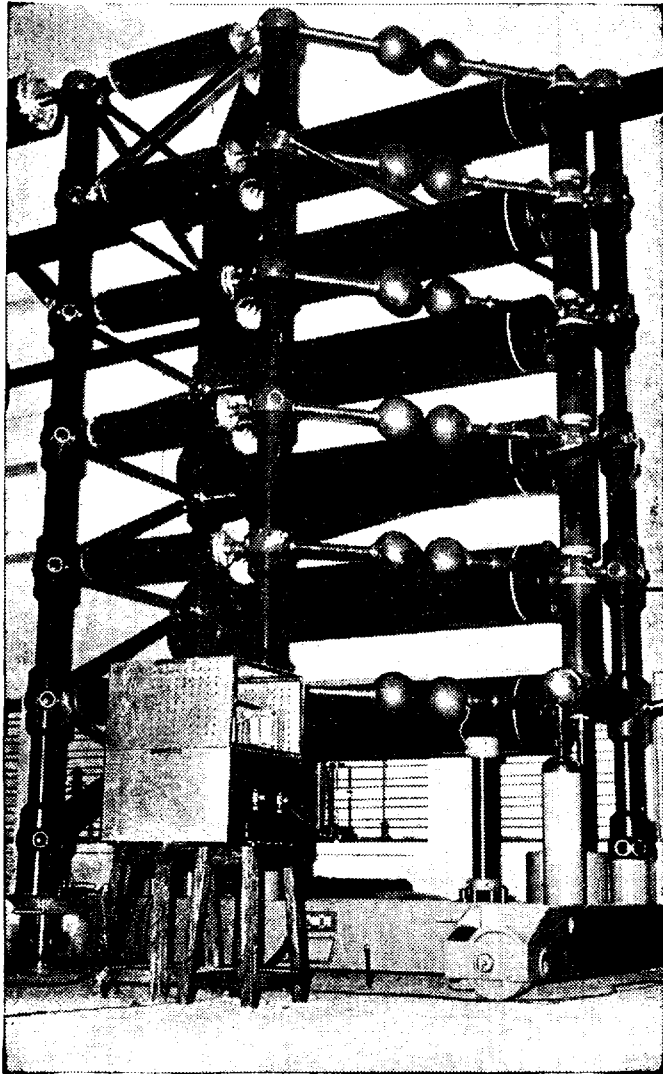
In continuation of the programme of faculty and laboratory development, three more members of staff went on deputation to West Germany. Two staff members of the Electronics and Communication Engineering section of the Department returned to their posts after completing their programmes at the Technical University of Aachen. Two more senior staff members from West Germany, Prof. Rutloh and Prof. Holtz arrived during the year and have been helping in the setting up and expansion of the Power systems and control Engineering laboratories respectively. Towards the end of the year, the Head of the Department paid a short visit to West Germany to study the salient features of electrical engineering education in that country and its relation to the electrical industries. He



PROTON MAGNETOMETER
(Electrical Engineering)



UHF TV ANTENNA
(Electrical Engineering)



TRIGGER GENERATOR
(Electrical Engineering)

also took the opportunity of visiting some leading schools in England and Scotland. Significant progress in laboratory development has been achieved during the year particularly in the Control Engineering Laboratory and the High Voltage Laboratory. An electronics and electrical instrument servicing centre has also been developed as a common facility for the whole Institute.

As part of the National Programme of providing continuing education opportunities, the Department has been running a sequential summer school for engineering teachers. The second summer of the sequence of three was completed this year.

HUMANITIES AND SOCIAL SCIENCES

Research work :

The fields in which research was going on during the year were Demography, Economic History, Statistics and Industrial Engineering. Two of the staff members will shortly complete their theses for the Ph.D. degree: one in Demography and the other in Economic History.

Sri V. S. N. Sarma has published in collaboration with Dr. N. Klein and Sri H. Sohre a translation into English of the German book 'Fundamentals of Electrical Engineering; Vol. 1. Sri S. Ramani in collaboration with Dr. N. V. Koteswara Rao and Sri R. Nagarajan of the Mathematics and Chemical Engineering Departments, respectively had published a book called 'Computer programming with Industrial and Engineering applications'.

A number of research papers had been submitted for publication. Seven papers were published or presented at various conferences and four had been submitted for publication.

Management Games :

"MMA Computerised Management Game". The game has been repeated seven times for various groups of Senior Executives from Industry and Government (S. Ramani and B. Vasudeva and MMA Games Panel). "Materials Management and Warehouse Distribution Game"—Non-computer game developed and adapted at I.I.T. Madras (S. Ramani and B. Vasudeva).

The Department had also helped Messrs. Sundaram Motors Private Ltd, Madras-6, in the formulation of psychological tests for the selection of skilled workers.

The Department, with a view to encouraging the objective of liaison with industry, had arranged lectures by prominent executives in industry for the benefit of the post-graduate students in Industrial Management and Industrial Engineering. Twenty prominent industrial executives participated in this programme.

Besides this, the Department had been deputing the post-graduate students to various industries for practical training in various fields covered by the post-graduate courses. Fourteen industries were covered in this scheme and the I year M.Tech. students submitted project reports on the work they did in these industries.

MATHEMATICS

As in the previous years, the Department undertook teaching for the B.Tech., M.Tech., M.Sc. and Ph.D. courses. The syllabi and curricula for various courses were revised and reviewed.

Members of the faculty were actively engaged in research in the following areas :

- (i) Continuum Mechanics
- (ii) Differential Equations
- (iii) Stochastic Processes
- (iv) Operations Research
- (v) Quantum Mechanics and Fields
- (vi) Graph Theory
- (vii) Cosmic Rays
- (viii) Mathematical Biology and Bioengineering.

Forty-five research papers were published during the year under review. Two research monographs—"Stochastic Theory and Cascade Processes", "Introduction to Random Differential Equations and their Applications"—and a Textbook -"Computer Programming with Engineering and Industrial Applications"—had been written by some members of the Department, in collaboration with a few others. Five faculty members and seven research scholars received Ph.D. degree.

The Department had collaborated in research programmes with Hydraulic Engineering Laboratory, Fluid Mechanics Laboratory, Heat and Mass Transfer Laboratory and Industrial Engineering (Operations Research) Section.

Members of the Department participated in some of the conferences, symposia, summer schools, etc., held within the country and in France and Germany.

Four more issues of the Journal of Mathematical and Physical Sciences were brought out during this year and the Journal continues to attract quality survey papers and original papers.

MECHANICAL ENGINEERING

During the year the Department concentrated in fulfilling the major objectives of the Department: imparting training at the under-graduate level, organising post-graduate courses, promoting research activities, undertaking research and developmental work and projects sponsored by industry and other agencies and organising faculty development and continuing education activities.

At the under-graduate level, the Department offered instruction in sixty-two subjects to the students of the 5 year B. Tech. Degree course. This included instruction offered to the students of sister Departments as well. Fifty-nine students completed their 5 year B. Tech. degree course and 27 students the 3 year B. Tech. degree course during the year.

At the post-graduate level, the Department offered fifty-seven courses to the students of M. Tech. degree in Mechanical Engineering and other branches. At the end of the year, 48 students were eligible for award of M. Tech. degree in Mechanical Engineering.

Two staff members of the Department received their Ph. D. degree in the last Convocation. Fifteen research scholars had registered for the M. S. degree and 33 for the Ph. D. Twenty-seven staff members were working as part-time scholars for the Ph. D. and 6 for the M. S. Degree. Thirty papers were/published presented during the year in various national and international journals and conferences.

Research work :

The Department intensified its research activities in the areas of :

Machine Elements and Mechanical Handling ;
 Production Engineering and Machine Tools :
 Fine Technics ;
 Heat Transfer and Thermal Power ;
 Internal Combustion Engines ;
 Thermodynamics and Combustion Engineering ;
 Turbomachines ;
 Refrigeration and Air-conditioning.

With the success achieved in the first sequential summer school conducted during the summers of 1967, 68 and 69, the I. S. T. E. (formerly A. P. T. I.) requested this Department to conduct second sequential summer school in Mechanical Engineering. The Department accordingly organised the second summer school from the summer of 1970, attended by 37 participants from the engineering institutions all over the country.

CENTRAL WORKSHOPS

1. Work orders completed during 1969—70 : 1717 Nos.

2. Details of Major outside jobs : during 1969—70 :

a) Equine Operation Table for Madras Race Club :

The Equine Operation table designed and fabricated by the Central Workshops, Department of Mechanical Engineering is meant mainly for horses but could be modified for other quadrupeds also.

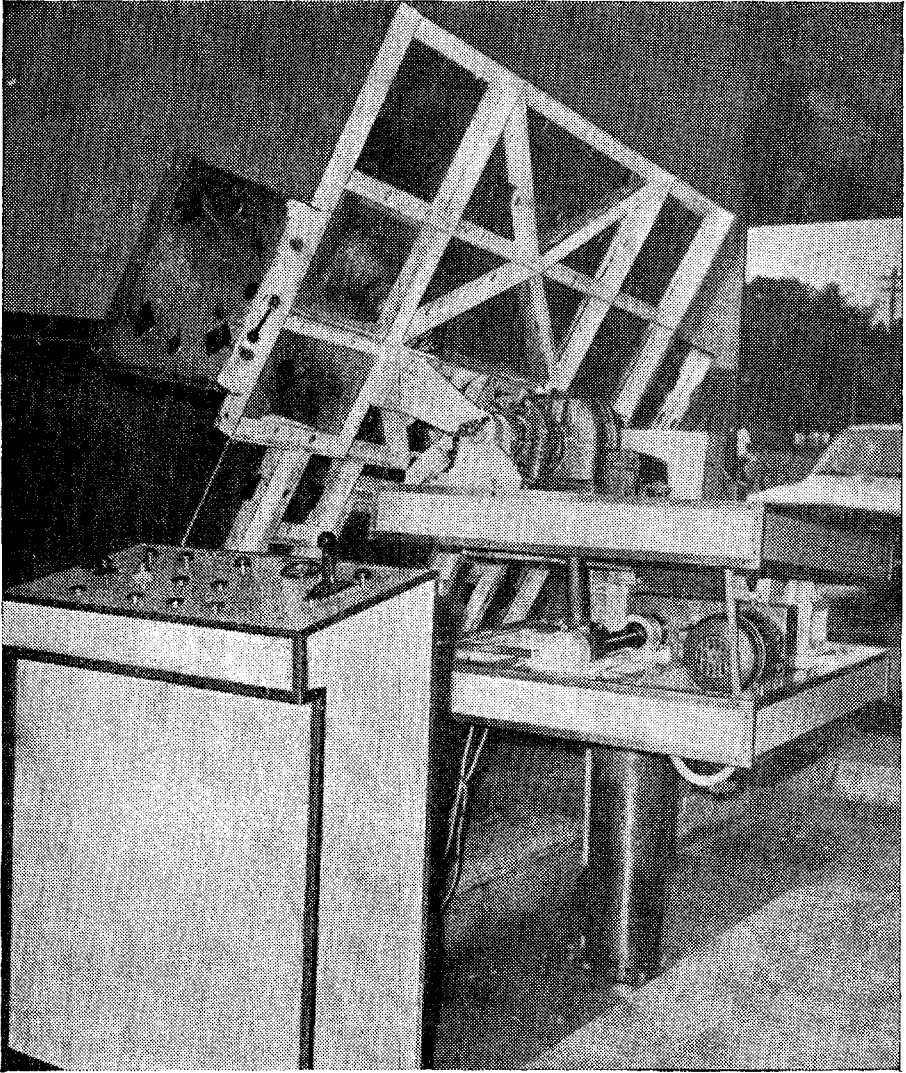
The table has an area of a little over 4 Sq. Metres and is universal in nature i.e. it can swing 110° from vertical to horizontal and also can be tilted to 10° on either side of Horizontal. The whole unit can also be raised and lowered to a height of 1.5 Metres from the floor level. The various movements of the table facilitates the Surgeon to perform the operation with ease. The entire operation in the operation table is made possible by remote control switches located on a control panel.

b) Gears for track recording Cars : Ministry of Railways. Two sets of Gears for Track recording Car (each set consists of 44 Spur Gears and 47 Bevel Gears) for Research Designs and Standards Organisation, Government of India, Ministry of Railways.

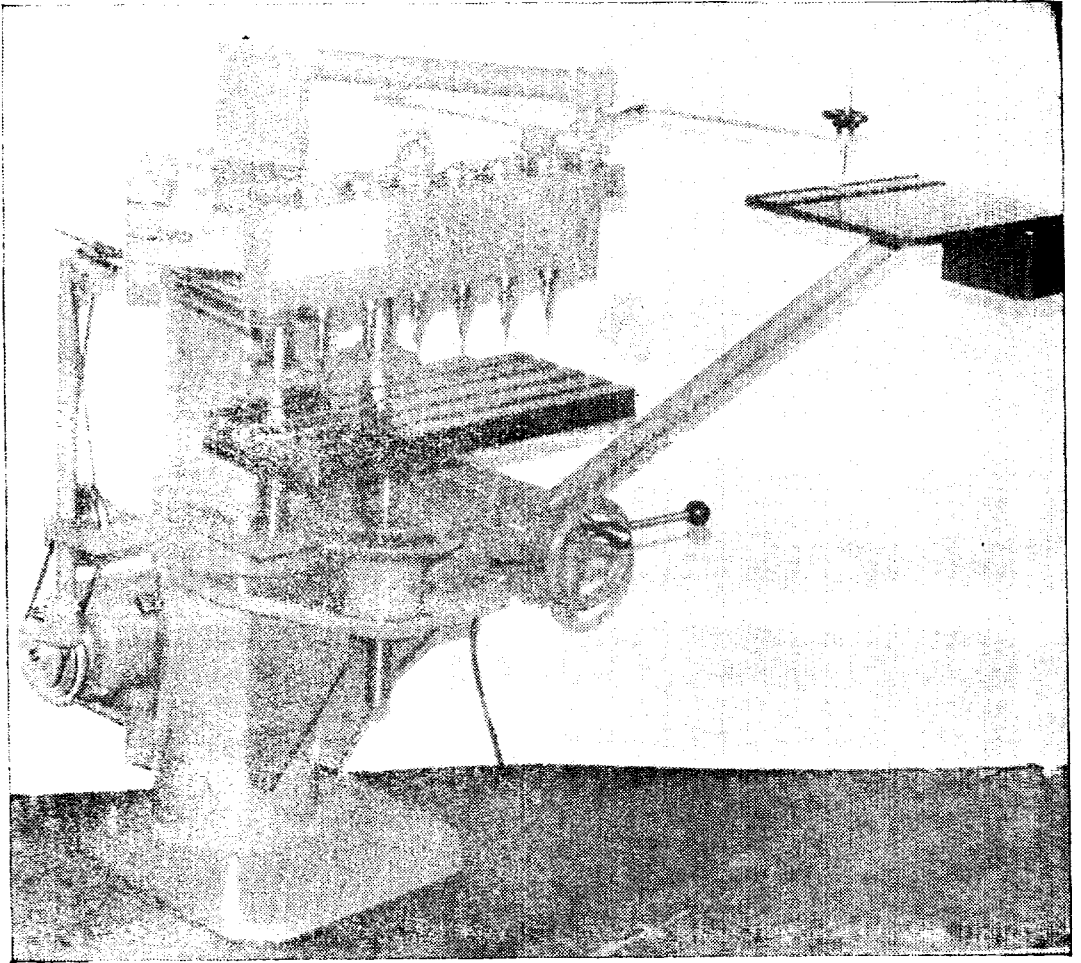
c) Multitube Manometer for Applied Mechanics Department.

d) Displacement apparatus for Applied Mechanics Department.

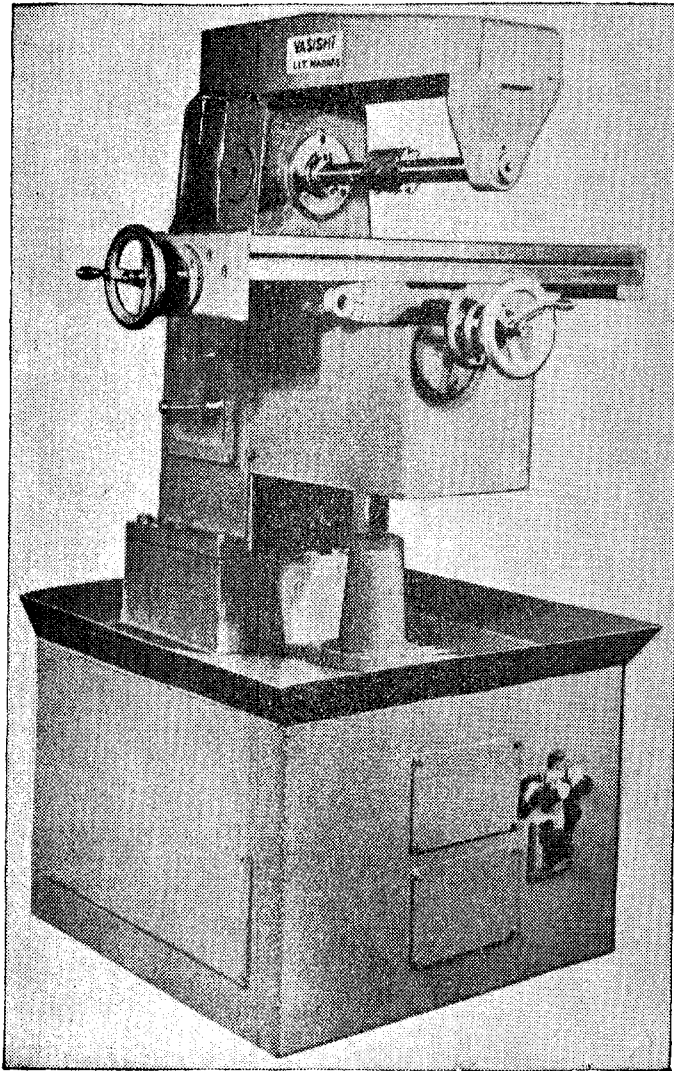
e) Components for Hovercraft for Internal Combustion Laboratory.



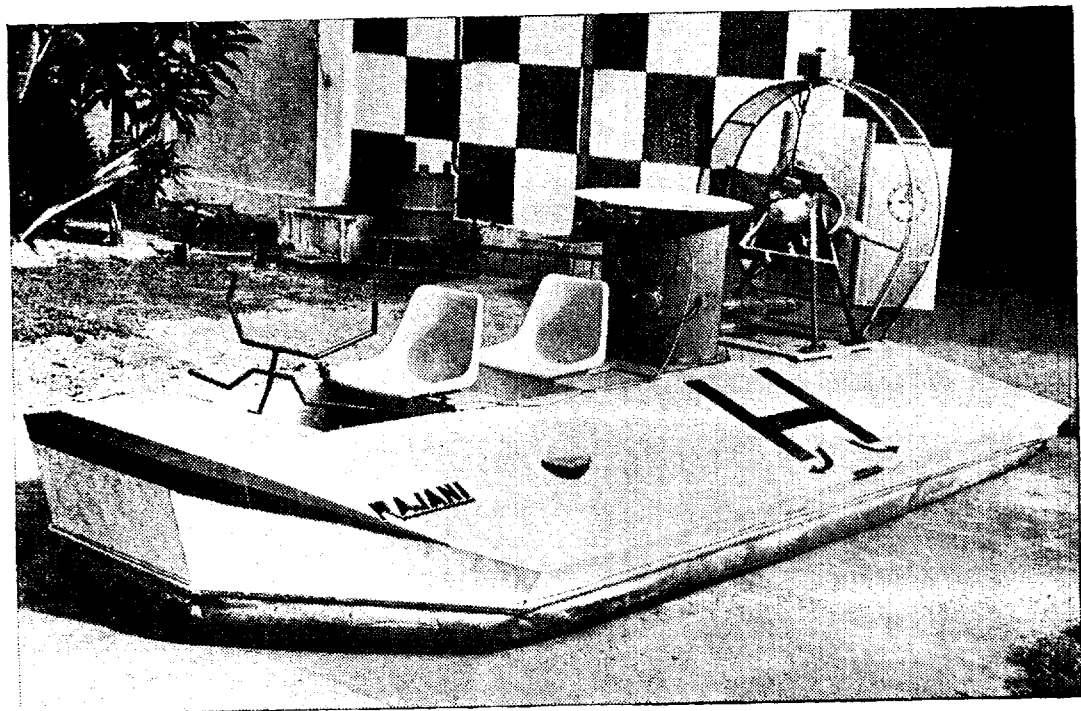
EQUINE OPERATION TABLE
(Mechanical Engineering)



MULTISPINDLE ENGRAVING MACHINE
(Mechanical Engineering)



HORIZONTAL MILLING MACHINE
(Mechanical Engineering)



HOVERCRAFT
(Mechanical Engineering)

METALLURGY

Research work :

Research activity in the Department increased considerably with 8 new registrations for the Ph. D. degree, bringing the total number working in the Department for the doctorate to 12. Two new registrations for the M.S. degree were also made. The first batch of 5 M. Tech. students, admitted in 1968, carried out successfully project work programmes assigned to them, and became eligible for the award of the degree.

Research and project work investigations on the following topics were carried out:—

1. Stabilisation of austenite.
2. Deposition and structural aspects of metallic thin films.
3. Dispersion strengthening.
4. Elastic constants by ultrasonic excitation.
5. Deep drawing of sheet metals.
6. Force measuring devices on forming machine tools.
7. Rolling tests on finned tubes.
8. Nature of the cold worked state in metallic materials.
9. Fatigue hardening and fatigue softening.
10. Interaction of fatigue and creep.
11. Studies on creep metals.
12. Mechanical properties of built-up metals.
13. Properties of vacuum treated steel.
14. Recovery of nickel from low-grade ores.
15. Electrowinning of nickel and copper using sulphide anodes.
16. Beneficiation and recovery of nickel from low grade nickel ore.
17. Electro-chemical behaviour of iron in organic acids.

18. Corrosion of metal composites.
19. Thermal properties of resin bonded moulding sands.
20. Gating and risering of long and narrow freezing range alloys.
21. Compacting characteristics of foundry sands.
22. Solidification characteristics of long freezing range alloys.
23. Trace elements in malleable iron.
24. Weldability of dissimilar metals.
25. Physical and mechanical properties of welded steels.
26. Influence of strain rate on yield stress of metals.
27. Press tools for cold extrusion.
28. Overall efficiency in metal forming machine tools.
29. Production of a Gudgeon pin by cold extrusion.

The activities of the Local Chapter of the Indian Institute of Metals, continued as usual in the Department.

A special Welding Demonstration Course was organised by M/s. Philips with the assistance of the Department, in November 1969, for the benefit of technicians from the local industry.

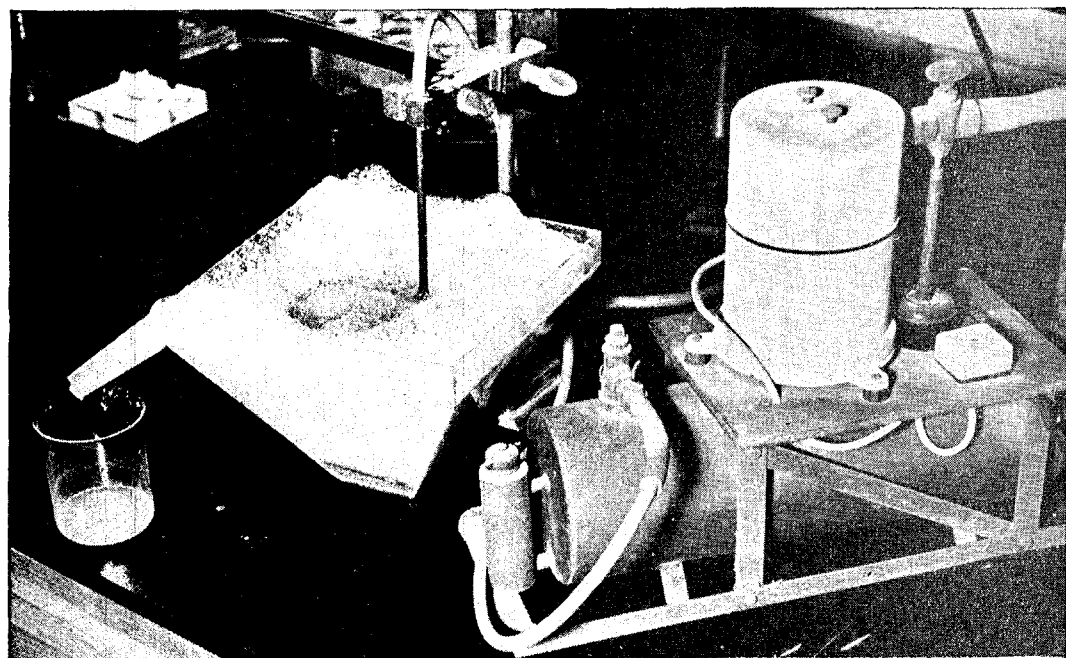
Special lectures and instructions were given to the participants of the Sequential Summer School for Polytechnic teachers during May–June 1970.

PHYSICS

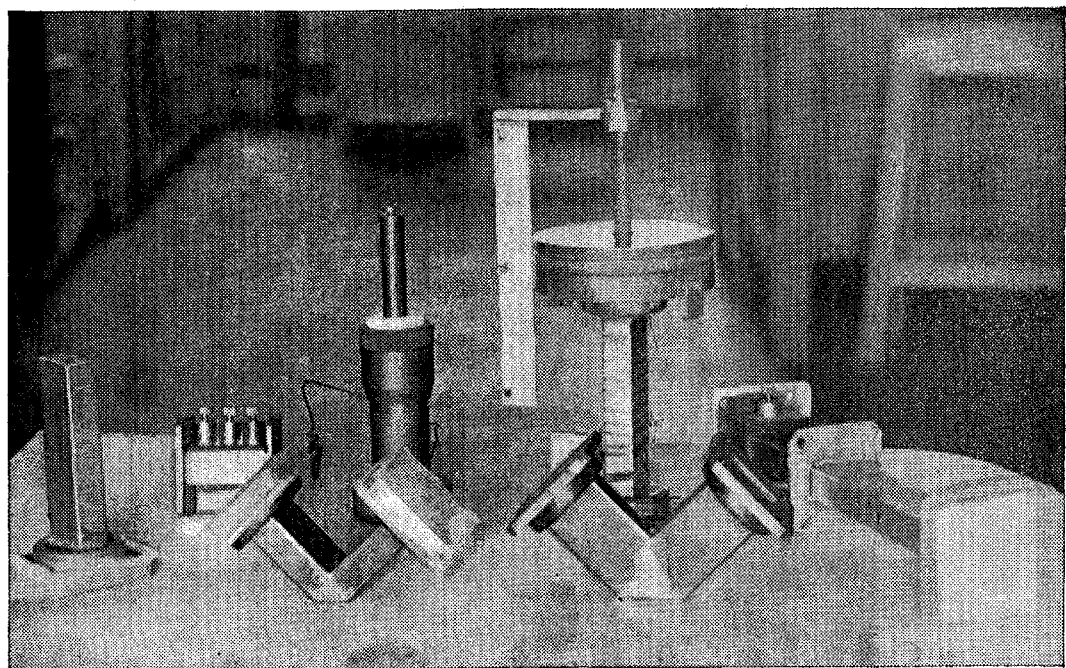
Teaching :

The Department continued to impart instruction in general physics during the first five semesters for all the undergraduate students in Physics. The Following elective courses were also offered for the prefinal and final year B.Tech. students.

1. Solid State Physics.
2. Laser Physics.



FLOTATION CELL
(Metallurgy)



MICROWAVE COMPONENTS
(Physics)

3. Transport Phenomena.
4. Reactor Physics.
5. Technical Acoustics.
6. High Vacuum Technology.
7. Material Science.

For the M. Tech. degree course in Engineering, the Department offered instruction in.

1. Material Science and Technology.
2. Measurements and instrumentation.

A two year M. Sc. degree course in Physics is offered with the following elective subjects :

1. Transistor Physics.
2. Microwave Physics.
3. X-ray crystallography.
4. Instrumentation.

Research :

The Department is being reorganised to receive equipments from West Germany for work in various fields in Solid State Physics. Research activities were carried out in the various aspects of Solid State Physics, as below :

- (a) Electrical conductivity of potassium sulphate and sodium chlorate.
- (b) Electron spin resonance studies of Cu in K_2SO_4 .
- (c) Study of Nuclear quadrupole resonance absorption frequencies of chlorine.
- (d) Optical absorption and colour centres.
- (e) Optical, Piezooptical and magneto-optical studies.
- (f) Molecular spectroscopy.

- (g) Semiconductor studies.
- (h) Lattice Dynamics:
- (i) X-ray crystallography:
 - (i) Study of dielectric constant of crystals at different temperatures.
 - (ii) Construction of an apparatus to grow crystals from melt by the Kyroponlous technique.
 - (iii) Development of a low temperature mount for optical absorption studies and for photo conductivity measurements.
 - (iv) Determination of the geological ages of the rocks and separated minerals in peninsular India.
 - (v) Determination of the elastic constants of niconel 200, inconel 600 and nimonic 60.
 - (vi) Investigation of Thermoluminiscence of KBr with Cu as impurity and calculation of the cohesive energies of several crystals of CsCl type.

The results of all these investigations are published in various reputed journals in the form of nearly 30 papers. Some of these results are also presented in the form of thesis by the research workers for the award of Ph. D. degree.

Considerable progress were made during this period on the following research projects sponsored by C.S.I.R. and Ministry of Defence.

1. Nuclear quadrupole studies in certain ionic crystals containing chlorine (C.S.I.R.)
2. Fabrication of a microwave test bench especially klystrons (Defence.)

LIBRARY

The Library registered an increase in the library membership during the year under review the total now being 3,289. The membership of the Library is open to industrial organizations on payment of an annual fee of Rs. 250/- and a few more important organizations of the city had taken advantage of this.

Readers' Service :

The library continued to work on all days of the year (except for the 7 closed holidays of the Library) between 8.00 A.M. and 9-30 P.M. On Sundays and other closed holidays for the Institute, the library was kept open from 9 A.M to 4 P.M. The total attendance of members was about 1½ lakhs and an equal number of books and periodicals were issued on loan.

Books and Periodicals :

The number of books and pamphlets rose from 76,995 to 85,498. 100 new periodicals were subscribed for, bringing the total to 1332. 64 back volumes of periodicals covering all subjects were added.

Text Book Collection :

The Text Books collection consisting of multiple copies of recommended text books has been further strengthened.

Gifts and Exchange :

3,021 German publications (including 2,050 DIN Standards) and 121 periodicals were received during the year under the Indo-German Agreement. Arrangements were made for a regular exchange of publications with the Libraries of five German Technical Universities co-operating with the Institute. The Library of the Technical University, Berlin, supplied free Xerox copies of articles requested.

Books, pamphlets, and other reading materials were received as gift from the British Council, Madras, the USIS, Delhi, the American

Embassy, New Delhi, the Asia Foundation, New Delhi, and the Ford Foundation, New Delhi.

Books and journals were obtained on the inter-library loan system from the libraries of the National Aeronautical Laboratory, Bangalore, the Tata Institute of Fundamental Research, Bombay, the Indian Institute of Technology, Bombay, the Indian Institute of Technology, Kanpur, the Madras University, Madras, the College of Engineering, Madras, the British Council Madras, and the National Science Library, New Delhi.

Reclassification of Books :

The entire book collection has been reclassified completely according to UDC.

Library publications :

The Library continued the publication of its fortnightly 'Library Information Bulletin'. The 'Handbook of Library Administration' had been made available to outside organizations on demand and on payment to individuals.

Translation work :

Translation service from German into English continued to be provided by the Library staff. It has also procured and supplied several translations and photocopies of scientific articles from Insdoc, New Delhi, Technical University, Berlin and other outside agencies for the use of research workers at the Institute.

Microfilming and photocopying service :

This service was rendered with the help of the Library photographer at nominal rates. Uptodate photographic equipment has been received and installed in the Reprographic Section.

Bindery :

A bindery with the required machinery is meeting the demands of the Library and the Departments of the Institute. 3,265 periodicals were got bound or repaired during the year.

ANNEXURE B

**ADMISSIONS TO THE COURSES OF STUDY
FOR THE 1969—70 SESSION:**

The number of students admitted to the various under-graduate and post graduate courses for the 1969—70 Session is given below :

<i>Courses</i>	<i>No. Admitted</i>
B. Tech. --	255
M. Tech. —	145
D. I. I. T. —	7
M. Sc. —	51

Registration for research work :

	<i>Full—time</i>	<i>Part—time</i>
M. S.	18	3
Ph. D.	45	33

STUDENT POPULATION OF THE INSTITUTE (1969—70 SESSION):

For the academic session 1969—70, the strength of the students in the different courses and research scholars was as follows :

<i>Course Programme</i>	<i>Full—time</i>	<i>Part—time</i>
B. Tech.	1,281	—
M. Tech.	247	44
D. I. I. T.	7	—
M. Sc.	98	2
M. S.	30	8
Ph. D.	99	106
Post—Doctoral Fellows	2	—
Total :	1764	160

The above figure includes 37 students from abroad.

SIXTH CONVOCATION OF THE INSTITUTE

2nd August, 1969

The Sixth Convocation of the Institute was held on 2nd August, 1969 at the Open Air Theatre of the Institute. Sri H.V.R. Iengar, Chairman, Board of Governors presided over the Convocation. Dr. S. Bhagavantam, Scientific Adviser to the Minister of Defence, Government of India was the Chief Speaker.

The Director conferred the Degrees and Diplomas on 244 candidates, who attended the Convocation and in absentia on 226 candidates who could not be present. The numbers of the graduates in the various categories are given below :

	<i>In person</i>	<i>In absentia</i>	<i>Total</i>
Ph. D. Degree :			
Chemistry	4	2	6
Civil Engineering	1	1	2
Electrical Engineering	1	...	1
Mathematics	5	1	6
Mechanical Engineering	1	...	1
Physics	1	2	3
Total	13	6	19
M.Sc. Degree :			
Chemistry	4	1	5
Mathematics	10	3	13
Physics	7	5	12
Total	21	9	30
M. Tech. Degree :			
Chemical Engineering	10	2	12
Civil Engineering	10	8	18
Electrical Engineering	7	10	17
Engineering Mechanics	3	3	6
Mechanical Engineering	18	5	23
Total	48	28	76

	<i>In person</i>		<i>In absentia</i>		<i>Total</i>	
	5-Year	3-Year	5-Year	3-Year	5-Year	3-Year
D. I. I. T:						
Chemical Engineering Practice						
	3		1		4	
Industrial Engineering						
	6		14		20	
	-----		-----		-----	
Total	9		15		24	
	-----		-----		-----	

B. Tech. Degree :

	<i>In person</i>		<i>In absentia</i>		<i>Total</i>	
	5-Year	3-Year	5-Year	3-Year	5-Year	3-Year
Aeronautical Engineering	9	...	5	...	14	...
Chemical Engineering	25	17	14	13	39	30
Civil Engineering	11	5	9	7	20	12
Electrical Engineering	23	9	16	45	39	54
Mechanical Engineering	31	13	35	16	66	29
Metallurgy	10	...	8	...	18	...
	-----		-----		-----	
Total	109	44	87	81	196	125
	-----		-----		-----	

After the conferment of the Degrees/Diplomas the Chief Speaker distributed the prizes to Prize winners (list annexed).

The graduates of the year who were present took the pledge, led by Sri P. Raghavendran, winner of the President's Prize.

After the Chairman's introductory speech Dr. S. Bhagavantam delivered the Convocation Address.

PRIZE WINNERS

Prizes awarded at the Sixth Convocation of the Institute
held on 2nd August, 1969.

President's Prize

(for the student of the B. Tech. Degree Course with the best academic
record)

Sri P. Raghavendran (3-Year B. Tech. Mechanical Engg.)

Governor's Prize

(for all-round proficiency in the B. Tech. Degree Course)

Sri Joshy Paul Kallungal (5-Year B. Tech. Chemical Engineering)

Institute Special Merit Prize

(for the student of the B. Tech. Degree Course with the best academic
record)

Sri Jayant Baliga (5-Year B. Tech. Electrical Engineering)

Merit Prizes

(a) 5-year B.Tech. Degree

(b) 3-year B. Tech. Degree

Aeronautical Engineering

Chemical Engineering

Dasigi Lakshminarasimha Sastry

T. Anantharajan

Chemical Engineering

Civil Engineering

R. Mutharasan

R. Nagaraj

Civil Engineering

Electrical Engineering (L.C.)

M. Hariharan

M. Sethuraman

Metallurgy

Mechanical Engineering

V. Nagarajan

P. Raghavendran

*(c) M. Tech. Degree**Chemical Engineering*

Vinay Kumar

Civil Engineering

Girdhar Badlani

Engineering Mechanics

M. Sathyamoorthy

*(d) M.Sc. Degree**Chemistry*

N. Periasamy

Mathematics

A. Thyagaraja

Physics

Rajaram Nityananda

*(e) D. I. I. T.**Industrial Engineering*

Ratnaswamy Shankar

Siemens Prizes*5-year B. Tech. Degree**Electrical Engineering (H.C.)*

Jegath Chandra Giri

*M. Tech. Degree**Electrical Engineering*

Janakiraman, P. A.

Philips India Prize*5-year B. Tech. Degree**Electrical Engineering (L.C.)*

Jayant Baliga

Banco Foundation Prize*5-year B. Tech. Degree**Mechanical Engineering*

J. Srinivasan

Prof. B. Sengupto Prize*M. Tech. Degree**Mechanical Engineering*

J. Pattabiraman

ANNEXURE D

**NUMBER QUALIFIED FOR THE DEGREES/DIPLOMAS
AT THE END OF 1969-70**

Degree	Number			Total
	I Class with distinction	I Class	II Class	
B. Tech. (Five-year Course)	3	180	56	239
B. Tech. (Three-Year Course)	2	73	31	106
M.Sc.	2	30	11	43
M.Tech.	9	112	4	125
D.I.I.T.				
Chemical Engineering				
Practice Industrial Engineering		4 } 17 }	5 1	27
Ph.D.				
Chemical Engineering	3			
Chemistry	3			
Civil Engineering	2			
Electrical Engineering	1			
Mathematics	4			
Mechanical Engineering.	2			
Physics	5			20

				Total 560

ANNEXURE E

PATTERN OF GRADUATION

(1964-70)

The number of candidates who were awarded Degrees/Diplomas at the first six convocations and the number to be awarded at the Seventh Convocation (being held on 29th August 1970) are as follows:

	Awarded at the First Six Convocations (1964-69)	Awarded at the Seventh Convocation (1970)	Total
B. Tech.	1282	345	1627
M.Sc.	121	43	
M.Tech.	224	125	349
D.I.I.T.	43	27	70
Ph. D.	44	20	64
Grand Total	1714	560	2274

ANNEXURE F

ALUMNI ASSOCIATION AND STUDENTS' PLACEMENT CENTRE

The membership of the Association increased from 1366 in July 1969 to 1800 at the end of June 1970.

The first issue of the News Letter was published in March, 1970 and the second issue released on the eve of Seventh Convocation in August 1970.

Regarding placement, most of the alumni of the previous batches are well-placed—vide annexure. The Centre was contacted by 58 firms both by private and public sectors. Screening and interviews were held by 16 companies. The Centre is arranging practical training to the students of the four years of the B.Tech. Course during winter and summer vacations.

Statement showing the Placement Position of Students who graduated in 1964, 1965, 1966, 1967, 1968 and 1969
(B. Tech./M. Tech./D. I. T./M. Sc.)

Year	Total passed out	Studying in India	Studying abroad	Employed abroad	Employed in India		Unemployed	Position not known *	Expired
					Private Sector	Public Sector			
1964	106	12	21	5	33	35	—	—	—
1965	163	20	35	14	43	51	—	—	—
1966	246	32	42	9	81	77	4	—	1
1967	319	59	43	6	84	85	12	—	1
1968	383	83	57	4	84	71	8	—	1
1969	396	76	40	—	68	66	—	—	—
Total	1,613	282	238	38	393	385	24	253	3

*These students have not intimated about their latest position.

It is therefore presumed that they might have either secured employment or gone abroad.

ANNEXURE G

INSTITUTE GYMKHANA

The activities of the Gymkhana for the year were inaugurated by the Director.

As in the previous years all the Committees were elected bodies with the exception of the Publication Committee which was appointed by the President, Institute Gymkhana.

The success of the literary teams was very significant, the Quiz and Debating teams winning most of the Inter-collegiate events. The Quiz team also won most of the AIR quizzes.

In the Cultural Week conducted by the Indian Institute of Technology, Kharagpur, the teams of the Indian Institute of Technology, Madras were placed at the top in both the Quiz and the Debate.

This year, two or three top singers bagged prizes in inter-collegiate events. A Dramatics club was formed with a view to encourage would be entertainers. The Sports team did very well this year, its notable achievement being the success at the Inter-IIT Sports Meet held at Kharagpur. The Institute Teams had their share of laurels in the various local sports events. The Hockey team won the Buck Memorial Trophy for the third time in succession.

The Inter-Hostel tournaments in all the sports activities were conducted during the year. The Annual Sports Meet was held on 14th March 1970. Sri J. C. Kumaramangalam, Managing Director, Neyveli Lignite Corporation presided over the function and distributed the prizes.

The Institute Day was celebrated on 25th March 1970 with Sri D. C. Kothari, President of the Federation of Indian Chambers of Commerce and Industry as the Chief Guest.

A new feature this year was a big Carnival held at the Institute. It was a great success owing to the hard work put in by the various Gymkhana Committees and the staff.

The overwhelming response to the Cultural Week, Science Fair and Art Competitions and their grand success this year are mainly due to the sustained efforts of the various Gymkhana Secretaries.

The External Affairs Committee, apart from conducting the Science Fair and arranging talks by eminent journalists, lawyers etc., had done a great deal in removing some of the existing difficulties of the students. This was mainly possible due to the cooperation of the Institute authorities.

Among the off-shoots of the various committees this year, are the Dramatics Club, Debating Society, the Music Club and the Political Sciences Group.

ANNEXURE H

NATIONAL CADET CORPS

(A) No. 4 Tamil Nadu Air Sqn. Tech. N.C.C.

During the year, a total of 153 Cadets (including III and IV year Cadets) received training. At the end of the training year 28 Cadets received N.C.C. 'B' Certificates and 14 Cadets received N.C.C. 'C' Certificates on passing the N.C.C. Examinations. Aeromodelling classes were in full swing in the first semester, the Cadets evincing keen interest.

74 Cadets attended the Annual Training camp at M.E.G. Campus Bangalore and successfully underwent the camp routine which included such varied activities like instructional visits to Air Force and Industrial establishments, Range Firing, Route March, Morning P.T., Games etc. The cadets exhibited active interest and cheerfully experienced the Camp Life.

The cadets provided a guard of honour to the Chief Guest Dr. Bhagavantam on the Institute Convocation Day. They took part in the Republic Day Parade, the Director of the Institute taking the salute.

(B) 2 (TN) Comp. Tech. Coy. N.C.C.

Though the training is confined to the first and second year students only, volunteers from the third, fourth and fifth year students were also taken on the rolls. During the year 168 cadets were on the rolls of this Unit.

Training was imparted to cadets according to the prescribed syllabus. The first year training is generally oriented to Infantry training consisting of drill, weapon training, map reading, field craft., etc. The second year training is oriented to technical corps to which the cadets are allotted. During the training year we had two batches consisting of Engineers and Signals. The technical training included organisation, employment and handling of equipment used in those corps.

Special ceremonial parades were held jointly with the Air Wing cadets on the Convocation Day, NCC Promise Day and Republic Day. At the Promise Day Parade, the Deputy Director of the Institute took the salute and administered the NCC pledge.

A combined annual training camp of 10 days duration for Army and Air Wing cadets was conducted at Bangalore during Nov/Dec. 69. The cadets did their annual firing with .22 and .303 rifles. Visits to BEL, Visweswaraya Museum were arranged. Signal/Engineer equipment demonstrations were arranged at the Camp. The aims of Annual Camp namely, building up of character, inculcating the sense of discipline and self-reliance, *esprit de corps* and fostering of the corporate way of living were fully achieved.

4 students qualified for the 'C' certificates and 32 for the 'B' certificates at the examination held at the end of the training year.

ANNEXURE I

INSTITUTE DISPENSARY

The clinical laboratory with a full-time qualified Technician undertook examination of various specimens numbering 4,517, almost trebling the number of examinations carried out during the previous year.

The immunisation programme with prophylactic doses of various vaccines to prevent diseases like Cholera, Small Pox, Typhoid, Poliomyelitis etc. were carried out as usual for children in the campus and the students in the Hostels. The total number of cases immunised were:

Anti Cholera	...	86	
Anti typhoid	...	80	
Small pox	...	397	
Diphtheria	}	Triple antigen	... 70
Tetanus			
Whooping cough			
Anti polio	57

A total of 152 cases of Chicken Pox, Infective Hepatitis, Mumps and Measles were isolated effectively in the Dispensary or in their houses and treated successfully with appropriate drugs.

The Ante-Natal Clinic examined 93 cases.

At the Women's wing necessary technical advice was given to 25 female patients and oral contraceptive tablets were issued free of cost. Lippes loop insertions were carried out under aseptic precaution in 7 cases.

The total number of patients examined and treated at the women and children wing of the dispensary by the Lady Medical Officer for the year 1969-'70:

Men	...	3,150
Women	...	6,472
Children	...	8,826

Total number of cases seen and treated by the Hony. Consulting Physician during the year 1969-'70 :

Men	...	2,834
Women	...	508
Children	...	549

Total number of cases seen and treated by the Surgeon Medical Officer-in-charge during the period from February to June 1970 :

Men	...	3,382
Women	...	148
Children	...	128

Ten major surgical cases were admitted to the V.H.S. Hospital and attended to by the Surgeon-Medical Officer of the Institute.

Grand total of all cases treated at the dispensary during the year were 25,997. The daily average stood around 71 cases.

The total number of minor operations was 317. House visits made by the Lady Medical Officer were 344.

76 cases of an emergent nature were also attended and necessary treatment rendered at the Dispensary. A beginning was made to admit such emergency cases in the dispensary for observation and treatment instead of referring them to the city hospitals. Total number of such cases treated as in-patients mostly students and children were 68.

Administration

<i>Director</i>	Dr. A. Ramachandran
<i>Deputy Director</i>	Prof. S. Sampath
<i>Registrar</i>	Sri C. V. Sethunathan
<i>Asst. Registrar (Acad.)</i>	Sri T. S. Rajagopalan
<i>Asst. Registrar (Admn.)</i>	Sri K. Sampath Kumaran
<i>Audit Officer</i>	Sri R. Venkataraman
<i>Stores Officer</i>	Sri S. Pattabhiraman
<i>Accounts Officer</i>	Sri A. V. Karunakaran Nambiar
<i>Executive Engineer</i>	Sri C. S. Subramaniam
<i>Hony: Consulting Physician</i>	Dr. P. M. Palani
<i>Medical Officers</i>	Dr. G. Atmaram Rao
	Dr. (Smt.) Shanta Krishnamurthi
<i>Security Officer</i>	Sri T. N. Venkataraman
<i>Officer Commanding,</i>	
<i>2 (Tamil Nadu) Comp. (Tech.)</i>	Lt. Col. S. Subramanyam
<i>Eng. EME Sig. Coy N.C.C.</i>	
<i>Officer Commanding,</i>	
<i>4 (Tamil Nadu) Air Sqn.</i>	Squadron Leader C. P. A. Nair
<i>Tech. Coy. N.C.C.</i>	

HEADS OF DEPARTMENTS

<i>Aeronautical Engineering</i>	... Dr. K. A. V. Pandalai
<i>Applied Mechanics</i>	... Dr. D. V. Reddy
<i>Chemical Engineering</i>	... Dr. D. Venkateswarlu
<i>Civil Engineering</i>	... Dr. P. C. Varghese
<i>Electrical Engineering</i>	... Dr. P. Venkata Rao
<i>Mechanical Engineering</i>	... Prof. R. G. Narayanamurthi
<i>Metallurgy</i>	... Dr. E. G. Ramachandran
<i>Chemistry</i>	... Dr. M. V. C. Sastri
<i>Mathematics</i>	... Dr. S. D. Nigam
<i>Physics</i>	... Dr. C. Ramasastry
<i>Humanities & Social Sciences</i>	... Prof. R. K. Gupta
<i>Librarian</i>	... Sri V. S. Nazir Ahmed