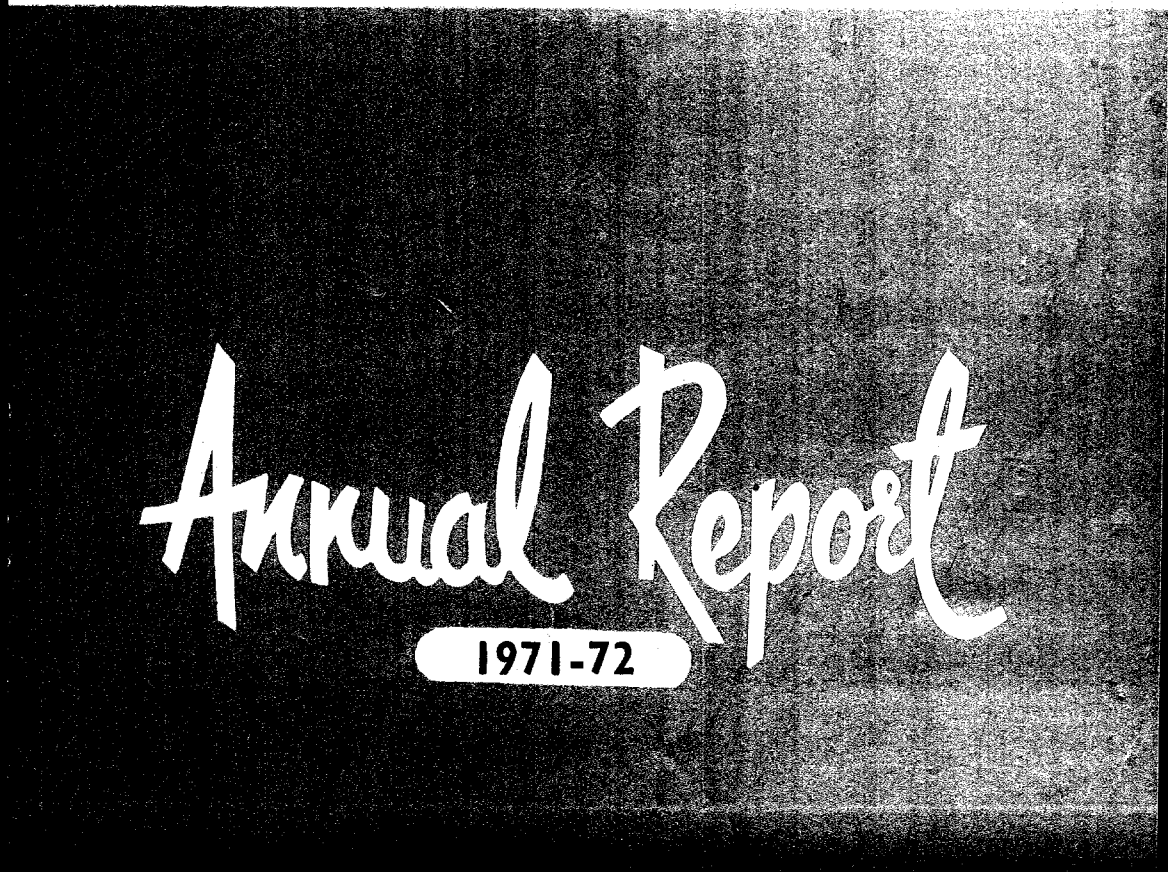
INDIAN INSTITUTE OF TECHNOLOGY

MADRAS



THIRTEENTH ANNUAL REPORT

1971-72

INDIAN INSTITUTE OF TECHNOLOGY MADRAS

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VISITOR: THE PRESIDENT OF INDIA

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Board of Governors, I.I.T., Kanpur.

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I.I.T., Madras.

Dr. M. S. Muthana, Director,
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Government of India, New Delhi.

Sri S. D. Nargolwala,
Financial Adviser,
Ministry of Finance,
New Delhi.

Dr. L. S. Chandrakant,
Educational Adviser (T),
Ministry of Education and Social Welfare,
New Delhi.

Representatives of Parliament:

Sri Bhaoo Sahaib Dhamankar, M.P.,
113, Vithalbhai Patel House,
New Delhi.

Sri Sarjoo Pandey, M.P.,
201, North Avenue,
New Delhi.

Sri U. N. Mahida,
Member, Rajya Sabha,
401, Vithalbhai Patel House,
New Delhi.

Representative of the All-India Council for Technical Education:

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

Nominees of the Visitor:

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7, Park Lane,
Lucknow.

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Chairman & Managing Director,
M. N. Dastur & Company Pvt. Ltd.,
P. 17, Mission Row Extension,
Calcutta.

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

Prof. S. Nurul Hassan,
Minister of State,
Ministry of Education & Social Welfare,
New Delhi.

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

Secretary:

Sri Biman Sen,
Deputy Educational Adviser (Tech.),
Ministry of Education & Social Welfare,
New Delhi.

The Board of Governors

Chairman:

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Chairman, Kerala State Industrial Development Corporation Ltd.,
P.B. No. 105,
Trivandrum

Nominees of the State Governments:

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Director of Technical Education,
Government of Mysore,
Bangalore.

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

Sri K. M. Ali,
Hony. Principal,
S. S. M. Polytechnic,
Tirur-5.

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

Nominees of the Council:

Dr. A. S. Adke,
Vice-Chancellor,
Karnatak University,
Dharwar.

Dr. H. V. K. Udupa,
Director,
Central Electrochemical
Research Institute,
Karaikudi.

Sri H. G. S. Murthy,
Director,
Thumba Equatorial Rocket
Launching Station,
ISRO Post Office,
Trivandrum.

Sri A. S. Rao,
Managing Director,
Electronics Corporation of India Ltd.,
Hyderabad-40.

Director:

Dr. A. Ramachandran,
Indian Institute of Technology, Madras.

Nominees of the Senate:

Prof. R. K. Gupta,
Professor & Head of the Department of
Humanities and Social Sciences,
Indian Institute of Technology, Madras.

Dr. P. Besslich,
Professor, Department of Electrical Engineering,
Indian Institute of Technology, Madras.

Secretary:

Sri C. V. Sethunathan,
Registrar,
Indian Institute of Technology, Madras.

The Finance Committee

Chairman :

Sri K. T. Chandy,
Chairman,
Kerala State Industrial Development Corporation Ltd.,
P.B. No. 105,
Trivandrum.

Members :

Sri B. Sen,
Deputy Educational Adviser,
Ministry of Education and Social Welfare,
New Delhi.

Sri O. P. Mohla,
Deputy Financial Adviser,
Ministry of Finance,
New Delhi.

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

Sri H. G. S. Murthi,
Director, TERLS,
I.S.R.O. P.O.,
Trivandrum.

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

Secretary :

Sri C. V. Sethunathan (Registrar).

The Buildings and Works Committee

Chairman :

Sri K. T. Chandy,
Chairman,
Kerala State Industrial Development Corporation Ltd.,
P.B. No. 105,
Trivandrum.

Members :

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

Sri M. G. Joseph,
Superintending Engineer,
C.P.W.D., Madras.

Dr. P. C. Varghese,
Professor and Head of the Department of Civil Engineering,
I.I.T., Madras.

Sri S. P. Namasivayam,
Chief Engineer (Buildings),
P.W.D., Madras.

Sri K. Ganesan,
Executive Engineer,
I.I.T., 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. R. S. Alwar

Dr. V. Anantaraman

Dr. P. T. Manoharan (From 16-2-72)

Dr. G. Mennig

Dr. B. S. Murthy

Dr. V. G. K. Murti

Prof. R. G. Narayanamurthi

Dr. Y. Narayana Rao (Senior Warden)

Sri V. S. Nazir Ahmed (Librarian)

Dr. G. Aravamudan (From 31-7-71)

Dr. S. T. Ariaratnam (Till 31-8-71)

Prof. M. Bantel

Dr. P. Besslich

Dr. T. K. Bose

Dr. N. V. Chandrasekhara swamy

Prof. N. K. Datta (Till 22-1-72)

Dr. Dieter Marx (From 15-11-71)

Mr. H. J. Ebert

Dr. H. P. Gerken (Till 26-5-72)

Dr. D. N. Ghista (From 16-7-71)

Dr. T. Gopichand

Dr. M. C. Gupta

Prof. R. K. Gupta

Prof. (Mrs.) Ingrid Davids

Dr. Jens-Ulrich Davids

Dr. Joachim Holtz (Till 23-4-72)

Dr. J. C. Kuriacose

Sri S. S. Mani
(Workshop Superintendent)

Dr. S. D. Nigam

Dr. K. A. V. Pandalai

Dr. C. N. Pillai (From 31-7-71)

Dr. K. P. Rajappan

Dr. E. G. Ramachandran

Dr. C. Ramasastry

Dr. B.V.A. Rao

Dr. D.V. Reddy

Prof. S. Sampath (Dy. Director)

Dr. K. S. Sankaran

Dr. M.V.C. Sastri

Dr. M.R. Seshadri

Dr. V. Sethuraman

Dr. A. K. Sreekanth

Dr. R. Srinivasan

Dr. S. K. Srinivasan

Dr. V. Srinivasan

Dr. K. Srinivasaraghavan

Dr. N. R. Subramanian

Dr. P. C. Varghese

Dr. R. Vasudevan

Dr. P. Venkata Rao

Dr V. C. Venkatesh

Dr. D. Venkateswarlu

Dr. M. Venugopal

Nominees of the Chairman, Board of Governors:

Prof. T. Balakrishnan Nayar,
"Chitra", Kilpauk Garden Road, Madras-10.

Dr. P. L. Bhatnagar,
Himachal Pradesh University, Simla.

Dr. G S Laddha,
Director, A.C. College of Technology, Madras-25.

Secretary:

Sri C. V. Sethunathan (Registrar)

Report by the Director

I have pleasure in presenting the Thirteenth Annual Report (1971-72) of the Indian Institute of Technology, Madras.

I. The Institute has completed thirteen years of service to the nation in the cause of technical education as one of the Higher Institutes of Technology and an Institute of National Importance. The Institute is becoming a major Centre for consultation by a number of industries as well as public sector/autonomous undertakings. The Alumni of the Institute have created a very good impression and the Institute has been receiving frequently very favourable reports from individuals and organisations both in India and abroad who have examined them, employed them and assessed them. This is also borne out by the fact that about a hundred industrial undertakings conducted in campus' interviews for the final year under-graduate and post-graduate students in the several branches to recruit suitable personnel for the organisations. This has been possible because in all aspects of the work of the Institute, there is a strong imprint of meticulous planning, attention to details and a mental attitude that makes no compromise with anything hat is sub-standard and accepts nothing but the best.

II. Student population and academic programmes :

(A) *Student population*

The ratio between the Post - graduate and Under – graduate students improved on the target ratio of 1:2 in 1970 -71 itself. The years 1971–72 and 1972–1973 showed a further improvement to 1:1.4 and 1:1.33 respectively. In 1973–74, the last year of the Fourth-Five year Plang this ratio is expected to be 1:1.26 approximately. This ratio may stabilise around 1:1 during the Fifth Plan period, as recommended by the Reviewing Committee.

The statement below indicates the position in this regard for the five years of the Fourth Five-Year Plan.

	Student population (Includes part-time registration also)				
	1969-70	1970-71	1971-72	1972-73	1973-74 (anticipated)
Under-Graduates	1281	1172	1235	1246	1250
Post-Graduates 398	643	414	502	520	528
Research Scholars 245		326 740	361 863	419 939	464 992
Total	1924	1912	2098	2185	2242
Ratio : PG : UG.	1 : 2	1 : 1·6	1 : 1·4	1 : 1·33	1 : 12·6

(B) *The following new courses were started in the year under report*

M. Tech. Chemical Engineering

1. Particle Technology 2. Chemical Plant Design

M. Tech. Mechanical Engineering

1. Machine Dynamics 2. Fine Technics

D. I. I. T. (Diploma): Civil Engineering-Building Technology

(C) *Progress in Inter-disciplinary Areas*

(i) *Bio-Medical Engineering*

(1) The first batch of students for M. S. and Ph. D. programmes was admitted in July, 1971.

(2) The following courses were offered during the year:

(a) Medical Physics

(b) Bio-mechanics

(c) Biological Transport Phenomena

(d) Bio-medical Systems and Control

(e) Medical Instrumentation

(f) Mathematical Biology

(3) Research Projects under way

(a) Nontraumatic detection of Intra-occular pressure

(b) Development of Cardiac Diagnostic Indices

(c) Analysis and Development of Design Guidelines of lower limb prosthesis (total hip prosthesis, B. K. prosthesis, fixation devices)

(d) Design guidelines for plastic surgery procedure

(e) Phone-cuff sphygmomanometry

(f) Tractor - occupant mechanics and design specifications for occupants' riding comfort

(g) Surgical Rehabilitation of Leprosy Hand

(h) Analysis and Design of Prosthetic Ballcage and Trileaflet Valves

(i) Artificial denture contour design and dental prosthesis

(j) Intuitional practise; Evaluation of its effects on mental physiological states and its use as a therapy

(k) Supporting mattress for minimisation of bed sores

(l) Pressure transducer for cardiac catheterisation

(m) Influence of pulsatile flow on concentration profile and mass flux across the semi-permeable tube

(n) Hystersis effects in Ultrasound absorption in highly viscous biofluids

(o) Probabilistic models of neuronal firings

(p) Cell Structure and Bacteriphage Reproduction

(q) Rheology of Non-Newtonian fluids and Non-Newtonian physiological flow studies

(4) Fifteen papers in the varied areas of research were published and nine papers are under publication.

(ii) *Desalination*

First set of experimental programmes in the following projects were completed during 1971-72.

(i) Desalination by freezing (Indirect heat exchange).

(ii) Scale formation during pool boiling in the presence of polymer coatings.

(iii) (a) Desalination of Brackish water by Ion exchange.
(b) Regeneration of Ion exchange resin using ferric chloride.

(iv) Testing cellulose acetate and collagen membranes for desalination by reverse osmosis.

The programme for the year 1972-73 will be to continue the experimental programme given above to incorporate the following:

(i) Desalination by freezing — Direct heat exchange, continuous freezing unit.

(ii) (a) Scale formation studies in pool boiling in the presence of fluidized particles.

(b) Desalination by direct contact evaporation by Ion exchange.

(iii) (a) Desalination of brackish water by Ion exchange using continuous fluid solid contactor.

(b) Dynamics of regeneration cycle in batch beds using ferric chloride process.

(iv) (a) Preparation of collagen membrane by electrophoresis and testing desalination characteristics.
(b) Preparation of ultra thin cellulose acetate membranes and testing desalination characteristics.
(c) Module system testing using cellulose acetate membranes.

(v) Desalination by a centrifugal impeller system with porous blades coated with a thin layer of membrane.

(iii) *Air and Water Pollution*

The Air and Water Pollution Committee was constituted in June 1970. Its primary aims are :

1. Carrying out research on the various basic problems connected with air and water pollution
2. To collaborate with other concerned agencies like Transport Corporations, law enforcement agencies etc. to control air and water pollution
3. To develop suitable indigenous instruments for the measurements of pollution

The progress made in achieving the above aims are reported below briefly.

(A) *Air pollution*

(a) Basic Research on air pollution problems have progressed in the following areas:

1. Emission control in S. I. engines by improved mixture distribution and enhanced after-burning
2. Development of Low-Emission Stratified Charge Engines
3. Study of Combustion Reactions
4. Carcinogens in the Diesel Exhaust
5. Study of thermal inversions
6. Study of flame quenching in engines and
7. Electrostatic precipitation of fine solids

(b) Collaboration with concerned agencies to control Air Pollution

The I. C. Engines Laboratory, Department of Mechanical Engineering, is working with the Pallava Transport Corporation authorities to control the smoke emissions from their buses.

In the work done upto now, badly smoking buses were selected from their fleet and the causes of smoke emissions investigated. Based on these studies, optimum periods of overhaul and replacement for critical components like injectors, fuel pumps and filters have been recommended.

Under this work, the effects of various smoke-suppressant additives on the engine performance and life are also being investigated.

Adulteration of fuel oil is a major problem faced by transport authorities. This programme includes devising methods of detecting and measuring such adulteration.

(c) Development of indigenous instruments to measure pollutants

Efforts to control air pollution in our country are handicapped by the lack of indigenous instruments to measure pollution In an effort to fill this need, the I. C. Engines Laboratory has developed a Smoke Meter to measure the intensity of smoke emissions from diesel engines. This meter is continuous indicating with instantaneous response. By comparison tests, it has been found to be superior to many imported meters in several respects.

(B) *Water pollution*

Exploitation of ground water is gaining momentum in various parts of the country. One of the less recognised and appreciated causes for contamination of deep wells situated near the coasts is the salt water intrusion.

It is proposed to study the problems of salt water intrusion in the Hydraulic Engineering Laboratory of the Institute as a venture of Institution–Industry liaison.

(iv) *Inter-Disciplinary R & D Groups*

Eleven inter-disciplinary faculty groups have been set up for research and development activity in the following areas :

1. Fluid Mechanics
2. Solid Mechanics
3. Heat and Mass Transfer
4. Combustion and Propulsion
5. Materials Processing
6. Engineering Design
7. Instrumentation and Control Engineering
8. Materials Sciences
9. Chemical Reaction Technology
10. Systems Engineering
11. Chemical Physics

The inter-disciplinary groups meet regularly to facilitate the exchange of ideas and the formulation of collaborative projects requiring joint participation of several departments in areas of overlapping interests.

Several groups are also working on collaborative development projects for such national scientific research and development organisations under the Departments of Space Science and Defence.

As a result of the activity of these R & D Groups, new courses of inter-disciplinary specialization are also being identified for offer to bachelor, master and doctor's degree students and to specific groups of participants from industry and academic institutions. In particular, the group on Chemical Reaction Technology successfully conducted a three-week Orientation Course on Applied Research in Chemical Industry in March-April, 1972.

III. Sponsored Research Schemes / Projects :

(a) The Institute has currently a number of Sponsored Research Schemes/Projects financed by organisations like C.S.I.R., Ministry of Defence, Department of Atomic Energy, Space Science and Technology Centre, Research and Development Organisation for Electrical Industry, etc.

Department of Aeronautical Engineering

Space Science and Technology Centre Scheme

1. Design and Development of an Air Heater
2. Design and Development of Hypersonic Wind Tunnel

Department of Applied Mechanics

A. *C.S.I.R. Scheme*

Design and Development of a low speed strain-rate controlled universal testing machine (Principal Investigator: R. S. Alwar).

B. *Space Science and Technology Centre Scheme*

1. Angular Motion simulator for Satellites Design, Development and Testing.
2. Structural Integrity of case bonded solid propellant grain.

Department of Chemistry

A. *C.S.I.R. Schemes*

1. Mechanistic studies on the activities of semi-conductor oxide catalysts (Principal Investigator: Dr J. C. Kuriacose).
2. Studies on photo-chemistry of aromatic hydrocarbons (Principal Investigator: Dr V. Ramakrishnan).
3. Hydride transfer reactions (Principal Investigator Dr. C. N. Pillai).
4. Mechanistic studies on catalysed substitution of aromatic compounds (Principal Investigator: Dr J. Rajaram)
5. Nucleophilic substitution reactions of Halogeneothers (Principal Investigator: Dr. S. R. Ramadoss).
6. Solid State Chemistry of complex oxides of some transition metals (Principal Investigator: Dr M. V. C. Sastri).
7. Electronics and molecular structural investigations of transition metals complexes by optical and magnetic measurements (Principal Investigator: Dr P. T. Manoharan).

B. *Department of Atomic Energy Schemes.*

Electronic Structural investigations of transition metal ions and their complexes.

C. *PL*-480 *Scheme*

1. Use of Platinum metal complexes as catalysts in homogenous hydrogenation.
2. Study of transition metal oxides with special reference to their catalytic properties.
3. High pressure Catalytic Transfer reaction.

D. *National Science Academy Scheme*

Studies on molecular rearrangements.

Department of Chemical Engineering

A. *C.S.I.R. Scheme*

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

B. *Space Science and Technology Centre Scheme*

Development, testing and production of insulation material for DPS-4.

Department of Civil Engineering

A. *C.S.I.R. Schemes*

1. Behaviour of concrete flexural members reinforced with Indian deformed steels (Principal Investigator: Dr. Ing. P. Srinivasa Rao)
2. Experimental studies on behaviour of raft foundations (Principal Investigator: Dr P. C. Varghese).
3. Investigation on under water Concrete by concrete process (Principal Investigator: Dr P. C. Varghese).

B. *CBIP Scheme*

1. Studies on the fluctuating pressures on stilling basin
2. Scour due to swirling jets.

Department of Electrical Engineering

A. *C.S.I.R. Scheme*

Studies of radio-wave absorption in the lower ionosphere at Madras (Principal Investigator: Dr M. Mukunda Rao).

B. *Department of Atomic Energy Scheme*

Design and construction of a demonstration digital computer.

C. *Research and Development Organisation for Electrical Industry Scheme.*

Development of thyristorized speed control scheme for 3 phase squirrel cage induction motor.

Department of Mechanical Engineering

A. 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. Effect of Turbulence on the performance of turbine blades in cascades with special reference to the separation zone on blade surface suction (Principal Investigator : Dr. D. Prithviraj)

B. Research and Development Organisation for Electrical IndustryScheme

Heat transfer studies in large electrical machines.

C. Ministry of Defence Scheme

Aerial Camera Project.

Department of Physics

A. C.S.I.R. Schemes

Surface state of semiconductors in high and ultra high vacuum. (Principal Investigator: Dr C. Ramasastry).

B. *Ministry of Defence Scheme*

Fabrication of Microwave test bench

C. *Department of Atomic Energy Scheme*

Surface Wave Propagation in Crystals.

(b) Centre for Systems and Devices: A Centre for Systems and Devices has been set up in the Institute for research and training in the Radar and Communications field sponsored by the Ministry of Defence, Government of India. The Centre has among its objects, the following :

(i) Futuristic investigation and research/development activities.

(ii) Offering long term and short term courses in selected areas/topics to Defence Officers and R. & D. personnel.

The Institute is concentrating its efforts in the following fields:

1. Signal Processing Techniques
2. New Semiconductor Devices
3. Control and Guidance Systems

IV. Assistance to Industry :

The dialogue between local Industries, Government Departments/ Organisations and Public Sector undertakings etc. and the Institute in regard to Design and Development, Consultancy and Testing facilities has shown marked improvement over the year. Several long term and short term industrial projects have also been taken up for investigation.

Some of the important Industries, Public Sector/ Autonomous undertakings with whom several Departments of the Institute have interacted are indicated below:

Department of Applied Mechanics

Name of the Firm	*Name of the Project*
M/s L.M. Chitale & Son	Structural Consultancy work for the S.V. University Auditorium
M/s Crompton Engineering Co. Ltd.	Tests on insolated phase busduct for seismic stability
Vehicles Research & Development Establishment	Working out various alternative combinations of gear and pinion
Bharat Heavy Electricals Ltd.	Certain experiments on electrostatic precipitators
Ashok Leyland Ltd.	Analytical and experimental investigations to determine the stress distribution on three different types of rear axle tubes

Department of Chemical Engineering

Geological Survey of India	Beneficiation Studies on bulk samples of molybdenite bearing rock from Kanadukathan area
Gurunath and Sons	Project on dry mixing of additive with edible salt
India Tobacco Co. Ltd	Development of polymeric dies

Name of the Firm	*Name of the Project*
Space Science and Technology Centre, Trivandrum	Process data and design of pilot plant for anhydrous hydrazine
K.C.P. Ltd.	Steam Distribution in conventional pans
Department of Civil Engineering	
UNDP Ground Water project	Construction of an analogue model
EID-Parry Ltd	Foundation and substructure of a machinery in the Co.'s factory Investigations
Directorate of Fisheries	Construction of ferro-cement boats
KCP Ltd	Steel design calculations for one of the grabbing cranes
Tor Isteg Steel Corporation	Investigation regarding the use of Torsteel for concrete sleepers
M/S Kamani Bros. Ltd	Subsoil investigation work for a multistoreyed building
Shri Ram Fibres Ltd	Topographical survey and soil testing for Nylon plant
Military Engineering Services	Subsoil investigation for construction of a multistoreyed building.
Department of Electrical Engineering	
Hygrodyn Private Ltd	Design consultation for a 500 kw. 400 AC/230V DC liquid theostat
Powerplus Battery Service	Design and fabrication of 10 kw 120 V 85 A battery charger
do.	Design, construction and testing of lighting dynamo for power tillers

Name of the Firm	*Name of the Project*
M/s. Carborundum Universal Ltd	Development of instruments for checking electrostatic precipitators
Tamil Nadu Electricity Board	Investigation into certain research problems
Department of Mechanical Engineering	
M/s. Devaki Industries	Fabrication and testing of a traverse indicator
M/s. Best and Co. Ltd	Design and analysis of propeller pump
M/s. Agro Engines Ltd	Design of a centrifugal pump
Central Leather Research Institute	Fabrication of cutting gadget
M/s. Texmo Industries	Consultancy and testing of IC 10 HP monoblock pump
M/s. Best and Co. Ltd	Precision gear pumps
M/s. Freezehold Engineers	Fabrication of one experimental unit in Refrigeration and Air-conditioning
M/s. Thomas Teakwood Industries	Design and development of a plate freezer
M/s. Best and Co. Ltd	Deep hole drilling machine and special purpose boring machine-two projects
M/s. Shaw Wallace and Co. Ltd	Improvement of the performance of a pump – consultancy
M/s Best and Co. Ltd	Detailed dimensional study of low capacity gear pumps
	Improving and testing of an axial flow pump

Name of the Firm	*Name of the Project*
M/s. Easwaran and Sons, Engrs (P) Ltd	Design and manufacture of a set of helical gears for a hydraulic pump
K. C. P. Ltd	Development of computer programmes for optimum design of dual type gearing
Swiss Welded Mesh Co. Ltd	Designing and drawing of a wire drawing machine
Indian Instt. of Petroleum	Design and fabrication of lathe tool dynamometer, drilling dynamometer
Trustwell Industries	Development of nyloc nuts
Hyderabad Allwyn Metal Works Ltd	Improvements to hermetically sealed compressors for refrigerators
M/s. P. Orr and Sons Ltd	Design and fabrication of one set of optical components for telescope.
EID-Parry Ltd	Project on efficient steam utilisation
T.I. Cycles of India Ltd	Reorganisation of pneumatic services.
Department of Metallurgy	
India Pistons Ltd	Preliminary examination of breakage in crankshaft.
Tamil Nadu Water Supply and Drainage Board.	Mechanical testing and chemical analysis of sluice valves.
Continuous Steel Casting Plant	Gamma Ray intensity measurements, etc.

V. Report on Activities of the Quality Improvement Programme :

The activities organised under Q. I. P. of the Indian Institute of Technology, Madras during 1971 72 are the following :—

1. Two Year M. Tech. Degree Course
2. Doctoral Programmes
3. Short-term in-service courses
4. Curriculum Development in Mechanical Engineering
5. Curriculum Development in Chemical Engineering

(1) *Two-year M. Tech. Degree Course :*

Fourteen Engineering college teachers from Mysore, Andhra Pradesh, Kerala, Delhi, Gujarat, Bihar and Maharashtra were admitted to the M.Tech. Course. They were admitted to the Departments of Applied Mechanics, Chemical Engineering, Civil Engineering, Electrical Engineering and Mechanical Engineering. In addition, four sequential summer school participants were admitted direct to M. Tech. II Year.

(2) *Doctoral Programme*

Fifteen engineering college teachers from Kerala, Mysore, Madras, Andhra Pradesh, Madhya Pradesh and Maharashtra were admitted to this programme. They were admitted to the Departments of Mechanical Engineering. Civil Engineering, Electrical Engineering, Metallurgy and Applied Mechanics.

(3) *Short-term in-service courses*

(a) *Heat and Mass Transfer*

The course was organised from 25th April, 1971 to 29th May, 1971. 25 Engineering college teachers from Andhra Pradesh, Bihar, Gujarat, Kerala, Madhya Pradesh, Maharashtra, Mysore, Orissa, Tamil Nadu, Uttar Pradesh, Rajasthan and Assam participated in the course.

The programme included an intensive series of lectures, laboratory work and discussion classes.

A total of 100 lectures were delivered on various topics. The laboratory work was so designed as to enable the participants to gather the know-how of duplicating the experimental set-ups in their respective institutions. Special invited lectures were arranged on 'Heat transfer problems in Nuclear Reactors" and "High Temperature Heat Transfer".

(b) *Automatic Process Control*

The course was organised from 8th November '71 to 27th November 1971. 15 engineering college teachers from Andhra Pradesh, Bihar, Maharashtra, Punjab, Tamil Nadu, Rajasthan and West Bengal participated in the course.

The participants attended lectures on Actual Process Control and carried out experiments on a number of process control units such as those for regulation of temperature, pressure, level, humidity, hydrogen ion concentration and weight.

(c) *Foundation Engineering with special emphasis on Machine Foundations*

The course was organised from 29th November 1971 to 24th December 1971. 25 Engineering college teachers from Andhra Pradesh, Bihar, Gujarat, Kerala, Madhya Pradesh, Maharashtra, Mysore, Punjab, Tamil Nadu, Uttar Pradesh and Haryana participated in the course.

For the first time in India, an organised course in well foundation has been given. Apart from the design of a well foundation, the various hypotheses and the latest developments and thinking with regard to the lateral stability of a well foundation which is very important have been presented and discussed. The various developments with regard to the settlement analysis, soil-structure interaction problems, the shear strength of soil, etc. have been high-lighted and discussed to stimulate interest in the participants for further studies.

(d) *Metallography and Heat Treatment of Steel*

The course was organised from 29th November, 1971 to 28th December, 1971. 20 Engineering college teachers from Andhra Pradesh, Kerala, Mysore and Tamil Nadu participated in the course. The course laid particular emphasis on principles and methods and consisted of lectures, laboratory experiments and visits to appropriate industrial establishments. Two lectures were delivered by the Chief Metallurgist of Ashok Leyland.

(e) *Mathematics for Teachers from Engineering Colleges*

The course was organised from 1st December, 1971 to 16th December, 1971. 32 participants from Andhra Pradesh, Bihar, Gujarat, Kerala, Maharashtra, Mysore, Orissa, Tamil Nadu, Uttar Pradesh, West Bengal and Delhi participated in the course.

(f) *New Energy Transformation Technology*

The course was organised from 13th December, 1971 to 25th December, 1971. 26 participants from Andhra Pradesh, Gujarat, Kerala, Madhya Pradesh, Mysore and Tamil Nadu participated in the course.

Seminar and group discussion were conducted instead of formal routine lectures, since the duration was limited to two weeks. Four guest lectures were arranged and the laboratory work enabled the participants to acquaint themselves with the sophisticated measurement techniques in the Indian Institute of Technology, Madras.

(g) *Short term course in Process Control*

(h) *Summer School in 'Nonlinear Structural Mechanics'*

(i) *Sequential summer school in Mechanical Engineering*

(j) *Short term course in Engineering Design*

(4) *Curriculum Development in Mechanical Engineering*

Under the Curriculum Development Programme, various study groups were formed with a view to identify the contents of the courses pertaining to that group. Experts from industries were also invited to participate and share their thoughts with the members of the group. The following study groups have met :

1. Material Science.
2. Thermodynamics
3. Heat Transfer, Refrigeration & Air-conditioning.
4. Production Engineering and Workshop Practice.
5. Laboratories.

The proceedings of these group meetings are being processed and will soon be brought out as individual booklets.

This Centre has also taken up the preparation of monographs on selected topics in the field of Mechanical Engineering. The one on Machine Design is nearing completion whereas topics on which monographs are being prepared include, Thermodynamics Problems, Metrology etc. These monographs are intended to serve as guides for teachers.

The Centre has also taken the work for preparing a Mechanical Engineering Laboratory Manual. This manual is intended to give guide lines for conducting each experiment, equipment needed, and for recording data. It would also give guide lines for the construction of laboratory equipment from indigenous material.

Efforts are being made to identify the names and addresses of the teachers of the engineering colleges relating to each subject of the curriculum, and to get them involved in the programme. There has been good response and active participation from them.

Group discussion was found very useful and made the members aware of the entire educational process in the right perspective. It has been planned to hold seminars and Colloquia on several aspects concerning technical education and make a concerted effort to evolve appropriate methods to improve the efficiency of the system. Two booklets, one on Electrical Engineering and the other on Mechanics have been brought out. Copies of the proceedings of the other groups are under preparation.

(5) *Curriculum Development in Chemical Engineering.*

(a) The Study Group of the Centre met on 3-6-1971 and suggested the formation of an Advisory Committee to consider the Programme of activities of the Centre.

The views of all the Heads of Departments of Chemical Engineering of Indian Universities were ascertained and placed before the Advisory Committee which met on September 18th and 19th, 1971. The recommendations of the Advisory Committee are:

1. Defining the objectives of chemical engineering education and revision of curriculum and syllabi.
2. Compilation of information about facilities available for teaching and research in Chemical Engineering.
3. Compilation of information about experimental units, models and instruments which are designed and fabricated in various institutions.
4. Preparation of laboratory manuals in Chemical Engineering.
5. Compilation of design and cost data.

6. Preparation of a pamphlet indicating the objectives and methodology of practical training in industry.

7. Compilation of a register of research and development problems from industries which can be given as projects for B. Tech./M. Tech /Ph.D. so that the institutions work on live problems of industry.

8. Procurement of films, slides, industrial cutouts and other teaching aids.

9. Publication of a manual of Chemical Technology with individual chapters written by experts and dealing with development of chemical industries in India.

10. Publication of a manual of design of process equipment following I.S.I. standards.

11. Organization of programmes of continuing education and seminars.

Expert Committees were appointed to advise the Centre on the following areas:

1. Objectives and Curricula.
2. Design and Cost Data.
3. Manual of Chemical Technology.
4. Training in Industry.

The Expert Committee on "Objectives and Curricula" completed the work and a pamphlet "First degree course in Chemical Engineering Objectives and Curricula" is published.

The work of the Committee on 'Manual of Chemical Technology' is in good progress and is expected to be completed by February, 1973.

To suggest revised and up-dated syllabi for the Chemical Engineering curriculum for the first degree course, thirteen study groups were formed. These study groups are going through their individual assignments.

In order to ascertain the relevance of the curriculum to the Chemical Engineering Profession, a questionnaire was drawn up and sent to over

2,000 members of the Indian Institution of Chemical Engineers. More than 670 of these have been returned. The analysis of the responses to this questionnaire is being done presently.

(b) Two seminars were conducted under the auspices of this Centre :

1. Application of Statistical Methods in Chemical Engineering, in collaboration with Indian Statistical Institute.
2. Materials of construction — in collaboration with Esso Standard Refining Company of India Ltd., Bombay.

The following Publications were brought out by the Centre :

1. Programme of work recommended by the Advisory Committee, Chemical Engineering Curriculum Development Centre.
2. Selective Bibliography of literature on Chemical Engineering Education, 1959-71.
3. Application of Statistical Methods in Chemical Engineering.
4. Chemical Engineering Education and Research in Indian Universities.
5. First Degree course in Chemical Engineering—Objectives and Curricula.
6. Materials of construction.

(c) Manuals under preparation

Manual of Chemical Technology
Manual of Chemical Process Principles
Solid fuels
Guide for practical training in industries
Bibliography of cost estimation on Chemical Process Equipment

VI. Continuing Education Programmes for Practising Engineers :

The Institute conducted the following Programmes :

(1) Advanced Short Course on Highway Bridges

(2) Special Course on 'Design & Construction of Concrete Shell and Folded Plate Structures'

(3) Refresher course in 'Sub-Soil Exploration and Soil Testing'

(4) Advanced Course on 'Coastal Engineering'

(5) Short term course on Applied Research in Chemical Industry

(6) Short term course in Particle Size Analysis.

(7) Advanced summer school in Unconventional Machining and Modern Production Techniques.

(8) The Institute also conducted a 24-weeks Management Training Programme, a one-year design trainees and a nine-weeks Process Planners Programmes for Engineers from H. A. L. Bangalore.

These Programmes will be offered in the coming year also.

Besides, the Institute was the venue for the Fourth Annual Convention of the Operations Research Society of India and the First National Heat and Mass Transfer Conference.

VII. Awards and Distinctions:

(a) The Institute had the privilege of four of the members of the Institute from the Department of Chemical Engineering being awarded during the year 1971-72, a prize for Import Substitution by the Inventions Promotion Board for the Fluid Energy Mill developed by them.

(b) The Inventions Promotion Board awarded the Institute a Bronze Shield in recognition of the motivating effort provided by the authorities which has resulted in successful development of the above item.

VIII. Third Indo-German Agreement:

The Third Indo-German Agreement was signed on the 26th of November, 1971 for the further development of the Institute and for the consolidation of the facilities already established by West German Collaboration. The Government of the Federal Republic of Germany will be bearing the foreign exchange costs in respect of the purchase of a large scale modern computer system upto an amount of D.M. 1.9 million. In addition, a sum of Rs. 10 million from the West German Food Aid Funds will also be used for this purpose.

The West German Government will also be giving, in addition to the above, equipment and spares to the various Laboratories already established under the First and Second Indo-German Agreements. Professors in specialised areas and technical experts for the Central Services in the Institute will also be assigned to the Institute for specified periods. Distinguished West German Professors will be visiting the Institute for short periods so as to continue and strengthen the already existing academic relationships between the Faculty of the Institute and the Faculties in the Technical Universities in West Germany. A number of Fellowships will also be offered for faculty members of the Institute for training and study visits in West Germany.

The Indian Institute of Technology, Madras is fortunate in having technical collaboration with leading Technical Universities in West Germany since its inception. This has enabled close contacts being established between Industry and the Indian Institute of Technology, Madras, as in West Germany.

The Third Agreement will enable the Institute to reach its cherished goal as a centre of excellence in the field of Higher Technological Education, Research and Development in India.

IX. Convocation :

The Institute has held nine convocations so far. At the 9th Convocation, held on the 26th August, 1972, Dr. Malcolm S. Adiseshaiah, Director, Madras Institute of Development Studies, was the Chief Speaker. 489 students took their degrees and diplomas as detailed below:

Degree	*Branch*	*Number*
Ph.D.	Chemistry	2
	Mathematics	3
	Physics	2
	Chemical Engineering	2
	Civil Engineering	2
	Electrical Engineering	7
	Engineering Mechanics	1
	Mechanical Engineering	8
	Metallurgy	2

Degree	*Branch*	*Number*	
M.S.	Aeronautical Engineering	3	
	Chemical Engineering	5	
	Civil Engineering	1	
	Engineering Mechanics	1	
	Mechanical Engineering	8	
	Metallurgy	3	
		——	21
M.Sc.	Chemistry	17	
	Mathematics	12	
	Physics	16	
		——	45
M.Tech.	Aeronautical Engineering	10	
	Chemical Engineering	14	
	Civil Engineering	30	
	Electrical Engineering	31	
	Engineering Mechanics	8	
	Industrial Engineering	8	
	Industrial Management	12	
	Mechanical Engineering	29	
	Metallurgy	11	
		——	153
B.Tech.	Aeronautical Engineering	18	
	Chemical Engineering	29	
	Civil Engineering	38	
	Electrical Engineering	46	
	Mechanical Engineering	71	
	Metallurgy	33	
		——	235
D.I.I.T.	Building Technology	6	6
		Total	489

X. Participation in Science Fairs :

The Institute has been playing an active role in the organisational work of the Annual Science Fairs being conducted by the Madras Science Association. Student participants from the Institute have given a creditable account of themselves. A brief report on the activities for the years 1970 and 1971 are given below.

1970: The Institute acted as the host institution for the First Annual Science Exhibition organised by the Madras Science Association in September, 1970. The Institute got a rolling trophy for the best overall entries in the field of Engineering Sciences. The first prize for the best entry in the Engineering Sciences was also won by a student of the Institute.

1971 : The Institute participated in the Second Annual Science Exhibition held by the Madras Science Association at the Madras University Examination hall, during 24th to the 28th of September, 1971. The first prize for the best exhibit in Engineering Sciences was won by Mr. Laxminarayanan of the M. Tech. class of the Institute. The Rolling trophy for the Quiz contest for undergraduate students was won by the B. Tech. students of the Institute. The post-graduate team won the second prize in the Quiz conducted at the post-graduate level.

Mr Laxminarayanan of the M. Tech. class was sent to Delhi along with 28 others of the City Colleges to participate in the National Science Exhibition conducted under the joint auspices of the Jawaharlal Nehru Memorial Trust, National Council for Science Education and NCERT at he National Physical Laboratory, Delhi. The Physics Department participated in the same Exhibition by organizing a number of demonstration experiments in Physics to the visiting public at Delhi who appreciated the programme very much.

XI. Research Work and Allied Activities :

The promotion of Research work has been one of the major endeavours of all the Departments of the Institute as in the past. 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 report, 29 scholars qualified for the Ph. D. bringing the total number of recipients to 111 over the last 8 years.

A publication summarising the research and allied activities of the Departments including Seminars and Symposia attended by the Faculty Members and publications of research papers covering the investigations carried out in the Science and Engineering Departments was placed before the Council.

XII. Union Catalogue of Books/Periodicals :

Union Catalogue of Serial Holdings available in all the IITs and IISc. complementary in nature to the Union Catalogue of Periodical Holdings of the same group of Institutes published last year, has now been printed by the Reprographic section of the Library from the Computer print, out of data previously collected and punched on the IBM cards.

With the release of Union Catalogue of Periodical Holdings and commencement of SDI service, requests have been coming from research scholars as well as from outside organizations in large numbers for photocopies or microfilms of articles. These are being attended to by the reprographic section of the Library.

XIII. Progress under "Construction" :

The Engineering Unit took up construction of some new buildings in addition to completion of works in progress in the previous year. The following works are under progress :

1. Setting up of Laser Communication Laboratory
2. Applied Chemistry block.
3. Centre for Systems and Devices
4. Setting up of Computer Centre
5. Gas Dynamics Laboratory
6. Staff Residential quarters : 30 flats
7. Flatlets : 24

The total amount spent on construction during the year 1971-72 was Rs. 32·35 lakhs.

XIV. Staff :

During the year, one Associate Professor and one Liaison Officer were assigned to the Institute from West Germany under the Indo-German Agreement.

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

1. Professors – 2

2. Senior Scientific Assistant – 1

During the year, 4 Associate Professors, 22 Assistant Professors, 16 Lecturers, 10 Associate Lecturers, 1 Senior Seientific Officer Gr. II, 2 Design Engineers, 1 Optical Designer, 2 Research Assistants, 10 Senior Technical Assistants and 10 Technical Assistants were appointed. These include the appointment of 2 Mechanics 'A' as Technical Assistants, 2 Technical Assistants as Senior Technical Assistants, 2 Associate Lecturers as Research Assistant/Design Engineers, 6 Senior Technical Assistants as Associate Lecturers, 7 Associate Lecturers as Lecturers, 18 Lecturers as Assistant Professors and 2 Assistant Professors as Associate Professors.

2 Lecturers, 3 Associate Lecturers, 11 Senior Technical Assistants and 3 Technical Assistants resigned.

XV Budget Proposals :

(i) Approved Budget and the expenditure for the year 1971—72 :

Approved Budget (Net) 1971-72,	
i.e., Revised Estimates	Rs. 194·41 lakhs
Amount allotted by the Ministry	Rs. 185·69 lakhs
Actual expenditure 1971–72 (Net)	Rs. 186·78 lakhs

(ii) Budget proposals for Revised Estimates 1972-73 and Budget Estimates 1973-74

Figures in lakhs of rupees

	Actuals for 1971-72	Budget for 1972-73 as per Ministry	Budget for 1972-73 as approved by Board	Revised Estimates 1972-73 (as recommended by Finance Committee and approved by Board)	Budget Estimates 1973-74 (as recommended by Finance Committee and approved by Board)
	Rs.	Rs.	Rs.	Rs.	Rs.
Recurring	152·31	151·60	163·42	165·24	166·93
Non-recurring					
Buildings	32·35	75·00	40·00	63·18	65·00
Equipments and others	20·80		23·18		
Total	205·46	226·60	226·60	228·42	231·93
Less Income	18·68	14·60	14·60	17·61	16·10
Net	186·78	212·00	212·00	210·81	215·83
Notional provision					
(i) Equipment	65·99	45·00	45·00	45·00	50·00
(ii) Partial adjustment for Computer from West Germany	—	15·00	15·00	15·00	85·00

XVI. Reviewing Committee :

The Reviewing Committee submitted its report to the Visitor during this year. The Ministry of Education and Social Welfare has informed the Institute that the reports of the various Reviewing Committees when received will be referred to a Special Committee. The Special Committee will examine the reports in detail in consultation with the Directors and make its recommendations to the Council. The Institute has taken note of in general all the valuable recommendations of the reviewing Committee and is already doing the preliminary work to implement those recommendations during the next Five Year Plan. The Institute hopes that the financial requirements for implementing these recommendations would be made by the Ministry of Education and Social Welfare, Government of India in liberal measure.

XVII. Reservation and Special Facilities for Scheduled Caste/Scheduled Tribe Candidates :

(a) *Admission* :

Reservation orders and advice received from the Ministry of Education and Social Welfare are implemented for Under-graduate and Post-graduate admissions. The following special concessions are offered :

Under-graduate Courses

(i) The upper age limit is relaxed by 3 years.

(ii) Those who qualify in the Joint Entrance Examination (J.E.E.) are offered admission irrespective of their merit positions in that Examination.

(iii) They are exempted from payment of tuition fees

(iv) Government of India Scholarships, subject to the rules laid down from time to time are available irrespective of the merit position in the J. E. E.

For the admission to the session 1973-74, reservations/concessions available for SC/ST candidates have been prominently announced in the admission notices and instructions to candidates.

Post-graduate Courses

The minimum percentage of marks for Scheduled Castes/ Tribes is 5% less than that prescribed for admission requirement in respect of the general students and the guidelines in the letter No. F. 30-36/63 T. 5 dt. 16th June, 1964 of the Ministry of Education, Govt. of India, are followed.

All those teachers belonging to SC/ST sponsored by their employers are admitted liberally.

(a) *Reservations'concessions in service* :

Reservation orders as communicated by the Ministry of Education & Social Welfare are followed.

In all advertisements for posts where reservation orders apply, this fact is clearly mentioned. For other posts also where even though reservation does not apply it is mentioned that preference will be given to SC/ST candidates subject to other things being equal. In the case of posts where reservation does not apply, SC/ST candidates are given preference in being called for interview even though others having only minimum qualifications are not called for interview.

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ANNEXURE 'A'

AERONAUTICAL ENGINEERING

The Department continues to offer courses leading towards B.Tech./M.Tech degrees as well as M.S./Ph.D. by research. In the case of M.Tech./M.S./Ph.D. students, specialisation is possible in any one of the following areas (i.e.) Aerodynamics/Gas Dynamics/Propulsion and Structural Mechanics. Time and again, the curricula for different courses have been reviewed and revised to be in consonance with the objectives of the Department, namely to be purposeful and utilitarian.

Development Activities

Aerodynamics/Gas Dynamics Laboratory:

The calibrations on the supersonic blow down windtunnel having a square test section of 100 mm. × 100 mm. and operating in a Mach number range of 1.75 to 3.75 and the Transonic Induction Windtunnel having a test section size of 263 mm. × 100 mm. and an operating Mach number range of 0·5 to 0·97 have been completed.

A free jet tunnel with simulation capability upto 25 km. altitude has been designed and fabricated. The test chamber is of 300 mm. dia. and encloses a supersonic free air jet of 70 mm dia. Altitude simulation is achieved by means of air ejectors placed downstream of the section. The tunnel is capable of a maximum operation time of twenty minutes in the Mach number range of 1·75 to 3·0.

Design and development of the hypersonic windtunnel project is progressing satisfactorily. Orders are being placed for vacuum pumps and a vacuum vessel. Design details concerning the Match 8.30 mm. axi-symmetric nozzleand the boundary layer growth in it is nearing completion. Work on the design of an air-heater and an after-cooler is under progress.

A rheo-electric tank for the study of axi-symmetric potential flow is being fabricated.

Propulsion Laboratory :

Tests, on the model Pebble Bed Air Heater, have been completed. The work on the full size heater for SSTC at Trivandrum is in progress.

A facility for testing combustion chambers of turbojet and ramjet engines is being set up. Another set up, that is being developed, is intended to study ' Fuel Injection Through Rotating Pipes '.

Analytical and experimental investigation on subsonic axi-symmetric plug nozzles are in progress.

Structures Laboratory :

Three more additional experimental set ups have been added in the following areas :

1. To study the instability of columns under periodically varying axial loads.

2. To determine the critical load parameter of a variable cross-section column having either hinged or fixed end conditions and their combinations.

3. To determine the horizontal and vertical displacement of the tip of the cantilever beam with a concentrated load at the free end, for various values of the load.

Facility is available for testing Fibre Reinforced Plastic plates for the purpose of calculating their material and elastic constants.

Research Work

Structural Mechanics :

The departmental research activities in future in the area of Structural Mechanics, is going to be oriented more towards composite materials and structures. Some initial work has already been done in the area of filament wound composite structures. Project reports in this connection have been submitted to R and D and CSIR for being sponsored. The results of these efforts are expected to come out shortly.

The other research work by the structural mechanics group of this department mainly concerns itself with elastic and plastic stress analysis of plates and shells, thermal stress analysis problems, experimental and theoretical investigation of gridworks, vibration of orthotropic and multi-layered shells and nonlinear vibration of beams, plates and shells.

Aerodynamics/Gas Dynamics :

Stability problem of superposed fluids. Boundary layer stability; Non-linear problems in aerodynamics; Lowspeed aerodynamics.

Propulsion :

Supersonic combustion; Solid and Liquid Propellant Rockets, Ramjets; High Temperature Gasdynamics and Aerodynamic Heat Transfer.

Short-term courses and Seminars

The Indian National Science Academy has sponsored a 3-week long summer school in 'Nonlinear Structural Mechanics' for promoting research wok in this area. The participation at this summer school has been restricted to active research workers drawn from various institutions in this country. Dr. K. A. V. Pandalai has been asked to be the Organising Secretary for this summer school. This is proposed to be held at the Birla Institute of Technology, Ranchi in May, 1972.

A 3-day seminar on the role of Computers in Structural Analysis, Design and Optimisation is scheduled to be held at I.I.T. during December, 1972.

A series of 6 lectures, were given by Dr. V. M. Ghatage, who was formerly the Chief Designer and later the General Manager (Aircraft) of Hindustan Aeronautics Limited, Bangalore, on 'The Basic Approach to Aircraft Design' from 27th March, 1972 to 31st March, 1972.

Liaison with Industry

The Hypersonic Windtunnel facility is being developed for the Space Science and Technology Centre, Trivandrum.

Departmental Publication

The first part of a book entitled 'The engineering theory of Bending, Buckling and Free Vibration of straight beams, flat plates and thin shells' is ready for publication. The author of the book is Dr. K. A. V. Pandalai.

APPLIED MECHANICS

The Department of Applied Mechanics expanded its activities by the initiation of an Inter-disciplinary Biomedical Engineering Programme. This programme which is of an Inter-Disciplinary character involves several Departments of the Institute and the coordination of the programme has been undertaken by the Bio-Mechanics group of the Department. The third batch of M.Tech. students in Engineering Mechanics graduated in 1971. The M.Tech. programme in Mechanical Engineering with Machine Dynamics option was started by the Department during the academic session 1971-72. The Department had during 71-72 nineteen Ph.D. scholars, six of them under the Quality Improvement Programme. The Department also had 4 M.S. scholars. 5 students were admitted in July 1972 for the M.Tech. Programme in Engineering Mechanics with one under the Quality Improvement Programme. 7 students have been admitted to the M.Tech. programme in Machine Dynamics. The Department continued its research activities and also its industrial liaison work during the year under review.

During July, 1972 seven students admitted to M.Tech. programme in Machine Dynamics and five to Engineering Mechanics (one under QIP).

Research Work

Solid Mechanics :

Structural Vibrations of Bridges — Some Investigation in the field of Structural Optimization. — Application of Finite Element Technique to Limit Analysis of Slabs — Dynamic Response of Curved Bridges — Non-linear Analysis of Sandwich Structures — Some Studies in Non-linear Problems in Elasticity — Energy Search — Three-dimensional Photoelastic and Finite Element Analysis of the Thick-walled Conical Shells — Viscoelastic Analysis of Adhesive Joints — Viscoelastic Analysis of Solid Propellant Grain — Nonlinear Analysis of Circular Cylindrical shell — Application of Finite — Element Method in Elastoplasticity - Shells with Cut-outs — Three-dimensional Stress Analysis of Certain Biomechanical Problems — Vibration and Buckling of Plates — Free Vibration and Buckling of Helically wound Conical Shells — Transient Response of Structures under Thermal and Mechanical Loads — Buckling of Helically Wound Multi-layered Circular Cylindrical Shells — Development of a Method for the Experimental Determination of Elastic Compliances of Composites — Stress Analysis of Nose-cone Type Structures — Impulsive Loading of Plates and Shells — Static and

Dynamic Response of Filament Wound Structures — Analysis of Hyperbolic Paraboloidal Shell — Large Deflection of Skew Plates — Vibration and dynamics of shells — Analysis of plates and shells by Numerical Methods — Creep Buckling of (1) Columns under Distributed and Concentrated Loads and (2) Noncircular Rings subjected to Normal Load — Application of Finite-element Method in Elasto-elasticity. and Vibration of Continuous Circular Plate Systems. (Isotropic and Orthotropic) — Buckling and Vibration of Elastically Coupled Circular N-Plate System — Buckling and Vibration of Orthotropic Circular-Complete and Annular Plates — Nonlinear Vibration of Rectangular and Circular Plates — Yield Criteria for Orthotropic Plates — Prediction of Criteria for the On-set of Machine Tool Chatter Using Analogue and Theoretical Methods — Buckling and Vibration of Anisotropic Conical Shells.

Machine Dynamics (Mechanisms, Vibrations , Acoustics and Tribology) :

Theoretical and Experimental Investigations of Instability due to Oil Film Hydrodynamic Journal Bearings — Studies on Response of Structures to Random Acoustic Excitation — Design and Development of a Shock Testing Machine and Studies Connected with Mechanical Shock Phenomena — Computer Oriented Design of Machine Tool Structures — Studies on the Critical Speed and Response of Rotors Supported on Hydrodynamic Journal Bearings — Some Studies on Hydrostatic Thrust Bearings with rotation and Capillary Restriction — Static and Dynamic Characteristics of Machine Tool Structures Taking into Account Effect of Damping Rotatory Inertia and Shear Deformation — Static and Dynamic Characteristics of Hydrostatic Bearings and their Applications in Stability Problems with Rotation and different types of restrictors—Some Study on self-excited Vibrations in Horizontal Milling Machine — Viscous Damper Design and Study of Isolation of Foundations — Studies on Disk Type Horns — Vibrational Analysis of Swept Back Aircraft Wings with Attached Engine Mases — Rotor Instabilities in Gas Lubricated Bearings — Static and Dynamic Stress Analysis of Cylindrical Shells with Cutouts — Static and Dynamic Behaviour of Machine Structures — Reduction of Vibration in Structures by Applied Damping Treatment - Rotor Instabilities in MHD Bearings — Instabilities in Rheodynamic (grease) Lubricated Bearings — Acoustic Response of Structures and Noise Studies — Performance Characteristics of a Double Acting Pneumatic Spring and its use as a

Vibration Isolator and also as a Vibration Free Table — Development of a Torsional Vibration Exciter and Study of Dynamic Torsion Problems of Non-Circular Shafts — Some Problems Connected with Shock Studies — Performance Characteristics of Indigenous Acoustic Materials and Design of Acoustic Horns — Critical Speed and Rotor Instabilities in Oil Lubricated Journal Bearings — Design and Development of an Electro-Dynaulic Valve for Hydraulic Vibration Machine — Some Problems on Riding Comfort of Road Vehicles — Design, Development and Performance Characteristics of Dynamically Loaded Journal Bearings — Model Studies on Machine Tool Structures — Design of a Model of an Airplane and Experimental Determination of its Structural Response to Vibration and Noise.

Fluid Mechanics :

Experimental Investigation of an incompressible three-dimensional wall jet — Experimental Investigation of Three-dimensional Turbulent Boundary Layers — Aerodynamic Interference between Fuselage and Nacelles in case of Rear-mounted Engines — Investigation of the Incompressible Flow in Nozzles — Experimental Investigation of Optimum Axi-symmetric diffusers — Effect of contraction ratio and screens in nozzles — Potential flow past axisymmetric bodies — Experimental Investigation of three-dimensional Boundary Layer Development on yawed wings — Wind force measurements on the model of auditorium for Sri Venkateswara University — Liquid Sheet formation in Swirl Spray Automisers — Three-dimensional wall jets; Experimental investigation of the properties three-dimensional wall jets for various initial geometrics — Experimental investigations on the efficiencies of stepped diffusers — Investigation of annular aerofoils at angles of attack; Pressure and velocity measurements both inside and outside of the annular aerofoils is envisaged.

Biomedical Engineering :

Development of Vernier and Microelectrode Device for Stereotaxic Procedures — Incorporation of a Quick Heating System for Croyo pens, used for detaching Eye Lenses — Development of a Transducer System for Monitoring Human Body Vibrations — Device for Determining Instantaneous Ground Reaction during Locomotion — Left Ventricular wall Stress and Vibrational Analysis (for Cardiac Diagnostic Indices) by Finite Element Method — Tractor Suspensions Design for Human Comfort — Development of Collogen Membranes and Evaluation of its Suitability for use in Artificial Kidney and Oxygenerator

Systems — Electro-mechanical Design Considerations in the Development of a Myoelectrically Controlled Artificial Arm — Nontraumatic Determination of the Mechanical Properties of Bones — Opto-electronic Transducer (employed invivo) for Monitoring the Vibrational Frequency of the Mitral valve Cusp — Analysis of Spinal Injuries During Vehicular Impact — Stress and Vibrational Analysis of the Mitral Valve Membrane to Non-traumatically Determine its Effective Modulus and Hence Infer its Pathology — Mechanical (stress, Buckling and fluid mechanical) Analysis of the tricuspid aortic valve to provide Design Guidelines for a Prosthetic Valve — Stability Analysis and Provision for above knee Limb Prostheses; Optimum Structural Design of Socket and Shank for Below Knee Prosthetics — Biomechanics of Squatting and Design Modification of Below Knee Limb Prosthesis to Facilitate Squatting — Stability analysis of Brachial Artery in relation to Korotkoff sounds — Mechanical Stresses in the Brain Under Acceleration Force-fields. — Design of Optimum Shape (for minimising Turbulence) for ball-cage Type Prosthetic Aortic Valve — Stresses in the Pallate Due to Artificial Dentures: Optimum Design of Artificial Dentures — Design of an Implantable Intra-crantal Pressure Transducer — Design of an optimum size of curved tube for preventing hemolysis—Determination of Optimum dimensions of the cardiac Cathertor to minimize error in pressure recordings — Frequency analysis of brain potential wave patterns (EEG) of varying states of consciousness — Experimental determination of vibrational frequencies of eye-ball — Peristaltic motion of fluids — Pulsatile flow in Bent Pipes — Rehabilitation of Fingers of Leprosy Patients — Development of instruments of measurements of finger movements associated with normal and pathological situations for diagnostic purposes. — Dental Mechanics — Mechanics of Foetus-uterus interaction around the period of Labour and until Delivery — Blood flow in Aortic and venous valves — Fluid Mechanics of aortic valves — Stress Analysis of the Femur and Design of an Artificial Implant — Mechanics of Neuromorphology. — Suture Diastasis following rapid weight gain in marasmic children — Growing (childhood) skull fractures.

Design and Development

Solid Mechanics :

1. An apparatus for the measurement of transient strains and impact forces on structures has been developed.

2. Moire Fringe Apparatus Fabricated.

3. Impact Testing Machine being fabricated.

4. Plate Buckling Frame.

5. Tension-Torsion Testing Machine.

6. Bending and Torsion Test Set-up.

7. Design and Fabrication of Wohler Fatigue Testing Machine for Demonstration purposes. (The fabrication is almost over except for the concreting of the foundation bed).

8. Resistance Network for Orthotropic Shells.

9. Design of reverse-bending fatigue testing machine for flat specimen.

10. Design and Development of a Strain-rate Controlled Testing Machine.

Machine Dynamics :

1. Universal Journal bearing testing machine.

2. Shock testing machine.

3. Hydraulic Vibration machine.

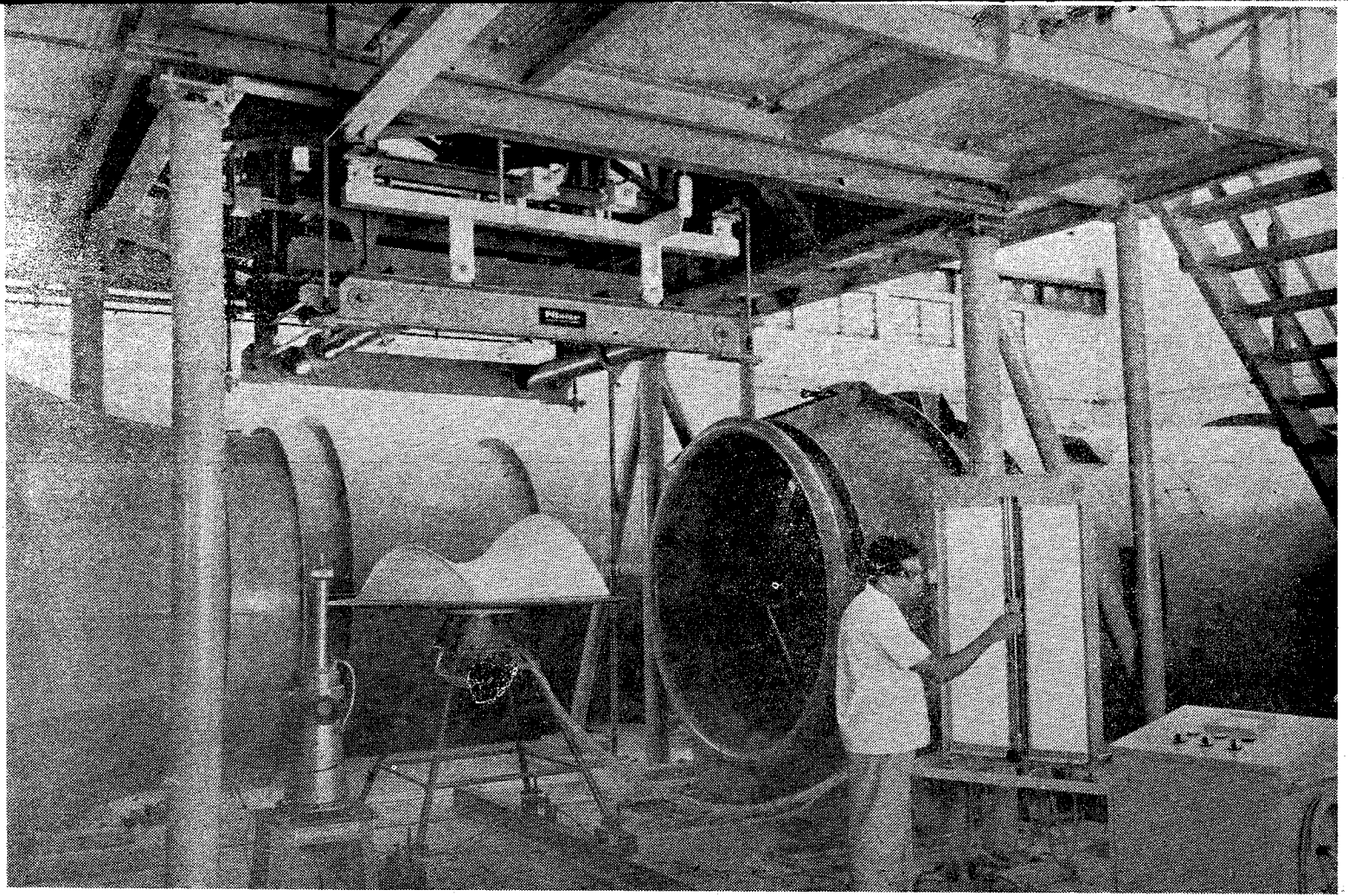
4. Electrodynamic exciter.

5. Hydrostatic bearing test rig.

6. Acoustic horn (exponential type).

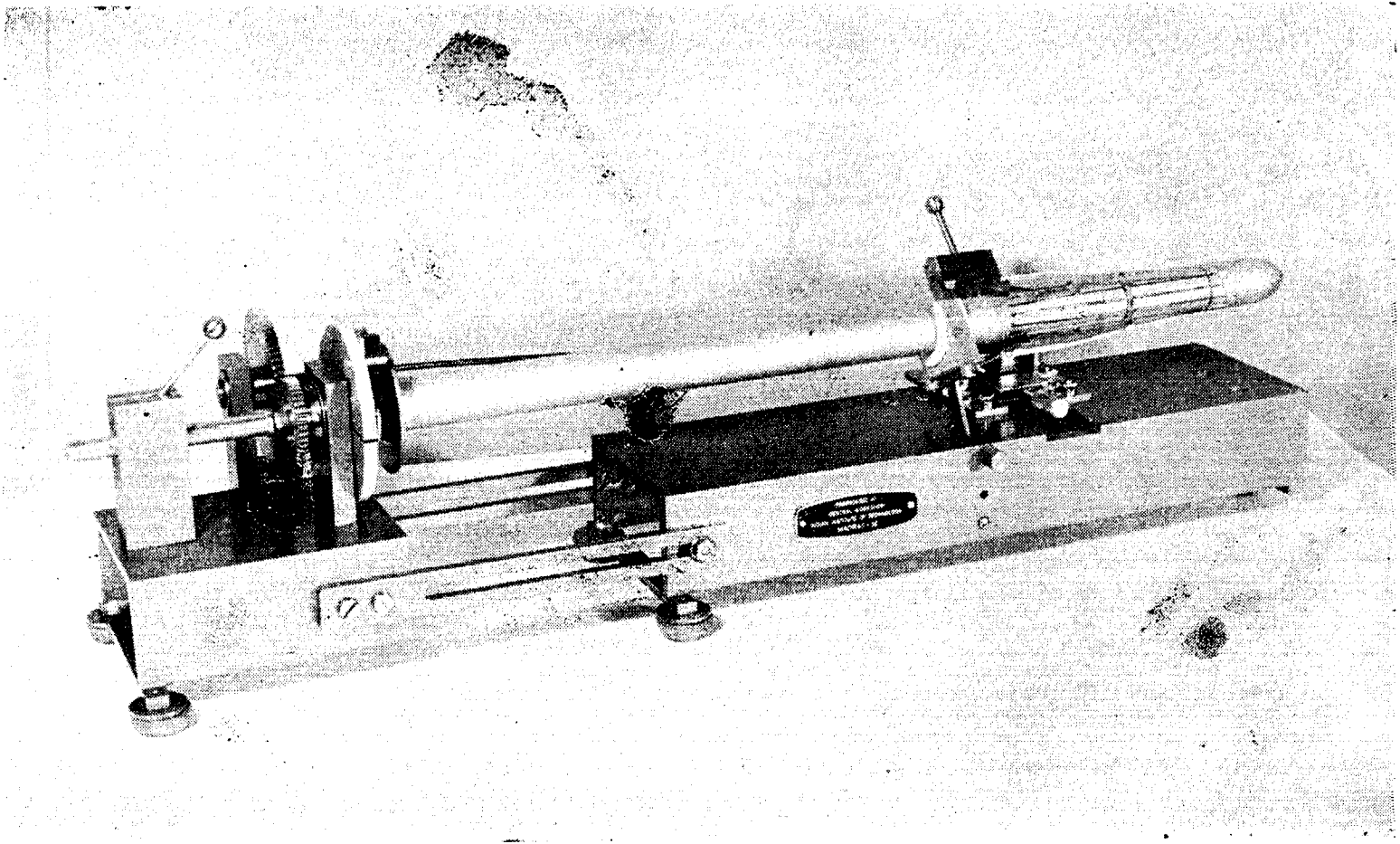
7. Mechanism for fatigue testing of conductor spacers.

8. Pneumatic spring suspension.



Model Studies on a hyperboloidol shell for an auditorium in wind tunnels

—Department of Applied Mechanics



Glueing Machine for Natural Intestine

– Central Workshop

CHEMICAL ENGINEERING

Brief review of the activities of the department in teaching, research and industrial liaison work is given below :

Teaching and Research

The number of students on rolls during 1971-72 and number graduated are given below :

	No. on rolls	*No. graduated*
B.Tech.	129*	29
M.Tech.	43**	14
M.S.	10	4
Ph.D.	20	3

* Last 3 years of the five year course

** 1st and 2nd year

Dr. D. Venkateswarlu has delivered a series of five lectures on "Problems of Particle Technology" at Andhra University under the University Extension Lectures Scheme. Proceedings of the International Seminar on "Particle Technology" has been edited by D. Venkateswarlu and A. P. Rao and has been published during the year 1971-72. Y. B. G. Varma worked at Technical University, Berlin (on Von Humboldt fellowship) on a Joint Research Project — Multistage Fluidisation — with Prof. H. Brauer, Lehrstuhl and Iinstitut fur Verfahrenstechnik.

The research projects of the department based on the six areas of specialization of the department — Transfer Operations, Reaction Engineering, Process Control, Particle Technology, High Polymer Engineering and Design — are being organized to dovetail such that the departmental productivity increases.

To organise the research activity in Reaction Engineering, on more sound basis by identifying the systems of relevance to industrial needs, M. Satyanarayana has worked for 3 weeks at Regional Research Laboratory, Hyderabad during summer. A PL-480 scheme has been sanctioned for "Catalytic high pressure hydrogen transfer reactions" with C. N. Pillai of Chemistry Department and M. Satyanarayana of Chemical Engineering Department as principal investigators.

The new research projects initiated in each area of specialization are given below:

Transfer Operations	—	Dispersion of powders in viscous fluids, Freeze drying.
Reaction Engineering	—	Development of fermentation reactors for vitamin B-12, Plasma reactor.
Process Control	—	Dynamics of heat pipes and plate heat exchangers.
Particle Technology	—	Venturi scrubbers.
High Polymer Engineering.		Polymeric surface coatings and degradation of polymers during processing.

Applications for two patents on polymeric surface coatings and cotton linters as additives for PVC have been made.

M. Ramanujam and P. R. Krishnaswamy have organised Short Term Courses on Particle Size Analysis and Process Control respectively.

Education Development Centre has conducted two seminars, — Application of statistical methods in Chemical Engineering and Materials. A booklet on Undergraduate Curriculum in Chemical Engineering has been prepared by the centre based on deliberations of professional chemical engineers in teaching, research and industries.

Industrial Liaison Work

The major schemes of industrial liaison work on design of evaporators for KCP Ltd., development of rubber-based insulation lining for solid propellant rockets for SSTC and design data for preparation of anhydrous hydrazine for SSTC have been done during 1971-72. About 14 small schemes for various industries have also been done.

The design of jet mill developed, has been released for commercial exploitation.

General

D. Venkateswarlu has been elected as President, Indian Institute of Chemical Engineers and T. Gopichand has been continuing on task force set up by C.L.R.I. to advise on the design of drying equipment for leather industry.

CHEMISTRY

Besides teaching under-graduate and post-graduate courses in Chemistry for students of engineering disciplines (B. Tech. and M. Tech. degrees), several improvements have been made in the courses for the post-graduates in Chemistry such as the introduction in the M.Sc. course of twelve elective subjects covering various branches of specialisation, the continuation of research-oriented M.Sc. Projects and systematisation of Course-work for Ph.D. Scholars. During the year under review, sixteen Post-graduate students of the Department qualified for the M.Sc. Degree and four for the Ph.D. Degree.

All the sophisticated spectroscopic and analytical instruments received under the German Aid have been commissioned and are in full use.

Research Programmes

The year under review witnessed a further stepping up of research activity of the Department. Thirty-three full-time Research Scholars and six staff members have been engaged in research work for the Ph.D. degree. The subjects of research covered important areas of heterogeneous and homogeneous catalysis, chemical kinetics, polymer chemistry, photochemistry, electrochemistry, theoretical and structural chemistry, organic reaction mechanisms and analytical chemistry. The Department has participated actively in two inter-disciplinary Institute Projects of national importance, namely, Desalination of sea-water and Environmental Pollution. Thirty-two papers were published by the faculty members in scientific journals in India and abroad, twenty-seven had been accepted for publication and nineteen were presented at Seminars and Conferences.

The Department, in conjunction with the Department of Chemical Engineering, conducted a three week course on "Applied Research in Chemical Industry" for post-graduate students and research scholars in Chemistry and Chemical Engineering during March-April 1972.

The Department has also rendered increased assistance by way of analytical and consultancy services to a number of industrial organisations, Government Departments and Educational Institutions in the region.

CIVIL ENGINEERING

During the year, the Department continued to offer courses in B.Tech and M.Tech in Civil Engineering and research courses in M.S. and Ph.D. in various branches of Civil Engineering. In addition, one-year post-graduate diploma course leading to D.I.I.T. (Building Technology) has also been offered. 38 students of the department qualified for B.Tech and 27 for M.Tech in the three branches, namely, Hydraulic Engineering, Soil Mechanics and Structural Engineering. 2 candidates were awarded Ph.D. degree, and one candidate was awarded M.S. degree. In addition, 22 scholars are working for Ph.D. (including part-time).

Curriculum for one-year post-graduate diploma course in Civil Engineering leading to D.I.I.T. (Coastal Engineering) has been finalised, the course is expected to commence in January, 1973.

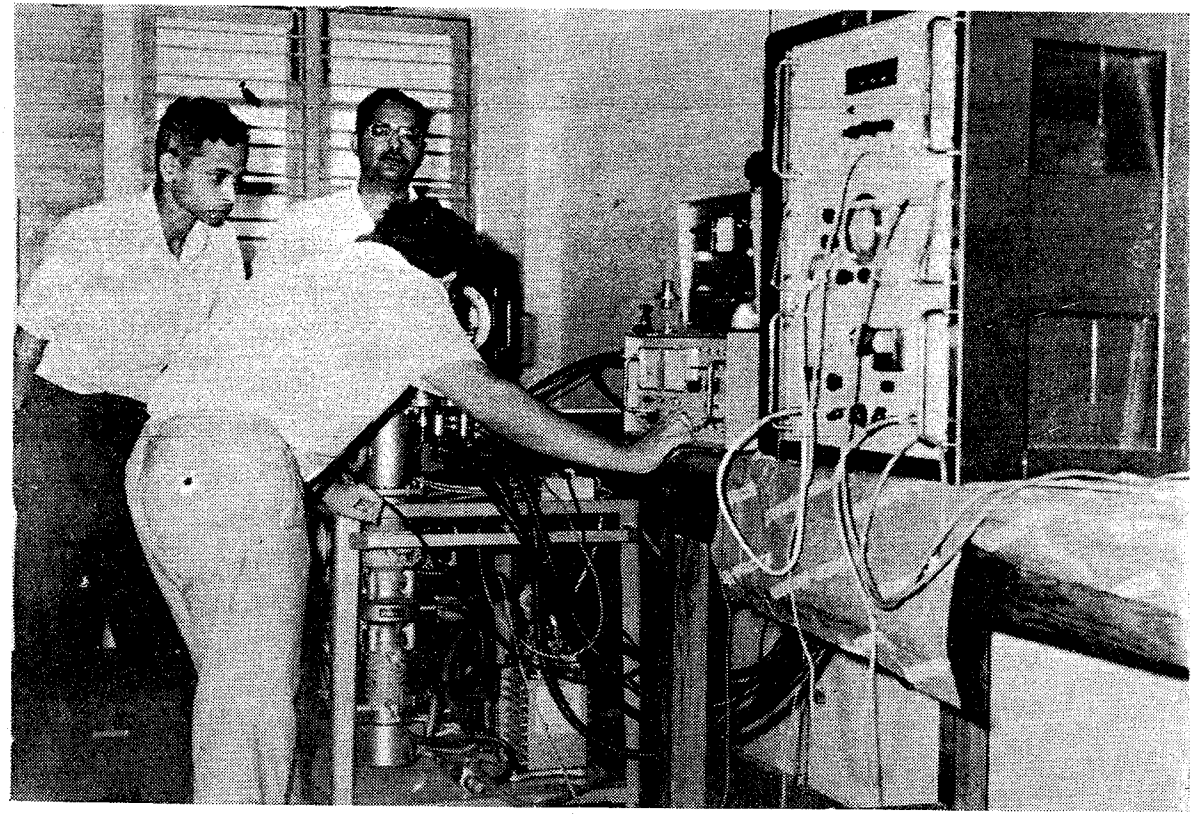
The Department conducted 5 short duration courses during the summer and winter, in which teaching staff from various institutions, and practising engineers from different engineering and port organisations participated.

Research Work

Research activity in the Department maintained its growth in variety and volume. During the year, 73 research programmes which include faculty research, M.Tech, M.S. and Ph.D. programmes were on hand. 4 research programmes, sponsored by C.S.I.R. are under way.

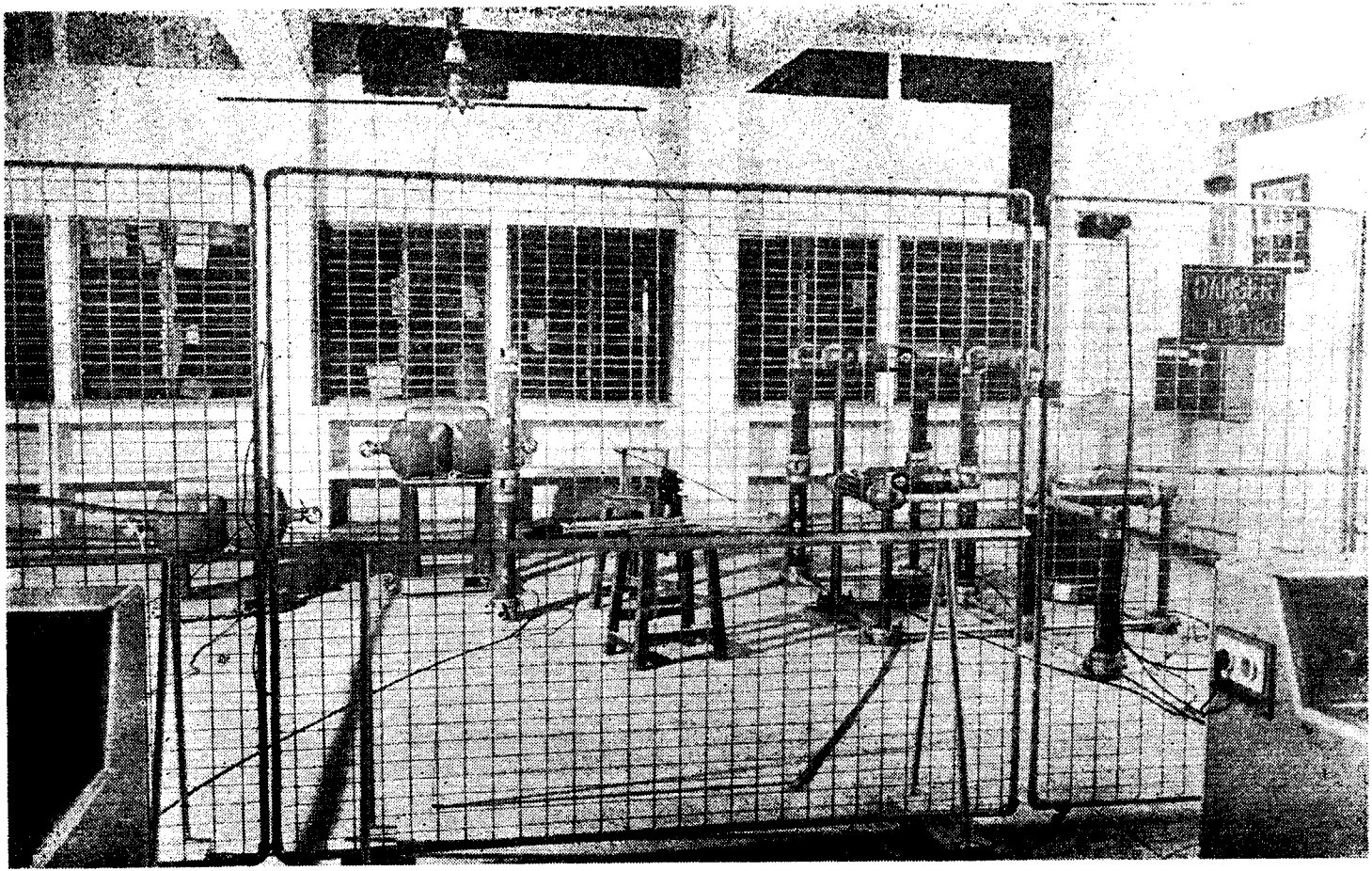
In the year under review, over 15 technical papers and discussions were published in important technical journals in India and abroad, while 10 more were accepted for publication later. The faculty members and research scholars either submitted or presented 17 papers at technical conferences/symposia held in India and abroad.

Liaison with industry has been further strengthened and several projects including testing work have been undertaken by the department for various Government and private agencies.



Thin Film Coating Unit

—Department of Phycics



Two Stage 280kv (Peak) impluse generator constructed with modular units in the High Voltage Laboratory

Department of Electrical Engineering

ELECTRICAL ENGINEERING

During the year under review, 46 students of the Department qualified for the B.Tech. degree and 31 students for the M.Tech. degree. Seven candidates were awarded the Ph.D. degree, bringing the total number of Ph.D. degrees awarded to twelve.

Research Work

Research activity in the Department had continued to maintain its growth in variety and volume. During the year, 48 research papers from the Department were published in leading technical journals in India and abroad, while 41 more were accepted for publication. The faculty members of the Department also presented 27 papers at technical conferences in India and abroad.

Important Projects

The CSIR Project on 'Fast response excitation controller for alternators' was completed during the year in the Power Systems Laboratory. Work on the project on the development of a Demonstration Digital Computer, sponsored by the Department of Atomic Energy, was continued in the Digital Techniques Laboratory. The Control Engineering Laboratory completed the design and construction of a smooth variable speed thyristor controlled drive for three-phase induction motor. This project was sponsored by the Research and Development Organisation for Electrical Industry, Bhopal. In addition, the different laboratories in the Department accepted and completed testing works from a number of industrial organisations.

Centre for Systems and Devices

The Centre, sponsored by the Ministry of Defence, has among its objectives, the following: (i) Futuristic investigation and research/development activities; (ii) Offering long-term and short-term courses in selected areas/topics to Defence Officers and R and D personnel. Research/development activities are being pursued in the areas of Signal Processing Techniques, Semiconductor devices and Control and Guidance. Planning and construction of laboratory building, procurement of equipment, construction of residential quarters and hostel for the Defence personnel have been making steady progress.

Statistics pertaining to the Department

Sl No.	*Subject.*		*Total No.*
1	Degrees awarded :		
	B.Tech.		505
	M.Tech.		147
	Ph.D.		12
2	Publications :		
	Indian Journals	55	222
	Foreign Journals	167	
3	Patents taken		2
4	Books written		1

HUMANITIES AND SOCIAL SCIENCES

During the year under review, research work covered various fields like Economics, History, Statistics, Industrial Engineering, Demography and two members of the staff were awarded the Ph.D. degree. One more staff member submitted his thesis and is awaiting the result.

23 research papers were published or presented at various conferences.

The Department has close liaison with industry. Prominent executives from industry delivered lectures in the Department. The post-graduate students were deputed to various industries for their project work.

MATHEMATICS

The Department continued to undertake teaching for the B.Tech., M.Tech., M.Sc., M.S. and Ph.D. courses. Some additional electives for M.Sc./M.Tech. courses were introduced in the year under report. A special course in Mathematical Biology at Master's level was organised as part of the inter-disciplinary activity in the area of Biomedical Engineering.

The faculty members were actively engaged in research work in the following areas :

(i) Solid Mechanics

(ii) Fluid Mechanics

(iii) Differential Equations

(iv) Graph Theory

(v) Stochastic Processes

(vi) Quantum Mechanics and Fields

(vii) Numerical Analysis.

Over thirty papers have been published during the year. The Department continued its collaboration with Hydraulic Engineering Laboratory, Fluid Mechanics Laboratory, Heat and Mass Transfer Laboratory and Industrial Engineering Section.

The 'Journal of Mathematical and Physical Sciences' brought out special issues in honour of Professor P. L. Bhatnagar.

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 course, promoting research activities, undertaking research and development work, projects sponsored by industry and other agencies and organising faculty development and continuing educational activities.

At the under-graduate level, the Department offered instruction in fifty subjects to the students of the B.Tech. Degree course. This included instruction offered to the students of sister Departments as well. Seventyone students completed their B.Tech. degree course.

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

Seven staff members and one research scholar of the Department were awarded the Ph.D. Degree. Eight students completed their requirements for M.S. Degree. Seven research scholars have registered for M.S. degree and eighteen for the Ph.D. Twentyseven staff members were working as part time scholars for Ph.D. and four for M.S. Degree. Seventy-eight papers were published/presented during the year in various national and international journals and conferences.

Research Work and Other Activities

The Department intensified its research activities in the areas of Machine Elements, Mechanical Handling, Production Engineering, Machine Tools, Fine Technics, Heat Transfer and Thermal Power, Internal Combustion Engines, Thermodynamics and Combustion Engineering, Thermal Turbomachines, Hydro-Turbomachines, Refrigeration and Air-conditioning.

The final sequence of the second sequential summer school in Mechanical Engineering was conducted by the Department during the summer, May-June, 1972.

The Department conducted a four-week Advanced Summer School in 'New Energy Transformation Technology' during May, 72, sponsored by ISTE.

The following winter/summer schools were conducted by the Department for the engineering college teachers under the Quality Improvement Programme, Ministry of Education:—

A two-week winter school in 'New Energy Transformation Technology' during December, 1971.

A four-week course in 'Engineering Design' during May, 1972.

A four-week Advanced Summer School in 'Unconventional Machining and Modern Production Technics' during June, 1972.

The Department ran the following courses for the Hindustan Aeronautics Limited, Bangalore:

A 12-week special course for Management trainees during the period May-June, 1972.

A special summer course for Process Planners during May-June, 1972.

The First National Heat and Mass Transfer Conference was organised at the Institute during December, 1971 in collaboration with the Department. The Conference was sponsored by CSIR, N.C.S.E., Ministry of Defence and Atomic Energy Commission. More than 200 delegates from India and abroad attended the conference. Seventy-six papers were presented.

The following projects under C.S.I.R. Scheme are in progress at the Department.

1. Design and development of lower strain rate testing machine.

2. Investigation on crankshaft vibrations and development of vibration dampers for Internal Combustion Engines.

3. Investigations on the concentration of unburnt hydrocarbons in closed vessel combustion.

4. Flow through non-circular annular passages.

5. Investigation on thermal processing of food products.

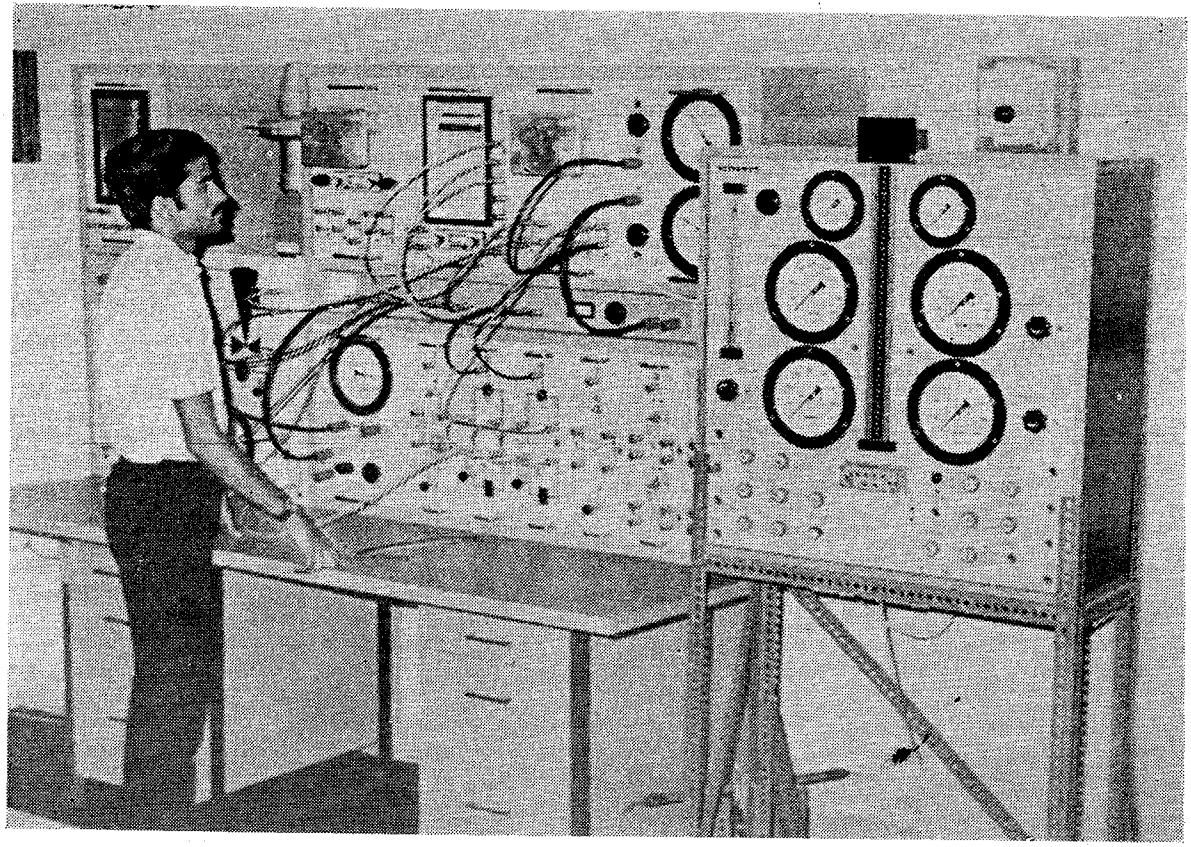
The Department continued to maintain close liaison with many industries and organisations. A few of the industries/organisations with whom the Department has inter-acted are indicated below:

K.C.P. Ltd., Best and Co., RDOEI, Bhopal; HEI, Bhopal; SSTC, Trivandrum; Standard Motor Co., Madras, Britannia Biscuit Company, Madras; E.I.D. Parry's, Madras, Swiss Welded Mesh & Co., Southern Sea Food Industry, Madras.

CENTRAL WORKSHOP

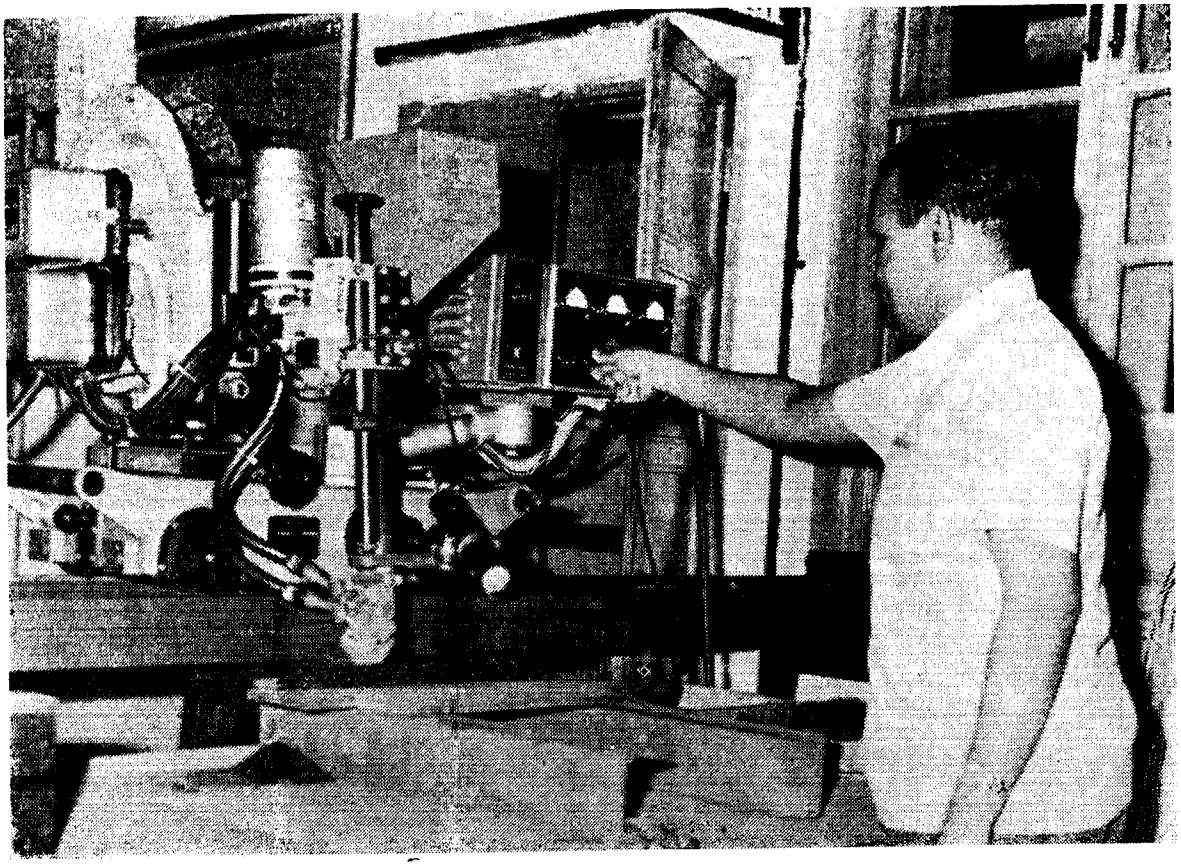
1. *Work Orders completed during* 1971-72: 1758 Nos.
2. *Outstanding jobs done during* 1971-72:

Sl. No.	Description of Job	Department/Laboratory
1.	Welding Machine	Fine Technics Laboratory
2.	7 Components for Electro Chemical Machine	Machine Tool & Production Engineering Section
3.	Displacement apparatus	Aeronautical Engineering
4.	Strain Rate testing machine parts	Applied Mechanics
5.	Gear box for Hovercraft (parts)	I.C. Engine Laboratory
6.	Plastic forming machine parts and heater unit	Machine Tool and Production Engineering Section
7.	Fresnel lens attachment	Fine Technics Laboratory
8.	Testing and calibration of pressure gauges	Heavy Vehicles Factory, Avadi
9.	Piercing Die for Foot Ball	M/s. Canthaswamy Enterprises, Madras-8
10.	Fabrication and assembly of sleeving mechanism	Fine Technics Laboratory
11.	Fabrication of steam trap	M/s. Peetees Engineering Services
12.	Sphere for Boundary layer probe measurements	Applied Mechanics
13.	Micrometer Fine adjustment assembly	Fine Techni Laboratory
14.	Heat treatment of Dies	ACE Engineering Corporation, Guindy
15.	Electrical control Panel boards for Deep hole drilling Machine (Automatic) and vertical boring machine	Machine Tool and Production Engineering Section



Pneumatic Simulator & Test Panel for Controllers

—Department of Mechanical Engineering



Submerged Arc Welding Machine

--Department of Metallurgy — Metal Joining Laboratory

METALLURGY

Research activity has considerably increased with the total number of candidates registered for Ph.D. being 15 and for M.S. 11.

3 theses for Ph.D. and 2 for M.S. were submitted. One Ph.D. and 2 M.S. theses were approved. The reports of others are awaited.

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

(1) Stabilisation of austenite.

(2) Fatigue of alpha brass.

(3) Studies on cracks and dislocations.

(4) Shape - memory effect in metals and alloys.

(5) Fatigue hardening and softening.

(6) Nature of cold worked state in metal and alloys.

(7) Metal coatings and fatigue properties.

(8) Surface crack detection by ultrasonics.

(9) Stress effects on creep of metals.

(10) Permanent magnet alloys.

(11) Low cycle impact and contact fatigue.

(12) Effect of prestraining on creep.

(13) Residual stress determination.

(14) Dislocations in ionic crystals.

(15) Nature of cumulative damage in fatigue.

(16) Vacuum melting of steels and cast iron.

(17) Production of low carbon ferrochrome.

(18) Formation of nickel cermets.

(19) Studies of organic addition to Ni plating bath.

(20) Compaction characteristics of foundry sands.

(21) Solidification characteristics of long freezing range alloys.

(22) Risering of long freezing range alloys.

(23) Effect of trace elements on malleable iron.

(24) Joining of dissimilar metals.

(25) Strain ageing characteristics of welded steels.

(26) Welding of age-hardenable Al. allows.

(27) High temperature properties of moulding sands.

(28) Investigation on various aspects of coining operation.

(29) Hydro mechanical drawing.

(30) Spinning and flow turning of conical parts.

(31) Deep drawing of rectangular components.

(32) Explosive forming of dome shaped components.

The activities of the local chapter of IIM continued as usual in the Department.

The Department arranged courses on metallography and heat treatment and special experimental techniques in metallurgy. Assistance to curriculum development and special lectures were given to outside agencies and colleges.

A few attachments were made for fracture toughness study. Also disc pelletiser and a creep bonding test unit were fabricated.

PHYSICS

Teaching

The Department is giving instruction in general Physics during the first five semesters for all the undergraduate students. The following elective courses were also offered for the pre-final and final year B.Tech. students.

1. Solid State Physics
2. Laser Physics and Transport Phenomena
3. Reactor Physics
4. Technical Acoustics
5. High Vacuum Technology
6. 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, as a two-semester course.

1. Transistor Physics
2. Microwave Physics and Resonance Spectroscopy
3. Electronics and Instrumentation
4. Structure and Texture of Solids

In addition, the M.Sc. students have a one-semester course, on one of the following special topics in the fourth semester.

1. Defect Solid State
2. Crystal Field Theory
3. Lattice Dynamics

Research

Most of the equipment received from Germany is already put into use. In addition, the following new equipment is also received in the department.

Carbondioxide Laser

The areas of research in the Department include:

1. Electrical conduction in ionic crystals
2. Electron spin resonance
3. Colour centres
4. Optical properties of solids, piezooptic and magneto-optic studies
5. Nuclear quadrupole resonance
6. Semiconductors
7. Lattice dynamics
8. X-ray crystallography
9. Dielectric properties in the Microwave and R.F. regions

CENTRAL LIBRARY

General

The year was eventful in that certain desirable and welcome changes have taken place in the staff structure and new services were organized. On the staff side three posts of Senior Assistant Librarians and three posts of Junior Library Assistants were created and filled. With the return of two of our staff members, Shri C. Deenadayalu and Mrs. J. Durairaj from Germany in March 1972 after an intensive training in computer programming and advanced librarianship respectively it has become possible to prepare the ground for computerisation of library services.

Computer Liaison Work

The Library is undertaking the Liaison work of collecting the Programs of all the Departments and getting them processed in the IBM 1130 Computer of the Madras University. Assistance in Programming and in debugging the Programs is also rendered to the users, on request.

Documentation and Publications

In order to bring quickly to the notice of the Research Scholars and faculty members nascent literature on their topics of research, a daily announcement service is started from January 1972 covering foreign and domestic technical periodicals including some not available in the Library's collection. The service which was originally intended for the faculty members and research scholars of the Institute has been extended to over thirty outside individuals/organizations on subscription basis.

The Union Catalogue of Serial Holdings available in all the IITs & IISc. a complementary volume to the Union Catalogue of Periodical Holdings of the same Institutes published last year, has now been printed within the Reprographic Section of the Library from the computer printout of data previously collected and punched on the IBM Cards.

The programme of publishing Cumulative Catalogue of Books available in the Central Library into 15 parts has been accomplished and copies distributed to interested faculty members. Copies of the Catalogues are also made available to other institutes/individuals on nominal payment.

The Handbook of Library Administration was revised with computerisation of library services in mind and issued as a revised edition during the year under review.

Reprographic and Translation Service

With the release of Union Catalogue of Periodical Holdings and commencement of the SDI Service, requests have been coming from research scholars as well as from outside organizations in large numbers for photocopies or microfilms of the articles. These are being attended to by the Reprographic Section of the Library at subsidized rates. Translation of technical articles is being arranged by Library wherever possible with the help of the Library staff and other faculty members of the Institute.

A roster of translators has been prepared to improve the quality of translation work by subject specialists.

Statistics of the main library activities are given as follows:

Membership :

(1) Institute members (staff and students)	4,723
(2) Outside Members:	
Individual	17
Corporate	12
(3) Consultation Permits	120

Working hours :

Weekdays	8 a.m — 10-30 p.m.
Sundays and Holidays	9 a.m. — 4-00 p.m.

Circulation :

(1) No. of readers visited	71,843
(2) No. of volumes issued	81,221
(3) No. of reservations for books attended	7,121
(4) Amount of overdue and other charges realised	Rs. 11,694.

Inter-Library Loan :

Borrowed for Institute members	183
Lent out from Institute Library	48

Acquisition :

Books and bound volumes of periodicals	5,147
Pamphlets and Reports	7,942
Microfilms and Microfiches	143
Total intake during the year	13,232
Total Accession up-to-date	1,10,246

Current Periodicals : 1,467

By subscription as on June 1972

By exchange/gift as on June 1972

Reprographic section :

Microfilms made	253 strips
Photocopies made	7,562 pages

Bindery :

No. of Journals and books bound for library	5,847
No. of journals and Books repaired	521
Other Departments' work	810

Information Transfer And International Co-operation

As announced earlier, the necessary equipments for quick information transfer like reprographic facilities and telex communication have been acquired and commissioned. We, as new members of the International Association of Technological University Librarians (IATUL) have introduced ourselves to other members and initiated action for exchange of publications and reprographic facilities on reciprocal basis. It is hoped that in the course of time when requests are made to other renowned technical libraries of the world most of whom are on telex, we should be able to get the required technical articles in the form of microfiches/ microfilms by air overcoming all commercial barriers without much loss of time.

ANNEXURE B

ADMISSIONS TO THE COURSES OF STUDY

(for the 1971-72 Session)

The number of students admitted to the various undergraduate and postgraduate courses for the 1971-72 session is given below:—

Courses	*No. Admitted*
B.Tech.	275
M.Tech.	218
D.I.I.T.	6
M.Sc.	47

Registration for Research work

	Full-Time	Part-Time
M.S.	25	—
Ph.D.	50	13

STUDENT POPULATION AT THE INSTITUTE (1971-72 SESSION)

(As on 30-6-72)

For the academic session 1971-72, the strength of students in the different courses and research scholars was as follows:—

Course/Programme	Full-Time	Part-Time
B.Tech.	1,217	—
M.Tech.	337	11
D.I.I.T.	6	—
M.Sc.	96	2
M.S.	50	14
Ph.D.	166	143
Post-Doctoral Fellows	3	—
	1,875	170

The above figures includs 58 students who are foreign nationals.

ANNEXURE C

EIGHT CONVOCATION OF THE INSTITUTE

31st July, 1971

The Eighth Convocation of the Institute was held at 5-00 p.m. on Saturday, the 31st July, 1971 in the Open Air Theatre of the Institute. Shri H. V. R. Iengar, Chairman of the Board of Governors of the Institute, presided over the Convocation. Prof. M. G. K. Menon, Director, Tata Institute of Fundamental Research, Bombay, was the Chief Speaker.

The Director conferred the Degrees and Diplomas on 225 candidates, who attended the Convocation and *in absentia* on 212 candidates who could not be present. The numbers of the graduates in the various categories are given below:

	In person	*In absentia*	*Total*
Ph.D. Degree			
Chemistry	3	1	4
Mathematics	3	—	3
Physics	2	—	2
Chemical Engineering	2	1	3
Civil Engineering	4	—	4
Engineering Mechanics	1	1	2
Mechanical Engineering	1	—	1
M.S. Degree			
Mechanical Engineering	5	—	5
Metallurgy	—	1	1
M.Sc. Degree			
Chemistry	13	3	16
Mathematics	13	5	18
Physics	3	12	15
M.Tech. Degree			
Aeronautical Engineering	5	6	11
Chemical Engineering	7	6	13
Civil Engineering	8	9	17
Electrical Engineering	17	15	32
Engineering Mechanics	5	—	5
Industrial Engineering	4	2	6
Industrial Management	6	2	8
Mechanical Engineering	16	11	27
Metallurgy	6	4	10

B.Tech. Degree

	In person	*In absentia*	*Total*
Aeronautical Engineering	12	8	20
Chemical Engineering	15	17	32
Civil Engineering	15	15	30
Electrical Engineering	19	38	57
Mechanical Engineering	21	41	62
Metallurgy	15	14	29
D.I.I.T.			
Chemical Engineering Practice	4	—	4

After the conferment of Degrees/Diplomas, the Chief Speaker distributed the prizes to prize winners.

The graduates of the year who were present took the pledge, led by Shri Satish Ramadhyani, winner of the President of India Prize.

After Shri H. V. R. Iengar's introductory speech, Professor M. G. K. Menon delivered the Convocation Address.

List of Prize Winners

Prizes awarded at the Eighth Convocation of the Institute held on 31st July, 1971.

President of India Prize

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

Shri Satish Ramadhyani (Mechanical Engineering—B.Tech.)

Governor's Prize

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

Shri S. Kannan (Mechanical Engineering—B.Tech.)

Merit Prizes

(for the student with the best academic record in each discipline of each course)

M.Sc. Degree Course

Shri Achutha Menon, K. (Chemistry)

Shri Damodaran, M. (Mathematics)

Shri V. S. Suryanarayana Sastri (Physics)

M.Tech. Degree Course

Shri Dasigi Lakshminarasimha Sastri (Aeronautical Engineering)
Shri Venkataram Mohan (Chemical Engineering)
Shri M. S. Mathews (Civil Engineering)
Shri Govinda Raju, N. (Engineering Mechanics)
Shri Prem Chand Roy (Industrial Engineering)
Shri G. Chandrasekaran (Industrial Management)
Shri Vasudevan, R. (Metallurgy)

B.Tech. Degree Course

Shri T. Govindaraj (Aeronautical Engineering)
Shri V. Jagadeesh (Chemical Engineering)
Shri Ravi George (Civil Engineering)
Shri N. Sridharan (Metallurgy)

Siemens Prizes

(Presented by M/s. Siemens Engineering & Manufacturing Company of India Limited to the students with the best academic record in Electrical Engineering of the M.Tech. and B.Tech. Degree Courses—Power)

M.Tech. Degree Course

Shri S. Ramanathan

B.Tech. Degree Course

Shri P. Jayachandran

Philips India Prize

(Presented by M/s. Philips India Limited to the student with the best academic record in Electrical Engineering (Electronics) of the B.Tech. Degree Course.)

Shri S. Narayana Murthi**

Banco Foundation Prize

(Presented by M/s. Banco Foundation, Baroda to the student with the best academic record in Mechanical Engineering of the B.Tech. Degree Course.)

Shri Satish Ramadhyani

Prof. B. Sengupto Prize

(Presented by Dr. A. L. Mudaliar, First Chairman of the Board of Governors to the student with the best academic record in M.Tech. Degree Course in Mechanical Engineering.)

M.Tech. Degree Course

Shri N. Murali (Mechanical Engineering)

**Taken in absentia.

ANNEXURE D

NUMBER QUALIFIED FOR THE DEGREES/DIPLOMAS AT THE END OF 1971-72

Degree	NUMBER			
	I Class with distinction	I Class	II Class	Total
B.Tech.	5	174	56	235
M.Sc.	7	31	7	45
M.S.	—	—	—	21
M.Tech.	4	134	15	153
D.I.I.T. (Building Technology)	—	4	2	6
Ph.D.				
Chemistry	2			
Mathematics	3			
Physics	2			
Chemical Engineering	2			
Civil Engineering	2			
Electrical Engineering	7			
Engineering Mechanics	1			
Mechanical Engineering	8			
Metallurgy	2			29
			Total	489

ANNEXURE E

PATTERN OF GRADUATION

(1964-72)

The number of candidates who were awarded Degrees/Diplomas at the first eight Convocations and the number awarded at the Ninth Convocation (held on 26th August 1972) are as follows:—

Degree	Awarded at the first Eight Convocations (1964-71)	Awarded at the Ninth Convocation (1972)	Total
B.Tech.	1857	235	2092
M.Sc.	213	45	258
M.Tech	478	153	631
D.I.I.T.	74	6	80
M.S.	6	21	27
Ph.D.	83	29	112
Grand Total	2711	489	3200

ANNEXURE F

PLACEMENT OFFICE

This office has been successfully serving as a liaison between the graduating students and potential employers. The accompanying statement shows the latest placement position of the graduates of the Institute.

During the year under review, this office was contacted by 104 companies/establishments from both the public and private sectors. In addition, representatives from 32 organisations visited the campus and interviewed the students for selection.

The Placement office continues to keep in touch with as many industries and other organisations as may require technically qualified personnel and furnishes them with information as to the courses offered with specialisations in the various branches, to enable them to have a detailed view of the potential talent available from among the graduates of the Institute.

ANNEXURE G

INSTITUTE GYMKHANA

The year under review started, as usual, with preparations for participation in the Inter-I.I.T. Sports Meet as well as Local and Inter-Collegiate tournaments.

The Gymkhana elections saw the emergence of a dedicated committee of student representatives. They spared no efforts in shaping new sports, athletic and other teams so that the Institute would retain the inter-I.I.T. Trophy. Intensive coaching was given to the various teams by experts from outside. Though the Inter-I.I.T. meet was cancelled owing to the Indo-Pakistan war, the efforts put in by the various teams would sure stand them in good stead in the future. A carnival was arranged in aid of the Jawans' Welfare Fund and it proved to be a grand success.

An exhibition of photographs and paintings and science fair were the highlights of the Cultural week organised by the Institute Gymkhana. In the sports field, mention must be made of the All-India Skating Meet held at our Institute, the participation of our skating team in the All-India Meet at Chandigarh, our participation in the Inter-university cricket tournament as also our participation in the Tamil Nadu chess championships held at Tiruchi.

All these activities were in addition to the usual inter-hostel tournaments on the domestic front and outside events like the Bertram, A.M. Jain College, and Y.M.C.A. tournaments outside, in Madras city.

The annual Sports Day was celebrated in the presence of Shri C. D. Gopinath on March, 17th. The Institute Day on March, 31st marked the end of Gymkhana activities for the year :1971-72. On this day, Dr. E. F. Bauman, Consul-General of the Federal Republic of Germany in Madras graced the ceremonies by his presence.

The Institute Gymkhana looks forward to another fruitful year of endeavour in both sports and cultural fields so that our members may become useful members of the society.

This office has also been handling increasing number of applications from students of the B.Tech. & M.Tech. degree courses for practical training during summer and winter vacations which, while enabling the students to acquire practical experience, also serves to help the industries in making use of their services and assessing their potential.

The Placement Office also looks after the work pertaining to the Alumni Association of the Institute.

Consolidated Statement showing Placement Position of students belonging t
1964 – 71 Batches

(Position as on 30th June, 1972)

Year	Total passed out	Studying in India	Studying abroad	Employed abroad	Employed in India		Position not known	Rem
					Private Sector	Public Sector		
1964	107	12	21	7	31	35	1	
1965	161	16	36	17	41	49	2	
1966	265	26	47	15	83	86	7	1
1967	323	50	47	9	80	92	44	1
1968	388	66	59	11	87	99	64	2
1969	470	80	56	—	99	104	131	
1970	560	95	89	1	101	111	163	
1971	437	86	28	—	77	76	170	
	2711	431	383	60	599	652	**582	4

* Deceased.

** We continue our efforts in collecting the particulars of the students w
placement position has been reported as 'Not known'.

ANNEXURE H

NATIONAL CADET CORPS

(A) No. 2 TAMILNADU COMP(TECH) COY. N.C.C.

Though the training is obligatory for the first and second year B.Tech. students only, volunteers from the third year were also taken on the rolls. During the year, 157 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 subjects of the 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 on 31stJuly, 1971, NCC Promise Day on 14th August, 1971 and the Republic Day. The Director of the Institute took the salute on the Promise Day and Republic Day parades.

A combined annual training camp of 12 days duration for the Army and Air Wing cadets was conducted in the IIT Campus from 28-11-71 to 9-12-71. The cadets did their annual firing with .22 and .303 rifles. In addition to normal camp training syllabus, visits were also conducted to certain industrial establshments and bridge construction sites. The aims of Annual Camp, namely, building up of character, inculcating the sense of discipline and self reliance, *espirit de corps* and fostering of the corporate way of living were fully achieved.

Fourteen cadets qualified for the NCC 'B' certificate and one for the 'C' certificate. Second Lieut. K. Ramakoteeswara Rao attended the special corps training from 1st May, 1972 to 22nd July, 1972 at NCC OTSKAMPTEE.

(B) No. 4 TAMILNADU AIR SQN (TECH.) N.C.C.

This Unit has completed seven years in this Institute. In this seventh year, 167 cadets were given training. At the conclusion of the training, NCC 'B' and 'C' certificates were awarded to 26 and 7 cadets respectively on passing the examinations.

The annual training camp for the year was held at Alakananda Hostel of the Institute. 32 cadets attended the camp. Besides normal activities, the cadets were taken on instructional visits to Air Force Station, Tambaram and Industrial establishments. The Deputy Director, Indian Institute of Technology, Madras visited the camp and spent one evening with the campers.

50 Cadets of this unit and No. 2 (TN) Comp. (Tech.) Coy. NCC jointly presented a Guard of Honour to Professor M. G. K. Menon, F.R.S. who delivered the Eighth Convocation address at the Institute.

Promise Parade and Republic Day Parade were held combined with Army wing unit of the Institute. Director, I.I.T., took the salute on both the occasions.

Three cadets attended Vayu Sainik Camp 1972, Poona for a period of 14 days.

IIT Roll No. B/7/69 (NCC Regt. No. 89408) Cadet Warrant Officer K. Balasubramaniam, won the First Prize for the BEST SHOT in the Burdwan Senior Division Shooting Competetion held amongst NCC Units during 1971.

ANNEXURE I

INSTITUTE HOSPITAL

The Institute Hospital has shown progressive growth in many spheres during he year under review:

Staff: A full time male Medical Officer was appointed during the month of August 1971, raising the total number of Medical Officers available to four to cater to the needs of increasing daily out-patient attendance.

Statistics: The hospital had attended to 55,849 out-patients during this year showing an increase of 10.686 patients over the figures for the previous year 1970-71.

The break-up is as follows: —

Students	—	9,359
Men	—	25,714
Women & Children	—	20,776

Surgical cases	—	3,664
Medical	—	48,625
Gynaecological & Obstetric cases	—	3,560
Total No. of In-patients :		
Women and Children	—	128
Men and Students	—	98
E.C.G. taken	—	37

Most of the in-patients were cases of infectious diseases like chicken-pox, infective hepatitis and enteric fever.

Surgical Cases: The cases attended to were mostly minor like abscess and cysts. There were 12 cases of fracture, all treated with plaster of paris immobilisation. Regular operation work has been commissioned from Aug. 1971. Two cases were operated for chronic appendicitis.

Details of cases:		
Minor operation	—	627
Major operations (like Hernia, Hydrocele, fissure etc.)	—	45
Details of Anaesthesia:		
General	—	136
Local	—	628

Midwifery and Gynaecological work: Regular obstetrical care of pregnant women is undertaken and records kept. Attempts have been made to do regular blood grouping of all the ante-natal cases and the records maintained. Routine gynaecological examinations of the patients done and necessary advice given. Regular family planning programme was carried out.

Ante-natal blood grouping done	—	43	
Ante-natal cases attended	—	105	
Normal deliveries	—	30	
Complicated deliveries (Undertaken in this hospital)	—	2	(forceps)
D & C	—	11	
Abortions	—	9	

2 cases were sent to outside hospital for Caesarian operation.

The hospital provided facilities to undertake mass blood donation of voluntary donors during the emergency and the response was quite encouraging. Mostly the student population took initiative and

came forward to donate blood. About 129 students were grouped and they all donated blood.

Immunisation Programme: Routine immunisation programme was undertaken this year also. It was very encouraging to note that not a single whooping cough in children was noticed in the campus. A few cases treated in this hospital were from near-by villages like Taramani, Velacheri etc.

Vaccination	— 472
Triple Antigen (for children)	— 283
Polio	— 267
Cholera	— 189
T.A.B.	— 74

There are about 42 cases of Primary complex in children. All were investigated and treatment started.

Building and Equipment: Operation theatre was provided with a mobile shadowless lamp, which gives more lighting facilities for the operation. Labour room was provided with a labour table. The labour room was also well lighted and equipped to undertake any complicated deliveries.

In addition to the staff and students of this Institute, the hospital also attended to the summer school participants of various departments, the relatives of the I.I.T. staff members, the staff and students of Vana Vani High School, Central School, Hostel servants, the employees of Central supplies, State Bank of India and Post-Office staff members.

The total number of laboratory investigations undertaken during this year is 4,672.

Administration

Director	Dr. A. Ramachandran
Deputy Director	Prof. S. Sampath
Registrar	Sri C. V. Sethunathan
Asst. Registrar (Acd.)	Sri T. S. Rajagopalan
Audit Officer	Sri R. Venkataraman
Stores Officer	Sri S. Pattabiraman
Accounts Officer	Sri A. V. Karunakaran Nambiar
Executive Engineer	Sri K. Ganesan
Hony. Consulting Physician	Dr. P. M. Palani
Medical Officers	Dr. G. Atmaram Rao Dr. (Smt.) Shanta Krishnamurthi Dr. P. C. Soundara Rajan
Security Officer	Sri T. N. Venkataraman
Officer Commanding, 2 (*Tamil Nadu*) *Comp.* (*Tech.*) *Eng./EME/Sig. Coy. N.C.C.*	Lt. Col. R. Narasimhan
Officer Commanding 4 (*Tamil Nadu*) *Air Sqn.* *Tech. Coy. N.C.C.*	Sqn. Ldr. K. Ramakrishnan

Heads of the Departments

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