INDIAN INSTITUTE OF TECHNOLOGY

MADRAS

Annual Report

1975-76

SEVENTEENTH ANNUAL REPORT

1975-76

INDIAN INSTITUTE OF TECHNOLOGY MADRAS

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VISITOR OF THE INSTITUTE

SRI FAKRUDDIN ALI AHMED

The President of India

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Union Minister for Education and Social Welfare,
Government of India, New Delhi

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Kharagpur

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Bombay

Sri K.T. Chandy, Chairman,
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I.I.T., Bombay

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I.I.T., Madras

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I.I.T., Delhi

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Indian Institute of Science,
Bangalore

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Ministry of Education and
Social Welfare, Govt. of India,
New Delhi

Sri Prem Nath,
Financial Adviser,
Ministry of Finance,
Govt. of India
New Delhi

Prof. M.G.K. Menon, Secretary,
Dept. of Electronics,
Govt. of India, New Delhi

Representatives of the Parliament:

Sri Bhaoo Sahib Dhamarkar,M.P.
113, Vithalbhai Patel House,
New Delhi

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

Dr. Rajat Kumar Chakrabarti,
220, North Avenue, New Delhi

Representative of the All-India Council for Technical Education:

Prof. S. Chakravarthy,
Member, Planning Commission,
New Delhi

Nominees of the Visitor:

Prof. G. Tripathi
Banaras Hindu University
Varanasi

Sri R.P. Billimoria,
Director,
Hindustan Steel Ltd.,
Ranchi

Sri M. M. Suri,
B-14, Greater Kailash,
New Delhi

Sri S.K. Mukherjee,
Director, Fertilizer,
Corporation of India
New Delhi

Secretary:

Sri S. Vedantham,
Deputy Educational Adviser (Tech.),
Ministry of Education & Social Welfare,
Govt. of India
New Delhi

The Board of Governors

Chairman:

Sri K. T. Chandy,
Chairman, Kerala State Industrial
Development Corporation Ltd.,
Trivandrum

Nominees of the State Governments:

Sri R. L. Sreshta,
Director of Technical Education,
Government of Karnataka,
Bangalore

Prof. T. R. Doss,
former Vice-Chancellor
J. N. Technological University,
Hyderabad

Dr. S. Vasudev,
Director of Technical Education,
Government of Kerala,
Trivandrum

Dr. V. C. Kulandaiswamy
Director of Technical Education,
Government of Tamil Nadu,
Madras

Nominees of the Council:

Dr. S. R. Valluri,
Director, National Aeronautical
Lab., Bangalore

Sri T. Abdul Wahid,
Businessman & Industrialist,
19, Vepery High Road,
Madras

Vice Admiral N. Krishnan,
Chairman & Managing Director,
Cochin Shipyard Ltd.,
Cochin

Prof. Gurbaksh Singh,
Vice Chancellor,
University of Hyderabad,
Hyderabad

Director:

Dr. K. A. V. Pandalai,
Indian Institute of Technology,
Madras

Nominees of the Senate:

Dr. S. K. Srinivasan,
Head of the Dept. of Mathematics,
I.I.T., Madras

Dr. B. S. Murthy,
Professor, Dept. of Mechanical
Engineering, I.I.T., 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.,
Trivandrum

Members:

Sri S. Vedantham,
Deputy Educational Adviser(Tech.)
Ministry of Education &
Social Welfare,
Govt. of India,
New Delhi

Sri Prem Nath,
Financial Adviser,
Ministry of Finance,
Govt. of India,
New Delhi

Prof. T. R. Doss,
former Vice-Chancellor,
J. N. Technological University,
Hyderabad

Dr. V. C. Kulandaiswamy,
Director of Technical Education,
Government of Tamilnadu,
Madras

Dr. K. A. V. Pandalai,
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.,
Trivandrum

Members:

Dr. K. A. V. Pandalai,
Director, I.I.T., Madras

Sri Raghupathi,
Superintending Engineer,
C. P. W. D. Madras

Dr. D. J. Victor,
Professor-in-Charge,
Engineering Unit,
I.I.T., Madras

Sri P. Sivalingam,
Chief Engineer,
P.W.D. Madras

Sri Y. S. Nagaraja Rao,
Executive Engineer,
I.I.T., Madras

Secretary:

Sri C. V. Sethunathan (Registrar)

The Senate

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

Chairman:

Dr. K. A. V. Pandalai

Members:

Dr. M. K. Achuthan
Dr. R. S. Alwar
Dr. V. Anantharaman
Dr. G. Aravamudan
Dr. B. V. Aswathanarayana Rao
Prof. K. Balaraman
Dr. D. K. Banerjee
Prof. C. S. Ballal
Dr. T. K. Bose
Dr. N.V. Chandrasekhara Swamy
Prof. K. A. Damodaran
Dr. T. Gopichand
Dr. M. C. Gupta
Sri S. Jambunathan
Dr. D. Johnson Victor
Dr. V. M. Krishna Sastri
Dr. M. V. Krishnamurthy
Dr. A. Kuppurajulu
Dr. J. C. Kuriacose
Dr. H. N. Mahabalia
Dr. P. T. Manoharan
Dr. B. S. Murthy
Dr. V. G. K. Murthi
Dr. C. R. Muthukrishnan
Prof. R. G. Narayanamurthi
Dr. Y. Narayana Rao
Sri V. S. Nazir Ahmed
Dr. S. D. Nigam
Dr. C. N. Pillai
Prof. S. Sampath till Dec. '75.
Dr. D. Prithviraj
Dr. H. C. Radhakrishna
Dr. N. R. Rajappa
Dr. K. P. Rajappan
Dr. E. G. Ramachandran
Dr. L. N. Ramamurthi
Dr. S. Ramani
Dr. C. Ramasastry
Dr. B. Ramaswamy
Dr. G. V. N. Rayudu
Dr. K. S. Sankaran
Dr. M. V. C. Sastri
Dr. M. Satyanarayana
Dr. V. Seshadri
Dr. A. K. Sreekanth
Dr. R. Srinivasan
Dr. S. K. Srinivasan
Dr. V. Srinivasan
Dr. K. Srinivasaraghavan
Dr. P. Srinivasa Rao
Dr. P. F. Thiede
Dr. K. Thulasiraman
Dr. Y. B. G. Varma
Dr. R. Vasudevan
Dr. P. Venkata Rao
Dr. V. C. Venkatesh
Dr. D. Venkateswarlu
Dr. M. Venugopal
Dr. Vincent X. Kunukkasseril

Nominees of the Chairman, Board of Directors

Dr. P. L. Bhatnagar,
Director,
Mehta Institute of Mathematical Research,
Allahabad

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

Dr. K. K. Pillay, till 16–4–1976
Director,
Institute of Traditional Culture,
University of Madras, Madras

Senior Warden

Sri P. Ramachandran till 16–3–1976

Dr. S. R. Ramadas From 17–3–1976 to 20–6–1976

Dr. N. M. Raghavendra from 21–6–1976

Secretary:

Sri C. V. Sethunathan (Registrar)

Report by the Director

Seventeenth Annual Report

July 1, 1975 — June 30, 1976

The Indian Institute of Technology, Madras is an Institute of national importance and higher technological education. An almost self contained residential institution of about 2,100 students, it is located in a beautiful sylvan setting of about 630 acres of land. Ever since it was established in July 1959, it has been growing from strength to strength.

The changes in the body of scientific knowledge and in the development of technology are fast and open up new possibilities and create immense scientific, technological and socio-economic problems and challenges. The Institute aims to provide leadership not only by mastering the developments in science and technology all over the world but also by contributing to these developments for the technological growth of our country and other developing countries. During the past seventeen years, the Institute has striven to discharge its obligation to the country and can claim a good measure of success in its efforts.

The Institute has endeavoured to establish a high standard in its educational and research programmes, comparable with the standard of leading institutions anywhere in the world. It has succeeded in its endeavour, thanks to the dedication of the Institute staff, the quality of the students and the faculty, the heavy investment of the Government of India (Rs. 11 crores in fixed assets and 15.7 crores for meeting the recurring expenditure) and colloboration with and assistance from the government and leading universities of the Federal Republic of Germany.

The more significant features of our work during the period under review are:

1. High percentage (42%) of the postgraduate and research scholars of the total students strength (902 postgraduate and research scholars as against 1241 undergraduate students).

2. Introduction for the first time of CEPA (Common Examination to Postgraduate Admissions) jointly with I.I.T., Kharagpur in May '76 at 20 centres all over India. The candidates who qualified in the CEPA were offered admission strictly on the basis of their rank in the examination results and their choice of specialisation without interview. This experiment has as its aim improvement of the standard

of admission to postgraduate programmes, as in the case of Joint Entrance Examination for B. Tech. admission.

3. The D.I.I.T. Programmes in Machine Design and Production Engineering of three semesters duration were introduced for the benefit of engineers working in and around Madras. These courses are offered in the city office of the Institute during evenings.

The D.I.I.T. programme in Industrial Tribology as a full time course was introduced. In the existing undergraduate and postgraduate programmes, 35 new courses and electives were added.

4. The number of Ph.D. Degrees awarded (74) at the twelfth convocation has been the highest for any year so far. More significant is the fact that out of the 74 Ph.D. degrees awarded, 51 are in Engineering subjects indicating that the thrust of research at the Institute is in Engineering.

5. Continuing Education Programmes of the Institute, Quality Improvement Programme and Centre for Systems and Devices.

6. Commencement of nine research projects under the Fourth Indo-German Agreement.

7. Colloboration with France for the development of activities in the Aeronautical engineering field.

8. Increase in industrial liaison activity resulting in 941 consultancy assignments and a revenue of Rs. 8.14 lakhs.

9. Inaguration of Rural Development Centre by Prof. Nurul Hassan, Union Minister for Education and Social Welfare, Government of India.

10. Commitment of the Institute to the Prime Minister's Twenty Point Programme.

The details of these and other contributions are detailed in this report under the following sections:

I. Admissions, Degrees and Prizes

1. Student admissions, 1975–76
2. Student strength
3. Degrees awarded
4. Prizes

II. Research and Development

1. Research publications and patents
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5. Indo-German colloboration
6. French Colloboration

III. Education Programmes

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1. Staff
2. Library
3. Institute Gymkhana
4. N. C. C. and N. S. S.
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V. Budget and Institute Earnings

VI. Institute's role in Twenty Point Programme and National Aims

VII. Future

I. ADMISSIONS, DEGREES AND PRIZES

1. Student Admissions, 1975—76

The number of new students and scholars admitted to various courses (1975–76) is given in Table 1.

Table 1

Admissions 1975—76

Department	B. Tech.	M. Tech.	DIIT	M.Sc.	M.S.	Ph.D.	Total
Aeronautical Engineering	13	9	—	—	1	1	24
Chemical Engineering	39	25	—	—	3	4	71
Civil Engineering	41	25	—	—	2	3	71
Electrical Engineering	62	34	—	—	—	3	99
Industrial Engineering	—	12	—	—	2	—	14
Industrial Management	—	13	—	—	5	—	18
Mechanical Engineering	62	55	6	—	1	1	125
Metallurgy	24	14	—	—	1	2	41
Chemistry	—	—	—	12	—	4	16
Mathematics	—	—	—	11	—	4	15
Physics	—	—	—	13	—	2	15
Computer Science	—	20	—	—	1	2	23
Applied Mechanics	—	3	5	—	1	2	11
Total	241	210	11	36	17	28	543

The total of 543 includes the following:

Foreign nation students	17
Scheduled caste students	37
Scheduled tribe students	5
Women students	18
QIP scholars	17
Sponsored condidates	7

2. Students Strength

The total strength of students and scholars in the departments are given below in the Table 2.

Table - 2

Total Students Strength 1975—76

Department	Under-graduate course	Post graduate course	Research	Total
Aeronautical Engineering	60	11	18	89
Applied Mechanics	—	6	37	43
Chemical Engineering	203	46	29	278
Civil Engineering	195	44	32	271
Electrical Engineering	329	64	38	431
Industrial Engineering	—	24	6	30
Industrial Management	—	31	18	49
Mechanical Engineering	324	137	70	531
Metallurgy	130	31	35	196
Chemistry	—	27	59	86
Mathematics	—	21	14	35
Physics	—	27	41	68
Computer Science	—	32	4	36
Total	1241	501	401	2143

The total of 2143 includes the following:

Foreign nation students	103
Scheduled Caste students	110
Scheduled tribe students	6
Women students	62
QIP scholars	82
CSIR Scholars	71
External registration candidates	12
Sponsored candidates	10
Part-time candidates	133

3. Degrees Awarded

The number of degrees awarded at the twelfth convocation of the Institute on September 27, 1975 are given in Table 3. Sri P. N. Haksar, Deputy Chairman Planning Commission delivered the convocation address.

Table 3

Number of degrees awarded

Discipline	B. Tech	M. Tech	M.Sc.	M.S.	DIIT	Ph.D.	Total
Aeronautical Engineering	13	8	—	1	9	1	32
Bio-Engineering	—	—	—	—	—	1	1
Bio-Medical Engineering	—	—	—	3	—	1	4
Chemical Engineering	54	21	—	5	—	6	86
Civil Engineering	15	11	—	2	3	8	39
Electrical Engineering	68	29	—	1	—	10	108
Engineering Mechanics	—	—	—	—	—	5	5
Mechanical Engineering	60	44	—	3	5	16	128
Metallurgy	34	15	—	4	—	3	56
Chemistry	—	—	14	—	2	15	31
Mathematics	—	—	22	—	—	5	27
Physics	—	—	16	—	—	3	19
Computer science	—	17	—	—	—	—	17
Industrial Engineering	—	20	—	—	—	—	20
Industrial Management	—	18	—	—	—	—	18
Total	244	183	52	19	19	74	591

The percentage of first and second classes are given in Table 4

Table 4

Number of first and second classes

Class	B. Tech	M. Tech.	DIIT	M.Sc.
First class with Distinction	13	7	6	—
First Class	73	85	51	75
Second Class	14	8	42	20

With this convocation in September 1975 the number of degrees awarded so far by the Institute is : B. Tech 2781, M.Sc. 396 M. Tech. 1178, DIIT. 124, M.S. 81, Ph.D. 273, Total 4833.

4. Prizes

The names of the academic prize winners for the year are given below:

1. *President of India Prize:* (For the student of the B.Tech degree course with the Best Academic Record)	Sri P. Vijayaraghavan (Electrical Engineering) Electronics - B. Tech.
2. *Governor's Prize:* (For all round proficiency in B. Tech degree course)	Sri K. N. Srikanth Electrical Engineering Electronics - B.Tech.

3. Merit Prizes for the students with the best academic record in each discipline of each course:

B.Tech. Course:

Aeronautical Engineering	Sri C. R. Sukumar
Chemical Engineering (Reliance Heat Transfer Private Ltd. Prize)	Sri O. V. Ananthakrishnan
Civil Engineering	Sri Siodia Behran Cawasji
Electrical Engineering (Power, Siemens Prize)	Sri Oommen B. John
(Electronics, Philips India Ltd.,)	Sri P. Vijayaraghavan
Mechanical Engineering	Sri M. Ramaswamy
Metallurgy	Sri D. Venugopalan

M.Tech. Course:

Aeronautical Engineering	Sri V. R. Anand
Chemical Engineering	Sri R. Ramachandran
Civil Engineering	Sri R. Sathasiva Chandrasekaran Nadar
Computer Science	Sri Padmanabhan Kisore
Electrical Engineering (Siemens Prize)	Sri P. Ramakrishnan
Industrial Engineering	Sri Narindernath Kathuria
Industrial Management	Sri S. Vasudevan

Mechanical Engineering (Prof. B. Sengupto's Prize)	Sri S. Venkataraman
Metallurgy	Sri C. Ramakrishna Prasad
Metallurgy—Metal Casting option (Sri S. Anantharamakrishnan Memorial Prize)	Sri S. Ramanathan

M.Sc. Courses:

Chemistry	Sri R. Krishnan
Mathematics	Kum. H. Sudha
Physics	Sri Caleb Dhanasekaran

II. RESEARCH AND DEVELOPMENT

1. Research Publications and Patents

The number of papers published in learned journals in India and abroad is 326. The department-wise distribution is:

Aeronautics, 3; Applied Mechanics, 22; Biomedical Engineering, 10; Chemical Engineering, 25; Chemistry, 44; Civil Engineering, 39; Computer Centre, 1; Electrical Engineering, 58; Humanities and Social Sciences, 6; Mathematics, 17; Mechanical Engineering, 38; Metallurgy, 36; and Physics, 17.

On the basis of Research and Development work done at the Institute, eleven processes were developed. Of these the following patents were obtained:

1. Improvements in or relating to two-speed, three-phase wound stators for induction motors. (I.P. 133788)

2. Improvements in or relating to the manufacture of transparent or translucent articles having high absorptive power with respect to infra-red rays (I.P.138029).

3. A method of preparing thermoplastic moulding powders with cotton linters as an ingredient. (I.P. 138030)

4. A single phasing preventing device. (I.P. 137359)

2. Sponsored Research Schemes/Projects

The Institute has currently a number of sponsored research schemes/projects financed by organisations like the Council of Scientific and Industrial Research, The Indian Council of Medical Research, Ministry of Defence, Department of Atomic Energy, Space Science and Technology Centre, Research and Development Organisation for electrical industry etc. Department-wise details are given below.

(I) Department of Aeronautical Engineering

A. *CSIR:* (Silver Jubilee Award to Dr. K. A. V. Pandalai, the, then, Professor & Head of the Dept. of Aeronautical Engineering now Director, I.I.T. Madras)

Composite structures with specific reference to fibre reinforced plastic structures.

B. *Vikhram Sarabai Space Centre*

1. Design and development of hypersonic wind tunnel
2. Design and commissioning of the aero jet facility
3. High temperature air heater

C. *Ministry of Defence*

1. Analytical, experimental and design studies in fibre reinforced plastic structures
2. Aerodynamics of generalised missile type configuration at supersonic speed
3. Design and fabrication of a supersonic wing calculator using analogue net work
4. Development of computer programme for evaluation of aerodynamic characteristics of swept wing aircraft
5. Design and development of rarefied gas dynamics facility
6. Design and development of ramjet engine
7. Flutter analysis of panels in supersonic flow in the presence of a boundry layer
8. Theoretical and experimental investigation on certain problems in gas turbines
9. Aerodynamic derivatives of missile configuration

(II) Department of Applied Mechanics

A. *CSIR*

1. Design and development of a low speed strain rate controlled universal testing machine
2. Development of artificial kidney

B. *Indian Council of Medical Research*

1. Structure and sole of melanins in health and in disease
2. Design and development of a system for recording standard 12-lead ECG during exercise and its evaluation
3. Development of membrane blood oxygenerator

C. *Vikhram Sarabhai Space Centre*

Acoustic transmissibility tests

D. *Ministry of Defence*

Corona discharge photography—a potential diagnostic tool

E. *Department of Science and Technology*

1. Development of tri-leaflet heart valve prosthesis
2. Development of a vertical axis wind generator

F. *Bharat Heavy Electricals Ltd. Hyderabad*

Stress analysis of large turbine castings

(iii) Department of Chemical Engineering

A. *CSIR*

Multistage fluidisation investigations in cold model

B. *Ministry of Defence*

1. Development of inhibitor for end burning solid propellant charge

C. *Department of Atomic Energy*

Experimental investigations on steady state performance and flow instabilities in boiling channel systems

D. *Brakes India Ltd. Madras*

Development of structural adhesives

(iv) Department of Chemistry

A. *CSIR*

1. Nuclephilic substitution reactions of halogeneoethers
2. Solid state chemistry of mixed metal oxides of zirconium and titanium

3. Mechanistic studies on the oxidation of olefines on oxide catalysts

4. Catalysed reactions involving photo-chemical stimulation

5. Liquid phase catalytic hydrogenation of glucose and fructose by transition metal complexes

B. *PL - 480*

1. Catalytic high pressure hydrogen transfer reactions

2. Light and heat induced activation of alcohols by semiconductor oxides

C. *Department of Science and Technology*

1 Studies on the solid state chemistry and catalytic properties of mixed oxides of some transition metals

2. Development of materials for (a) Production of hydrogen by photo-electro chemical decomposition of water using solar energy and (b) Storage of hydrogen

D. *Indian National Science Academy*

Characterisation of iron, cobalt and nickel complexes and their effectiveness as catalysts for hydrogenation.

E. *Department of Atomic Energy*

An investigation of catalytic properties of neutron irradiated zinc oxides

F. *Bharat Heavy Electricals Ltd., Hyderabad*

Development of posistors

(v) Department of Civil Engineering

A. *Ministry of Shipping and Transport*

Model tests on torsion in bridge decks

B. *Ministry of Defence*

Load testing of K. M. bridge components

C. *Ministry of Railways*

Tests on a special type of cement (Pozzolana Cement)

(vi) Computer Centre

Department of Electronics

Computerised hospital information system

(vii) Department of Electrical Engineering

A. *CSIR*

Development of silicon Mos capacitors or Mos Varactors

B. *Indian National Science Academy*

Effect of atmospheric turbulance on an open air laser communication line

(viii) Engineering Design Centre (Systems Group)

Department of Science and Technology

Design and development of a compatible set of photogrammetic and multispectral remote survey cameras

(ix) Department of Mechanical Engineering

A. *CSIR*

1. Technology of preservation of fruits, vegetables and marine products
2. Porous cylindrical solar heater
3. Holographic techniques for stress analysis
4. Design and development of ultrasonic burner
5. Stress analysis in production processes Development and application of a special technique.

B. *Bharat Heavy Electricals Ltd., Hyderabad*

1. Heat transfer studies in large electrical machines
2. Thermal design and research studies in large deaerators used in power plants

C. *Ministry of Defence*

1. Design and development of an serial camera similar to F-95
2. High speed compressor and turbine investigations
3. High speed cascade tests

D. *PL-480*

Control of exhaust emission from diesel vehicles

E. *Department of Science and Technology*

1. Development of 3-ton solar air-conditioner

2. Design and development of the multipurpose tubular reversible axial flow machines

F. *Department of Electronics*

Development of printing units

G. *Department of Atomic Energy*

Holographic techniques for stress analysis and holographic non-destructive testing

(x) Department of Metallurgy

A. *CSIR*

1. Cold pressure welding of similar and dissimilar metals

2. Fabrication of friction welding machine

3. Study of the structure of glasses using the Warren Mozzi techniques

4. Development of breakdown agents for sodium silicate carbondioxide bonded sands.

(xi) Department of Physics

A. *CSIR*

1. Development of information storage devices

2. Development of cryostats for the study of some properties of materials at low temperature

3. Pseudopotential calculation of the equation of state and harmonic properties of metals

4. Surface state of semi-conductors in high and ultra-high vacuum

5. Spin-wave resonance and nuclear magnetic resonance studies in ferromagnets.

B. *Ministry of Defence*

1. Development of infra-red detectors to grow single crystals

2. Cryogenic systems for infra-red detectors

C. *Department of Atomic Energy*

Theory of point defects

D. *Bharat Heavy Electricals Ltd., Hyderabad*

Development of rotating dewar for liquid helium with transfer coupling

(xii) Quality Improvement Programme

AICTE and UGC

1. Identification of goals, curriculum design, needs and aspirations in engineering education

2. Curriculum development processes

3. RESEARCH CENTRES

Centre for Energy Research

In the wake of the recent energy crisis and in consequent need for marshalling energy resources for their optimum use, the Institute has set up a Centre for Energy Research.

The Wind Power Division of the Energy Research Centre has entered into a collaboration project with the BHEL under the auspices of the Department of Science and Technology for the design and development of a vertical axis wind machine. The project which is expected to run for a little more than two years is worth about Rs. 3.5 lakhs. In the initial instance, the group at I.I.T., Madras is concentrating on the design and development of a vertical axis wind machine with straight blades. A preliminary model 1 metre high has been designed and working drawings prepared. Almost all the components have been fabricated and the final assembly is being done. Depending upon the experience with this model, it will be extended to larger sizes.

Engineering Design Centre

This centre is oriented towards design and development of products, processes and total systems from planning to production, especially in inter-disciplinary fields utilising the available resources of the Institute.

The Centre is currently engaged in the development of multi-spectral and photogrammetric cameras, static trainer intended to be used for training 'L' drivers and leather processing machinery for the production of finished leather. The centre proposes to establish standard facilities for processing professional grade printed circuits and to develop applications for standard active electronic components of various manufacturers.

The Multispectral and Photogrammetric Camera Project, one of the largest projects at the Institute was started in early 1976. The result of over two years of work to find support for an advanced air-borne multipurpose electroptical imaging system, the project is time-targeted as it replaces imported equipment to be used by NRSA and Survey of India. The twenty lakh project is running to schedule and design of most of the major sub-systems is already complete.

Fibre Reinforced Plastics Research Centre

This centre has undertaken several steps towards the development and propagation of FRP technology in India. New FRP products like micro-wave antenna, storage tanks, on-line tap changer arc chute chamber etc. have been developed. Consultation works worth Rs. 85,000/- have been completed and work worth over Rs. 4 lakhs initiated on new projects.

One short course on FRP Structures and a one day workshop on FRP have been organised for training engineers working in industry. As part of our effort to help the small industries, technical assistance and product testing services have been offered to several small scale industries in and around Madras.

Materials Science Research Centre

The following research projects are in progress :

1. "Development of posistors" sponsored by BHEL (R & D) Hyderabad.

2. "Studies in the solid state chemistry and catalytic properties of mixed oxides of transition metals" supported by the Department of Science and Technology.

3. "Development of solid material for the production of hydrogen by photoelectro-chemical decomposition of water using solar energy and for storage of hydrogen" supported by the Department of Science and Technology.

Regional Sophisticated Instrumentation Centre

The most important function of the Centre is to help the scientists within the Institute and from outside the Institute. During the year 1975-76 three new instruments have been bought and commissioned. About 50 universities and colleges and 25 industries and national

3. Development of high-speed digital link

4. Heat-transfer studies in electrical machines

5. Speed-control of a squirrel-cage induction motor

6. Centrifugal compressors

7. Improvement of weld quality in wheels

8. Preparation and investigation of magnetic properties of ferro-magnetic materials of technical interest

9. Design and construction of cryogenic equipment

Equipment and spare parts valued at Rs. 54 lakhs have been received (April 75 to March 76). T. V. equipment to implement the training programme in T.V. Engineering in India worth Rs. 39 lakhs has been received (April 75 to March 1976).

Mr. Dieter Welzel, the German expert joined the Institute to implement the training programme in T.V. Engineering. Prof D. Ing. Hans Wagner has since joined as an adviser for a period of two years to assist the Institute in the field of applied research and development.

6. FRENCH COLLABORATION

The recent agreement with France for collaboration and assistance to the Aeronautics Department of this Institute is being implemented. This enables the Institute to enlarge its association and collaboration with another great and friendly European country like France that has contributed so much to human liberty, civilisation culture, science and technology. Our most sincere thanks go to the Government and the people of France.

III EDUCATION PROGRAMMES

1. CONTINUING EDUCATION PROGRAMMES

The following short term/part-time courses have been conducted during the year under report.

1. Principles and practice of cryogenics (May 12 to July 4, 1975)

2. F. R. P. Structures (September-October 1975)

3. Experimental Stress Analysis with special emphasis on Photo elasticity (October-November 1975, KCP Ltd., Madras)

4. Achievement Motivation (December 13 and 14, 1975)

5. Materials management (November 24, 1975 to May 30, 1976)

laboratories have used the measurement facilities during this year. The number of measurements made during the year 1975–76 in various categories are: Infrared Spectra 1363 (787); UV Vis IR Spectra 40 (160); 60 MHz NMR Spectra 154 (410); ESR spectra 315 (3210); 100 MHz NMR spectra 39 (55); the numbers in bracket being the number of measurements made by I.I.T. scientists and the number outside the bracket by the outside scientists. The number of measurements made in this laboratory for outsiders during this year has far exceeded that of last year. A special brochure on RSIC was brought out in September 1975, explaining in detail the nature of equipment pooled in RSIC and the work undertaken. A Summer School sponsored by the DST on 'Chemical Applications of Spectroscopy' was conducted and about 35 participants from various parts of the country took part and were benefited.

4. ASSISTANCE TO INDUSTRY-INDUSTRIAL CONSULTANCY CENTRE

The Industrial Consultancy Centre was established at the Institute in April 1973 to serve as a link between industry and the Institute and to co-ordinate the industrial liaison activities of the latter.

During the year under report, a get-together of entrepreneurs, scientists and financiers was organised at the Institute on 30th–31st January, 1976 with the object of providing a forum for personal discussions to promote commercial utilisation of the technical know-how developed at the Institute and various research laboratories. The get-together was sponsored by the Indian Bank, I.I.T., Madras, National Research and Development Corporation of India and the C.S.I.R. More than 150 entrepreneurs registered for the get-together.

In all 75 commercially viable processes were presented to the scientists and 19 developmental processes were presented by the I.I.T. Madras and NRDC of India.

During the year 941 consultancy assignments worth Rs. 8.14 lakhs were taken up.

5. INDO-GERMAN COLLABORATION

The Fourth Indo-German agreement which came into effect from 1st December 1974 has started showing remarkable signs of progress for furthering our knowledge and friendship with the people and the Government of the Federal Republic of Germany. Our sincere thanks are due to them for their continuing collaboration and assistance. A recent visiting German Parliamentary delegation felt that no international project of collaboration and assistance in which their country is engaged, has worked so well as the one represented by this Institute.

Nine inter-universiy Indo-German projects have been identified and work is under progress. They are

1. Design and development of a multistage fluidised bed reactor
2. Development of pretensioned pre-stressed concrete railway sleeper for the Indian Railways

6. Product Design (January 3 to April 17, 1976)

7. Maintenance of Refrigeration and Airconditioning equipment (January 9 to March 19, 1976)

8. Workshop at FRP Research Centre (14, Feb. 1976)

9. Maintenance Engineering and Management (5th to 17th April, 1976)

10. Chemical Applications of Spectroscopy (May 10–20, 1976)

11. Programme for Instrument Technicians (June 20 to July 9, 1976)

12. Jig and Fixtures in Quality Production (June 1976)

2. QUALITY IMPROVEMENT PROGRAMME

1. Serving teachers programme:

The number of teachers of engineering colleges admitted during the year is 17 for M. Tech and 10 for Ph.D This brings the number of QIP scholars on rolls in 1975–76 session to 82.

2. Short term courses:

The details of the short-term courses conducted for faculty members of engineering colleges are given below:

1. Bio-Medical Engineering (3 weeks in December 1975: 21 participants)

2. Cast Metals Technology (3 Weeks in December 1975; 27 participants)

3. Gas Turbine Engineering (3 weeks in December 1975; 31 participants)

4. Numerical Control of Machine Tools (2 weeks in December 1975; 19 participants)

5. Structural Design for Dynamic Loads (3 weeks in December 1975; 18 participants)

6. Material for Engineering Technology (3 weeks in summer 1976; 22 participants)

7. Fluid Mechanics (2 weeks in summer, 1976; 35 participants)

8. Materials Handling Technology (4 weeks in summer 1976; 14 participants)

9. Computer Engineering and Applications (3 weeks in summer 1976; 28 participants)

10. Television Engineering (2 weeks in summer 1976; 21 participants)

11. Engineering Education Programme (2 days in February 1976: 324 participants)

This brings the total number of short-term courses conducted under QIP to 45 with a total participation of 1419 faculty members from all engineering colleges in India.

3. CURRICULUM DEVELOPMENT CENTRES

Chemical Engineering

The reviews of publications of this year are given below:

1. *Introduction to Chemical Equipment Design: Mechanical Aspects* (B. C. Bhattacharyya, I.I.T., Kharagpur, 298 pp) 'The book is quite comprehensive. Every student and practising chemical engineer must possess this book for study and reference'. (Chemical Industry News, March 1976)

2. *Corrosion and its Prevention: An Introduction* (K. S. Rajagopalan, CECRI, Karaikudi, 63 pp) 'A study of this book is bound to be of real benefit to all students of science, engineering and technology' (Chemical Industry News, March 1976).

These bring the total number of publications of this Centre to seven.

The visiting specialists of the Centre during the year are:

1. Prof. N. H. Wagh, Indian Institute of Technology, New Delhi.

2. Dr. L. W. Shemilt, Dean, McMaster University, Hamilton, Ontario, Canada.

3. Dr. S. V. Mainkar, Govt. College of Engineering and Technology, Raipur, M. P.

Mechanical Engineering

The Curriculum Development Centre in Mechanical Engineering has been endeavouring, for the past few years, to up-date and upgrade the existing engineering undergraduate degree programme in Mechanical Engineering. Several conferences, symposia and study group meetings have been arranged in this connection. The Centre has published several monographs on Mechanical Engineering subjects which serve as guides to both teachers and students. These

monographs have been well received and some of them are likely to be published as reference text-books. During the year 1975–76, the following monographs were published:

1. Mechanical Handling Equipment

2. Mechanical Measurements

3. Theory of Elasticity (just published).

A symposium on four-year-undergraduate degree programme was held. This symposium has relevance to the changed pattern of secondary school education in the country.

4. IMPORTANT LECTURES AND SEMINARS

The following are some of the important lectures and seminars held at the Institute.

1. Convocation address by Sri P. N. Haksar, Deputy Chairman Planning Commission (September 1975)

2. "Effectiveness and the Indian Environment" by Sri P. J. Fernandes, Secretary, Department of Fertiliser and Chemicals, Ministry of Petroleum and Chemicals (November 1975, Employees Federation of Southern India Lecture)

3. "Space Technology and the Utilisation of Forest Wastes', by Prof. S. Dhawan, Chairman, Space Commission of India and Director, Indian Institute of Science, (February 1976, Dr. A.L. Mudaliar Memorial Lecture)

4. "Integration Technology" by Dr. B.H. Wadia, Managing Director, Behram Wadia and Associate, Pune (March 1976, Philips India Limited Endowment Lecture)

5. Seminar in "Engineering Education" inaugurated by Prof Satish Chandra, Chairman, University Grants Commission (March 1976)

6. "Education 2001" a seminar jointly organised by I.I.T., SCERT and the Devi Educational Institute, Madras (March 1976)

7. Address by Prof. Nurul Hassan, Union Minister for Education and Social Welfare on Rural Development (March 1976)

8. "Space Exploration" lecture by Astronaut Alan Bean (March 1976)

IV. OTHER FACILITIES AND ACTIVITIES

1. STAFF

During the year 12 Professors, 5 Assistant Professors, 1 Senior Scientific Officer Gr. I, 6 Lecturers, 4 Senior Scientific Officers Gr. II, 1 Assistant Workshop Superintendent, 3 Deputy Registrars, 1 Asst. Registrar, 2 Asst. Stores and Purchase Officers, 1 Asst. Finance and Accounts Officer, 1 Special Assistant to Director, 1 Secretary to Director, 1 Secretary to I.C.C., 1 Medical Officer, 4 Junior Superintendents, 10 Senior Technical Assistants, 4 Accountants, 2 Technical Assistants joined the Institute. Many internal candidates qualified themselves for higher posts in the open selection. This brought the total academic staff strength to 343 and non-academic staff strength to 1076. The total number of Institute employees came to 2165 including the work charged staff.

2. LIBRARY

The Central Library continued to get scientific books, periodicals and Xerox copies of technical literature from Technical University Library, Berlin under the Indo-German Collaboration programme. The British Council Division of British High Commission, Madras has gifted 264 British scientific and technical books costing Rs. 20,670 under ODM Books Presentation Programme. The compilation and printing of data for the Union Catalogue of Serials of the five I.I.T.s and Indian Institute of Science by computer-aided method are under progress. The library is operating a pilot project in collaboration with computer centre and INSDOC under the NISSAT Programme of the Department of Science and Technology, Government of India for the computerised CHEMICAL ABSTRACTS/SDI Service with Canadian software, sending fortnightly SDI output to about 120 scientists all over India and neighbouring developing countries like Nepal and Sri Lanka. The statistical data of the library are as follows:

Books and Bound volumes of periodicals (acquired)	6,249
Pamphlets and reports (acquired)	2,420
Microfilms and Microfiches (acquired)	52
Total intake during the year	11,694
Total accessions up-to date	1,44,041
Total number of Periodicals	1,330
Expenditure during the year	About 2 lakhs

3. INSTITUTE GYMKHANA

The students continued to take active part in all extra-curricular activities. The teams in hockey, foot-ball, basket ball, volley ball,

tennis and athletics went up to finals in Madras Collegiate Athletic Association tournaments. The swimming team has won Inter Collegiate Championship. Hockey and ball badminton team were winners in their division. The swimming team has won the championship in the Open Collegiate Meet of Buck Memorial Sports. Hockey, basket ball, badminton, swimming, tennis teams were runners up in the Stanley Medical and Betram Memorial Tournaments and were winners in the Y.M.C.A. Gymkhana Club and in other open table tennis championships. Our boys for the fifth time in succession claimed the trophy at the Inter-I.I.T. meet held in December at Kharagpur. Our students R. Ravi and S. Murali represented Tamil Nadu in the National Table Tennis Championship.

Cultural and literary activities reached their highest mark during January 1976 when the cultural festival which drew students from all over the country was organised. An exhibition of photographs and paintings was also organised. Our students won Jayees Madras and Lions Club of Guindy Inter Collegiate quiz trophies and shields.

4. N. C. C. AND N. S. S.

One hundred and fifty four students enrolled themselves in the Air and Army wings of the N.C.C., raising the strength of cadets in the two wings to 194 and 95 respectively. During the year under review, 26 cadets of the Air Wing were given gliding training. The cadets relaid 250 meters long and 4 meters wide road in a day while they were on their Annual Training Camp. Cadet G.M.K. Raju of the Army wing performed creditably in a rock climbing course held at the N.C.C. Academy, Purandhar. Twenty six cadets passed B-Certificate examination and seven 'C' certificate examination.

Our students did excellent social work under the N. S. S. in Narayanapuram village. The cadets of this well motivated group have endeared themselves to the people of the village and made themselves accepted into the community to act as catalysts for changes and social transformation which will come about in that area.

5. GENERAL FACILITIES

Additional campus facilities included a swimming pool this year. It has started attracting large number of students and staff both as a recreation and as a sport. The acquatics team is expected to take full advantage of this facility to achieve better records in competitions. An indoor shuttle badminton hall has been added and is proving popular.

The institute hospital continued to provide good general health care. Dr. (Miss) S. Maricar, former Director of Health Services, the Tamil Nadu State Government was appointed as Advisor to the Institute Hospital. A family planning unit has been started.

6. CONSTRUCTION OF BUILDINGS

The following are some of the important buildings which are in progress or were completed during the course of the year.

I. List of works in progress

1. C_1 type quarters (2 blocks)
2. D type quarters (4 blocks)
3. Married Officers Hostel (1 block)
4. Extension to Kendriya Vidyalaya
5. Construction of 2 blocks of E_1 type quarters
6. Construction of second floor over B.S.B. rear wing
7. Setting up television laboratory
8. Construction of fuel filling station and housing for petrol and diesel tanks near auto shop
9. Additional room to R & A. C. lab in gas dynamics laboratory
10. Construction of shuttle badminton court
11. Construction of first floor over guest house
12. Extension to heavy vibration laboratory
13. Extension to hospital

II. Works completed

1. Construction of first floor over rest block for mess staff
2. Additional class rooms in Vanavani High School
3. Swimming pool

7. CENTRE FOR RURAL DEVELOPMENT

The importance of the village to Indian life in general and to Indian economy in particular can be seen in the main thrust and direction of the Prime Minister's Twenty Point Programme. The village, the backbone of the nation was never given a fair deal in the past. This resulted in an exodus to the towns and cities, which, instead of solving old problems created new ones. Problems of proliferating urbanisation compounded with those of a demographic nature worsened the situation. No wonder poverty and dirt, disease and superstition confront the villager.

The only solution to these multi-faced problems is an integrated rural reconstruction and development programme based on Gandhian approach. The villagers, one and all, must be involved enthusiastically in this reconstruction programme aiming at an all round and self sufficient development of the village.

With these aims and approaches in view, the I.I.T., Madras has started a Centre for Rural Development (CRD), the emphasis of which is on the transfer of appropriate technology already available at the Institute, to the village to generate immediate employment for the villagers making use of available local materials through their proper management. An energy complex combining bio gas, solar energy and wind power production along with an economic water management is being set up. Every effort is being made to develop the complex in such a way that this 'Programme Package' can be replicated in other villages with suitable modifications.

V. BUDGET AND INSTITUTE EARNINGS

1. BUDGET PROPOSALS

(i) Approved budget and the expenditure for the year 1975–76:

Approved budget (Net) 1975–76	Rs. 311.55 lakhs
Amount allotted by the Ministry	Rs. 407.00 lakhs
Actual expenditure 1975–76 (Net)	Rs. 401.15 lakhs

((i) Budget proposals for Revised Estimates 1976–77 and Budget Estimates 1977–78:

(Figures in lakhs of rupees)

	Actuals for 1975–76	Budget for 1976–77	Revised Estimates 1976–77	Budget Estimates 1977–78
	Rs.	Rs.	bs.	Rs.
RECURRING	303.86	328.00	378.72	409.96
NON-RECURRING				
Buildings	36.86	40.00	90.42	75.00
Equipment and others	87.24	50.00	114.86	119.73
Total	427.96	418.00	584.00	604.69
LESS Income	26.81	21.00	71.69	45.28
Net	401.15	397.00	512.31	559.41
NOTIONAL PROVISION				
Equipment	93.38	58.00	69.50	37.50

2. INSTITUTE EARNINGS

It is heartening to note that thanks to the creativity, talents and reputation established by a very high percentage of the faculty, the total earnings during 1975–76 by way of sponsored R and D projects, industrial consultancy work,computer earnings and from various courses organised for scientists and engineers from industries and outside organisations, have touched the record percentage of 70 out of the total amount paid out to all the faculty members by way of 'Pay and Allowances" which, in turn, represents 45 percent of the total amount spent during 1975–76 for 'Pay and Allowances' for all the staff members numbering about 2165. For administrative staff, the 'Pay and Allowances' during 1975–76 was 13 percent of the total spent under this heading and for maintenance of the vast campus of 633 acres, an extra expenditure representing 5.5 percent was incurred. The use of the computer system now exceeds 400 hours per month, out of which 220 hours are accounted for by external agencies.

VI. INSTITUTES ROLE IN TWENTY POINT ECONOMIC PROGRAMME AND NATIONAL AIMS

The essence of the Twenty-Point Programme is discipline, devotion and dedication by each and every one in the country irrespective of the station or position he/she occupies. No nation can progress and develop without everybody concerned putting his shoulder to the wheel to promote community welfare and increase efficiency and productivity. This is particularly true of developing countries with a long history of colonial rule and tradition, the burden of which is acting against the true spirit of science and technology. The social transformation of a society where 80% of the vast population live in rural areas and about 50% live below the poverty line are not tasks and responsibilities to be shouldered by the Government alone. It is the responsibility and task of every Indian who has the privilege and advantage of education which at all levels is subsidised. This social obligation has been kept in our mind. I.I.T., Madras has therefore set up a Centre for Rural Development (CRD) with its focus on appropriate education and technological inputs to generate the maximum number of jobs in and around the village of Narayanapuram that has been adopted by the Institute. On a 94 acre plot of land allotted to the Institute by the State Government, a Rural Technological Complex (RTC) is to be set-up consisting of several small village oriented but viable industrial units which are agro-based. A comprehensive plan for the rural technological complex is being drawn up and one of the leading banks has agreed to finance the scheme. Our students belonging to the NSS have already done good work in the Narayanapuram village and have won the hearts of the people of the village by their enthusiasm, zeal and desire to serve. It is a major achievement that they have been accepted as catalysts for the social transformation and economic growth and development of the village of Narayanapuram and the neighbouring villages.

For the students who come from economically difficult circumstances and the weaker sections of the society, the special academic

programme introduced at the beginning of the last academic year is being continued with suitable modifications in the light of our past experience.

Under the Book Bank Scheme, 100 of these students are currently deriving benefits. One of our main concerns must be about those who are underprivileged and handicapped. For such students, 'Students Assistance Programme' is being evolved so that by putting in about eight hours of work per week on suitable projects and assignments to which they can meaningfully contribute, they will be able to earn extra money to meet their basic needs and requirements for which an absolute minimum of Rs. 175/- per month is essential. There are nearly 300 such students who need help. It is estimated that an annual expenditure of nearly Rs. 2.50 lakhs will be required, in order to give adequate help to the students.

We need also to introduce a 'Core Menu System' in our hostels so that the daily mess rate is kept down to below Rs. 4/-. Those who are more privileged and can afford to pay for 'extras' and luxury items may do so. In consultation with the student representatives, a detailed study in trying to introduce certain educational reforms is being taken up. One of the reforms arranged is relaxing the existing rigidity relating to the time factor of ten semesters for the B. Tech. programme is under way. When this is implemented, it will enable each student to progress at his own pace. However, this will involve considerable individualised student counselling by the faculty members. It is an experiment worth trying and its success will very much depend upon the effectiveness and efficiency of the counselling system and the student-faculty interaction.

As a part of the programme, the Institute has striven hard to rise to the occasion and to attain higher efficiency of its working. Constant study of the administrative set up and organisation and its viability in the context of our present need, are given attention to. An incentive scheme to tone up discipline, efficiency and productivity based on the functional needs of the fast-expanding activities of the Institute, has been introduced. This scheme is being extended to all class III and IV employees, based on certain norms and criteria that have been and are being evolved. This scheme is like giving due recognition to the students for their excellence in academic or extracurricular activities. It is our belief that excellence in all spheres of human endeavour from the lowliest to the highest, must be encouraged, promoted and appreciated.

For the first time in the history of the Institute, a faculty member who has a penchant for process development leading to patenting and commercial exploitation of these has been given an award, as a token of appreciation by the Institute for his creativity and productivity. In other words, the new culture that the Institute wants to develop in this campus is one which encourages and promotes excellence and productivity in all spheres of activity and among all members of the Institute community, irrespective of whether they are students, faculty or nonfaculty. The new India that men of the calibre of Tagore, Gandhi

and Nehru dreamt of can come about only when distinctions based on class, caste, communalism and parochialism are rooted out from the minds of all in this country. Only then, will the almost infinite gap existing between the preaching morality and practising morality get bridged.

To promote a composite culture among the Institute community consisting of three components (the student, the faculty and the non-faculty staff) and to evolve an approach to sort our problems, realizing that the Institute community is a chain of 4200 links, the strength of which lies in the weakest, certain schemes and welfare measures as well as machinery and the mechanism for discussion and dialogues with all concerned in the Institute, have been introduced.

The student representation on both the undergraduate and post-graduate committees enables them to participate in the decision-making process in academic matters.

For the Faculty, apart from the fact that all the revised scales as approved by the Ministry have been implemented, the sabbatical leave has also been approved by the Ministry.

For the non-faculty staff, we have introduced the 'Employees Welfare Scheme' which in fact is open to all employees of the Institute. It provides for quick and prompt payment to the nearest relative of any subscribing employee who passes away while in service, a lump sum of Rs. 4,000/- apart from paying for the funeral expenses upto maximum of Rs. 250/-. The subscription is nominal at Re. 1/- per month. A similar Welfare Scheme is being introduced for the hostel employees also.

A programme of refresher and special training courses for Class III and IV staff has been drawn up and this is estimated to cost rupees one lakh per year. Currently three such programmes are going on or completed, involving a total cost of about Rs. 45,000/-. Class III and IV employees now can go for higher studies and training on a very highly subsidized and graded basis, as approved by the Board. Currently 24 employees are availing of this scheme.

VII. FUTURE

The Institute cannot rest content with the contributions it has so far made. The country faces many problems whose solutions lie in the application of science and technology. In line with the plans developed by the nation as a whole for the promotion of science and technology, the Institute has to diversify its activities in scientific and technological education, research and development, design and consultancy and liaison with all sectors, contributing to the economic growth and development of the nation. The Institute must establish new records and reach higher peaks of excellence through discipline, dedication and devotion to duty as well as team-spirit and team-work of faculty, staff and students.

As our activities increase in tempo and get diversified, a proper monitoring and planning mechanism becomes essential, as otherwise, the developments will be poorly co-ordinated and not well-thought-out. Therefore, it is proposed to set up a "planning and monitoring" cell. Although it is impossible to predict the future, the necessity for perspective planning cannot be questioned.

The Institute stands for encouraging excellence, creativity, and innovation in all spheres of activity and at all levels. The spirit of inquiry, the readiness to accept challenges, keeping an open, questioning, analytical mind unfettered by dogmas and prejudices all of which represent the essence of the scientific culture must become part of the blood-stream of everybody connected with this Institute.

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./MS./Ph.D. students, specialisation is possible in any one of the following areas (i.e.) Aerodynamics/Gas Dynamics/Rockets and Missiles/Structural Mechanics.

Development Activities

Aerodynamics/Gas Dynamics

Development of a holographic interferometric apparatus for aerodynamic diagnostic purposes. Development of the instrumentation for the low density wind tunnel.

Rockets and Missiles Laboratory

Low pressure burning rate test rig for solid propellants. Pyramid type wind mill. Test stand for spinning solid propellant rocket motors.

Structural Mechanics Laboratory

Bending of plates by Moire method. Photoelastic Polariscope

Research Activities

Aerodynamics/Gas Dynamics

Optimization studies in aerodynamics. Flow through tubes at low pressures. Effect of hard blowing inboundary layers. Study of turbulence in wind tunnel contractions. Measurements in axisymmetric transonic-subsonic turbulent mixing flow. Piloted open flames. Stability of pilot flames behind Bluff bodies. Rockets at high angles of attack. Thwaites method for wind tunnel contractions with large number of terms.

Rockets and Missiles

Performance of polyvinyl chloride plastisol propellants. Design procedure for star grains of single and multicomponent composition. Shock boundary layer interactions. Non-similar solutions of laminar and turbulent boundary layer heat transfer. Transonic flows in cascades. Rapid de-pressurization of solid propellants. Transport properties of a two-temperature argon plasma.

Structural Mechanics

Thermal buckling of elastically restrained orthotropic circular plates. Effect of an isotropic core on the thermal buckling of orthotropic circular plates. Analysis of cantilever plates of variable planform. Stress concentration in composite plates. Collocation methods by derivative.

The following Projects are in progress under the Aeronautical Research and Development Board:

1. Panel flutter in supersonic flow with boundary layer effects.
2. Analytical, experimental and design and fabrication studies in FRP Structures.
3. Rarefied gas dynamics facility.
4. Certain heat transfer problems on gasturbine blades.

APPLIED MECHANICS

The Department consists of four major groups in the areas of Elasticity, Machine Dynamics, Fluid Mechanics and Biomedical Engineering. It continues to offer M. Tech. degree courses in Engineering Mechanics and Machine Dynamics. Besides these it is offering two more postgraduate courses - one in Industrial Tribology (one year D.I.I.T. programme) and the other in Maintenance Engineering and Management (two year M. Tech. programme). In addition, M.S./Ph.D. by research are also offered in the areas of Solid Mechanics, Machine Dynamics, Fluid Mechanics and Biomedical Engineering. There were 4 M.S. and 18 Ph.D. research scholars during the year 1975–76. The Department maintains its active role both in research and industrial liaison work. It has been responsible for contributing to some of the major developmental works for the industries.

Research Work

Elasticity Laboratory

Structural vibrations of bridges. Nonlinear analysis of sandwich structures. Viscoelastic analysis of adhesive joints. Nonlinear analysis of circular cylindrical shell. Vibration and buckling of plates. Transient response of structures under thermal and mechanical loads. Stress analysis of nose-cone type structures. Impulsive loading of plates and shells. Large deflection of skew plates. Application of finite element methods for the design of high speed grinding wheels. Bending, buckling and rupture of noncircular rings under creep conditions using numerical methods. Nonlinear vibrations of plates and shells (geometric and material nonlinearity) in vacuum and acoustic medium. Nonlinear vibrations of multilayered plates and shells made of elastic and viscoelastic materials. Creep deflection of plates and shells

including second order effects. Nonlinear analysis of frames (geometrical and physical). Free vibration and buckling of anisotropic (and orthotropic) conical shells. Transverse vibration of rotating orthotropic shafts of constant and varying thicknesses. Application of Laser diffractography to structural problems.

Machine Dynamics Laboratory

Signature analysis Diagnostic maintenance. Vibration analysis of electric transmission lines. Dynamic analysis of machine tool structures. Development of torsional damper test rig. Flexible rotor test rig and airbearings for high speed spindles. Physical and chemicai properties of lubricating and re-refined oils. Stress analysis of centrifugal baskets. Studies on acoustic transmissibility and effect of impact on short length bars.

Fluid Mechanics Laboratory

Measurement of turbulence structure in a three-dimensional turbulent boundary layer developing on a yawed flat plate. Investigations of flow through a two-dimensional diffuser with a lifting body. Turbulent boundary layers in adverse pressure gradient. Experimental investigations of liquid sheet formation from swirl spray nozzles. Experimental investigations on conical diffusers with centrally distorted inlet velocity profiles. Studies on contraction cones.

Biomedical Engineering

Ultrasonic instrumentation for physiological monitoring. A new system for recording 12 lead ECG during exercise. Development of counterpulsation technique as a cardiac assist device. Blood coagulation time measurement. Blood flow measurement using laser Doppler velocimeters. A portable audiometer. Digital Cardio techameter. Development of membrane blood oxygenator. Development of artificial kidney. Optimization of resources in Health care Delivery System. System analysis of population dynamics. Drug infusion pump. On-line EEG power spectral analysis. Neuro signals analysis. Evoked response studies. Development of biocompatible bags for blood storage. Functional electrical stimulation of extremities. Development of bioceramic materials.

Design and Development work

Development of a Laser diffractographic setup for measurement of transient response of structures. A calibration device for calibrating piezoelectric transducers. Design of a suitable vertical axis wind machine.

Academic activity

Output of M. Tech., D.I.I.T., M.S. and Ph.D. students for the year

M. Tech. (Machine Dynamics) - 7, M. Tech. (Engg. Mech) - 3,

D. I. I. T. (Industrial Tribology) - 5, M.S. - 4, Ph.D. - 6

Sponsored projects and Industrial Consultancy

Stress Analysis of Turbine casings for the Super Thermal power plant (Bharat Heavy Electricals Ltd., Hyderabad). Shell analysis (C. S. I. R. New Delhi). Testing of springs (Commercial Credit Corporation (1943) Pvt. Ltd., Madras). Testing of springs (Southern Switchgear Ltd., Madras). Acoustic transmissibility test on SLV-3 Rocket (V.S.S.C., Trivandrum). High speed air bearing studies (BARC, Bombay). Vibration test on heavy marine engine mountings (Naval production and Inspectorate, Ministry of Defence). Vibration and acoustic measurements on 2000 HP compressor at Udyogamandal (FACT). Vibration and acoustic measurement on machine tool (Lathe) of M/s Kirloskar Ltd., Harihar (India Design Centre). Testing of torsional dampers for their characteristics - Vibromech (Engineers (P) Ltd.) Acoustic measurements at Hotel Chola. Study of noise pollution levels at different locality in various cities of Kerala State. Impact noise studies on RCC structures (MAPP, Kalpakkam). Development of stockbridge dampers - (Star Iron Works, Calcutta). Testing of packaging material for vibration and damping characteristics (Rubrofibre Ltd., Alleppey) Development of a vertical axis wind turbine (Department of Science and Technology). Wind tunnel tests on cabana model (Wratches India, Madras).

Continuing Education Programmes

A summer school in Fluid Mechanics for a duration of 2 weeks (17th May to 28th May 1976) was conducted in which the faculty from different colleges and scientists working in industry took part. A Winter School in Biomedical Engineering (December 1975) and a six Lecture Course on Physiology (August 1975) were arranged.

CHEMICAL ENGINEERING

Teaching and Research

The number of students on rolls during 1975–76 and number graduated are given below:

	No. on rolls	*No. graduated*
B. Tech.	122*	48
M. Tech.	34**	17
M.S.	6	3
Ph.D.	11 (* 3 staff)	6 (Staff 2 Student 4)

Undergraduate curriculum is in the process of continued revision. Most of the subjects are made to base on tutorials and assignments,

giving considerable scope to the student, for self-study. The examinations are being made more and more of the objective type. The post-graduate programmes continue in the pattern for the student to gain depth in the fundamentals of Chemical Engineering and opportunity to specialize in one of the six selective areas.

The research programmes that are started in different sections are:

1.	Reaction Engineering:	Stochastic modelling in tubular flow reactor with motionless mixing elements.
2.	Transfer Operations:	Studies in multistage fluidized bed.
3.	Particle Technology:	Rotary bubble generator
4.	Process Control:	Control and dynamics of typical process equipment
5.	High Polymer Engineering:	Development of non-biaefringement acrylic plastics

The department has organised lectures by

(1) Prof. L. W. Shemilt, McMaster University, Hamilton, Canada,

(2) Prof. E. Fitzer, University of Karlsruhe, West Germany and

(3) Prof. J. W. Carter, University of Birmingham, U. K.

Industrial Liaison

About twelve major projects were taken up for industry. Testing and analysis of materials were also undertaken.

Services of two staff members were continued for consultation on annual basis.

General

A total of 25 papers were published. Two patents were taken.

CHEMISTRY

The Department continued the teaching programmes for B. Tech., M. Tech., M.Sc., and Ph.D. Courses of the Institute.

The major areas of research in the department are homogeneous and heterogeneous catalysis, Surface chemistry, Solid state chemistry, Photochemistry, Polymer chemistry, Electrochemistry, Analytical

chemistry, Structural Chemistry, Organic Chemistry (Synthetic and mechanistic), Coordination chemistry and Nuclear chemistry.

In addition to research supported by the Institute, Projects sponsored by outside agencies such as CSIR, PL480, Department of Science and Technology and the National Science Foundation continue to be investigated. Three new projects sanctioned by CSIR, INSA and the Defence Science Establishment have been taken up this year.

Seventeen candidates qualified themselves for the Ph.D. Degree of the Institute this year, while the enrolment for the year was eleven. Over 45 original research papers were published from the Department.

A one day Seminar for Chemistry teachers from Colleges affiliated to the University of Madras, where M.Sc. (Chemistry) course is offered was organised to familiarise them with how we organise the project work for the M.Sc. students.

A two day symposium (March 6, 7) on current research in Chemistry with about 250 participants from City colleges, I.I.T., University of Madras and the Central Leather Research Institute was arranged. Some 30 research papers were presented at this meeting.

A month long summer school sponsored by NCERT for I year B.Sc., (Chemistry) students from all over India, holding the National Science Talent Scholarship, was held during May-June 1976. There were 44 participants. The Programme included lectures and laboratory work in the major areas of Chemistry.

Prof. M. C. Markham (U.S.A.) visited the Department and rendered assistance as consultant on the NSF scheme on Photocatalysis

CIVIL ENGINEERING

During the year the Civil Engineering Department offered courses leading to the award of B. Tech. and M. Tech. degrees 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. The department offers a 5 semester course leading to the B. Tech. degree in Naval Architecture for Civil and Mechanical graduate candidates sponsored by Cochin Shipyard Ltd., Cochin.

During this year 8 candidates qualified for Ph.D. degree, 11 for M. Tech. degree, 2 for M.S. and 16 for B. Tech. degree. Three candidates qualified for the Diploma D.I.T.T. in Building Technology. There are at present 30 research scholars working for Ph.D. degree (including part time) and 5 for M.S. in various branches of Civil Engineering.

Research activities in the Department maintain growth, variety and volume. During the year nearly 50 research programmes which include faculty research, M. Tech., M.S. and Ph.D. programmes are under investigation. Tor-Isteg Corporation of India, Ministry of Railways

(R.D.S.O. at Lucknow), Ministry of Shipping and Transport & C.S.I.R. have sponsored research programmes which are under investigation.

In the year under review 25 papers were published in important technical journals in India and abroad. 15 papers were presented at National Symposia and Seminars.

Liaison with industry has been further strengthened and several projects including testing work has been undertaken by the Department for various public and private sector undertakings.

COMPUTER CENTRE

Research and Development Work

The research and development work done essentially consist of development of application software, implementing software packages, updating the operating system and introducing new facilities to meet user's requirements.

Some of the work done include the implementation of the latest release of WATFIV Compiter (Version 1, Level 4), development of routines to add, delete and validate job numbers, routines for controlling output at job level, automatic allocation and deletion of disk space, automatic billing routines, incorporation of the latest OS/Release 21.8, job validation routines for WATFIV and system Generation of OS/VSI Release 4. A Sophisticated software package ORSER, for processing of ERTS 1 satellite imagery has been successfully implemented which is used by NRSA. Modifications to PLOTTER software for off-line plotting has also been done. A program for finding complex eigenvalues and complex eigenvectors of a general unsymmetric matrix has also been developed.

Installation of Integrated Civil Engineering System (ICES) has been successfully completed in collaboration with the Civil Engineering Department. A Cross-Assembler and Simulator for PDP 11 in IBM 370/155 is nearing completion. Inter departmental research continues in the area of biomedical signal processing (Biomedical Engineering Division) and mini computer data acquisition system (Electrical Engineering). A selective Dissemination of Information (SDI) service in collaboration with INSDOC, New Delhi has been started for which the required software CAN/SDI - was successfully implemented within a very short period. This information service is being continued with assistance from the Department of Science and Technology, New Delhi. Some of the other projects completed include the development of systems for processing of Academic Records for I.I.T., Madras, for processing of Common Post Graduate Admission Entrance Examination Phase 1 and an information Management System for Tea Estate, Jorhat (CSIR).

On-Going and Future Projects:

1. Analysis of ERTS - 1 satellite in collaboration with NRSA

2. Supporting NISSAT. In particular, setting up an Entrepreneur Information Service for the Leather Industry (Jointly with CLRI).

3. Computerised Hospital information System jointly with the Directorate of Tamil Nadu Teaching Hospitals, (Department of Electronics.)

4. Computerisation of Madras Telephone Directory.

5. Tamil Nadu Nutrition Data Analysis project.

6. Selective Dissemination of information service to Chemists and Chemical Technologists in India and in neighbouring countries like Sri Lanka, Pakistan, Bangaladesh (jointly with INSDOC, New Delhi, sponsored by DST).

7. Establishing a link between IBM/370 and the small computer system to be acquired by SERC (CSIR Complex), for which SERC will buy the necessary hardware.

8. Connect the PDP/11 system in the Digital Techniques Laboratory to the system 370/155, necessary software will be developed by the Computer Centre. An inter University project between I.I.T., and the University of Bremen has been started to develop the necessary hardware.

9. In the field of Artificial Intelligence an interactive system which learns to recognise curved line drawings simulating human recognition process has been developed.

Special Programmes

Q.I.P. Summer School on Computer Engineering and Applications:—
A summer school was conducted from May 17th to June 5, 1976 on Computer Engineering and Applications. Advanced Programming in Fortran IV (G) and (H) level were taught. The other subjects dealt with include an introduction to the IBM 370/155-II, General Purpose Simulation System, Continuous System Modelling Program, tape disk utilisation, Data set organisation, introduction to Boolean Algebra, Numerical Methods, Dynamic Simulation and Operations Research.

ELECTRICAL ENGINEERING

During the year under review, the Department graduated 10 Ph.D., 25 M. Tech., 1 M.S. and 67 B.Tech. of which 29 were of Heavy-current option and 38 of Light current option. The number of Ph.D. degrees awarded this year has been the maximum for any year so far.

Sophisticated facilities for fabrication of silicon semiconductor devices have been established in the department with Federal Republic German aid with special emphasis of fabrication of MOS transistors and integrated circuits. The centre for Systems and Devices (CSD) has acquired additional facilities to supplement with emphasis on fabrication of PIN diodes and related devices. Equipment to the tune of Rs. 80 lakhs in foreign exchange have been received from Federal Republic of West Germany for the Television Engineering Laboratory in the department (both colour and black and white). Laboratory facilities for this centre have been planned for implementation and civil works for the laboratories are at the moment in progress. An expert from Germany has joined and another German Professor is expected to join the department shortly.

An Indo-German R and D project on 'Speed Control of a Squirrel Cage Induction Motor' has been undertaken in collaboration between the Control Engineering Laboratory of this Department and the corresponding Laboratory of Technical University Braunschweig.

The Centre for Systems and Devices, run in this Department with Defence Ministry support, conducted four short-term courses during the year on the areas of 'Laser Communication', 'Fast Fourier Transforms', 'Guidance and Control' and 'Gyro-Technology'. The first three defence service and R & D officers deputed for study completed their projects at the Centre and obtained their M. Tech. degrees in 'Guidance and Control' area.

The Department has continued its tempo of research and development activity and industrial consultancy work. During the year under review, 14 industry sponsored jobs were completed in the department, amounting to earnings of Rs. 1.37 lakhs. 58 research publications originated from the faculty and research scholars of this Department. Seven technical monographs were released by the staff of the Centre for Systems and Devices.

HUMANITIES AND SOCIAL SCIENCES

Teaching

The Department continues to offer M. Tech. Degree Courses in Industrial Engineering and Industrial Management as well as guidance for M.S./Ph.D. Degrees by research in the same areas. The department continued the recently introduced management input package programme for B. Tech. degree courses. During the period under review, the number of M. Tech. degrees awarded are 18 in Industrial Engineering and 18 in Industrial Management.

Under the Q.I.P. progress has been made on Identification of the goals of Engineering Education in our country.

Research Activities

Operational efficiency of a metropolitan transport system. Optimisation of work-in-process inventory in an automobile industry.

Financial planning in a metropolitan transport system. Purchase-inventory interphase in a manufacturing organisation. New product planning and launching. Computerised vendor rating. Purchasing and inventory policy in a tyre manufacturing organisation. Maintenance planning in a refinery. After sales service management in a consumer goods industry. Application of industrial engineering techniques in hospitals. Multiechelon inventory in a manufacturing organisation. Spare parts inventory management in a agro-industry. Effect of change in price level on accounting practice. Marketing practices in machine tools industries. Allocation of sales territories to salesmen. A study in the economic feasibility of solar energy for water heating.

Industrial Engineering and Ergonomics Laboratory

(a) *The equipments designed are:* Arm strength measuring equipment, SQC - demonstration kit, time study equipment, Reaction time measurement apparatus, Unopar.

(b) *The kits designed and fabricated are:* Time study training and method study training kits.

Industrial Liaison

The Department had industrial liaison with several industries during the year. About 40 projects were carried out at industries by the students and staff.

Consultancy work

Flood forecasting and routing for Gandhi Sagar Dam, Madhya Pradesh. The recommendations have been finalised and will be implemented soon.

Continuing Education Programmes

Some of the faculty members of the Department conducted executive development programme for some of the leading industrial houses and public sector industries under the auspices of several professional bodies. They also participated as faculty in Management Development Programmes in various organisations. The following part-time programmes were conducted for the benefit of the industrial executives:

1. I.I.T. - I.A.M.M. certificate course in Materials Management.

2. I.I.T. - M.P.C. certificate course in Industrial Management.

HAL - BEML Management Training Programme

This programme was being offered by the I.I.T., Madras for the fourth time, by the joint collaboration of several departments of I.I.T. Eighteen participants have undergone this course and they were awarded certificates.

MATHEMATICS

The Department of Mathematics continues to be engaged in teaching and research in the various aspects of the pure and applied mathematics. Mathematics is being taught for the first nine semesters of the B. Tech. and three semesters of the M. Tech degree courses leading to different specialisations. A course on general mathematics is offered during the first two semesters of the M.Sc. (Chemistry) course. Course on Ship Hydrodynamics, Numerical Methods and Computer Programming as well as Operations Research are offered to the students of the Naval Architecture. The D.I.I.T. M.S. and Ph.D. scholars from the engineering disciplines are given training in special topics of mathematics depending on their particular requirements. The Department has a four semester Master's Degree Programme. In the convocation held in September 1975, seven scholars were awarded Ph.D. and fifteen students the M.Sc. degree. Four scholars have completed the requirement for their Ph.D. and fifteen scholars are currently working on their theses. Collaboration with other departments of the Institute in promoting teaching and research activities progressed.

A few of the faculty members are reviewing regularly the research papers for the review journal and some are serving as referees for certain technical journals.

Research Work

Fluid Mechanics, Magnetohydrodynamics, Solid Mechanics-Elasticity, Piezo Electricity, Stochastic Processes, Differential Equations, Operations Research, Graph Theory, Quantum Mechanics and Fields - Elementary Particle Physics, Numerical Analysis, Theory of Functions, Biomathematics and Bio-Engineering, Mathematical Physics, Topological Dynamics, Theory of Relativity.

Journal of Mathematical and Physical Sciences

The journal published by the department, has started attracting large numbers of research papers both from India and abroad. The (February, April, June, August, October and December) has six numbers per volume, the current volume number being ten, 1976. Till now, since volume 1, 1967, about 420 research papers have been published and about 100 papers are awaiting publication as on date (30th June 1976). The journal has a wide circulation of about 300–160 abroad and 140 in India. About 30 journals from abroad are being received by the Institute in exchange for our journal.

Books

The book on 'Probability and Random Processes' by Prof. S. K. Srinivasan and Dr. K. M. Mehata in the UGC Book Writing Programme is under publication. Dr. P. Achuthan and Dr. K. Venkatasan are translating Nobel Laureate Wolfgang Paulis article "Allgemeinen Princzipien der Wellen Mechnik" into English to be published in a book form.

Conferences

Some members of the faculty and research scholars participated in scientific conferences and presented research papers. Seminar lectures and discussions on topics of current interest were regularly held. Some guest speakers in addition to the members of the Department also participated in the same.

MECHANICAL ENGINEERING

Teaching

The department executed its major task of imparting instructions to the students of B. Tech. and post-graduate courses, promoting research and development activities sponsored by outside agencies in addition to its own. The department engaged itself also by organising quality improvement programme and continuing education activities.

One part-time D.I.I.T. Course in Production Engineering, two M. Tech. level courses (Advance Thermal Power, and Computers in Engineering) and two B. Tech. level courses (Axial - Flow Turbomachines and Computation Techniques) have been introduced in the year 1975–76.

The number of students admitted, on rolls and graduated during the year 1975–76 is:

Degrees	*No. admitted*	*No. on rolls*	*No. graduated*
B. Tech.	62	324	62
M.Tech.	55	108	47
M.S.	7 (1 Faculty)	15	2
Ph.D.	10 (5 Faculty)	53	11

45 papers have been published in various national and international journals and 71 papers have been presented in conferences at home and abroad. The Curriculum Development Centre of the department of Mech. Engg. has brought out two monographs.

Research Work

The areas of research and development activities of the laboratories of the department are given below:

Combustion and Propulsion

Laminar and turbulent flame propagation. Flame stabilisation Combustion in swirling flames. Droplet Combustion. Air pollution quenching. Utilisation of solar energy-(Air and water heaters, Solar refrigeration and Solar air conditioning) Shock tube studies of ignition delay of explosive mixtures.

Fine Technics

Resonant magnetic suspension. Synthesis of controllers. Synthesis of mechanisms. Optical and computer holography. Optical data processing. Surface roughness. Sintered bearings. High speed printing mechanisms. Optical systems. Development of He-cd laser. polaristion transfer and optical transfer measuring systems.

Heat Transfer and Thermal Power

Heat transfer in electrical machines, in thermal power and process equipment and in electronic equipment. Fluid flow and heat transfer in nuclear devices. Thermal storage devices. Rural Energy systems.

Hydro Turbomachines

Axial flow fully reversible pump-turbines. Bulb-turbines Cavitation in hydro turbomachines. Flow studies on axial flow-turbo-machines. Computer aided design of centrifugal pumps. Design and developmental studies of various types of pumps and turbines.

Internal Combustion Engines

Fundamental studies in engines–preflame reactions. Heat release patterns and turbulence studies in engines. Simulation and evaluation of engines. Exhaust pollution control. Development of alternate fuels such as alcohols and bio-gas for I. C. Engines.

Machine Elements and Mechanical Handling

Mechanisms. stress and strength analysis. Machine elements. Sintered materials. Cranes. Pneumatic conveyance.

Production Engineering and Machine Tools

Wear behaviour of coated carbides. Surface integrity studies on gears. Surface finish assessment and analysis. Contact rigidity. Photo-elastic and moire stress analysis. Research on ECM, EDM, ultrasonic machining. Adaptive control of machine tools. Explosive welding. Machine tool chatter studies.

Refrigeration and Air-conditioning

Refrigeration and airconditioning, Food preservation. processing and transport. Cryogenic engineering. Utilisation of solar energy for refrigeration and airconditioning.

Thermal Turbomachines

Centrifugal fans and compressors. Axial flow fans. Two and three dimensional cascade flows. Wind energy.

Sponsored Projects

The following sponsored projects are currently in progress:

Development of a 3 ton solar airconditioner (DST). Design and development of a sonic burner (CSIR). Design and development of printing units (ECI). Design and development of an aerial camera (Defence). Heat transfer studies in large electrical machines (RDOEI). Thermal studies on tray deaerators (BHEL). Porous cylindrical solar water heater (CSIR). Design and development of multipurpose reversible axial flow machines (DST). Detection, measurement and control of carcinogenic polycyclic aromatic hydrocarbons in the diesel engines exhaust (NSF, USA). Development of alternative fuels for diesel engines (Ganapathy Trust). Stress analysis of production process. The development of a new three dimensional technique (CSIR). Measurement of walking forces (Artificial Limb Corporation of India). Technology of preservation of fruits, vegetables and marine products (CSIR). Development of a 10 ten vapour absorption plant working on a low temperature energy source (BHEL). High Speed centrifugal compressor (Aero R and D Board). Two dimensional cascade tests (Aero R and D Board). Energy - centrifugal compressors (I.I.T./D.A.A.D.). Splitter vanes for centrifugal impellers (CSIR). Design and development of machines for making pre-stressed concrete pipes (in collaboration with Structural Engineering Research Centre, Madras).

Seminars/Symposia, Short Term courses, Winter and Summer Schools Held

Following Courses were held:

A course for HAL Process Engineers during Nov. 1975 to January 1976. A short term course on "Gas turbine enginering" during Dec. 1st 1975 to Dec. 24th 1975, A Q.I.P. course on "Numerical control of machine tools" during Dec. 8th to Dec. 20th 1975. A course on the maintenance of refrigeration and air conditioning equipment for the Engineers of Post and Telegraph Department during Jan. 1976 to March 1976. A short term course on "Product design" during Jan. 1976 to April 1976 (Saturdays only). A course for HAL Process Engineers during May 1976 to July 1976. A Q.I.P. course on "Material handling technology" during May 17th 1976 to June 11th, 1976. A course on "Fan Engineering" during June 14th 1976 to June 26th 1976. A training course for Instrument Technicians in collaboration with Madras Productivity Council during June 28th 1976 to July 9th 1976.

Industrial Liaison

The Department continues to maintain liaison with many industries and organisations. The design and development work is being carried out for the following industries and organisations:

M/s Coromandel Prodorite Ltd., Madras. M/s. Technolab, Instruments Company, Madras. M/s. Marshall sons and Company, Madras. M/s. Dunlop India Ltd., Ambattur. MERADO, Madras. M/s. Indian Oil Corporation, Faridabad. M/s. BHEL Trichy. V.S.S.C. Thumba, Trivandrum. M/s Acme Industries, Madras. M/s. India Oil and Fertilisers Ltd., Nellore.

In addition to this, the Department carried out testing and calibration work for large number of industries and organisations.

Inventions Patents and Awards

Co. G. N. Bajpai's prize (Rs. 500/-) has been awarded by Institution of Engineers (India) for the paper entitled "Some aspects of electro-chemical machining" at its annual meeting in January, 1976. The paper entitled "Heat transfer during aircooling and storing of moist food products" was accorded "Honourable Mention" in the 1975 paper awards activity of the American Society of Agricultural Engineers.

Invited Lectures Delivered Outside I.I.T.

Following invited lectures were delivered outside I.I.T., Madras:

Combustion phenomena (BHEL, Trichy). Utilisation of solar energy, (South India Steam and Fuel Users Association, Madras and National Productivity Council, Madras). Porous bearings and applications, (National Productivity Council, Madras). Synthetic Holography for testing optical elements (I.I.T., Delhi). Safety by Instrumentation, (National Safety Council, Bombay in collaboration with Madras Productivity council, Madras). Instrumentation and control in major plants. (National Productivity Council, Madras). Heat transfer in electrical machines, (BHEL, Hyderabad). Heat transfer in electrical machines (E.S.N.P. Staff). Gears (Institution of Engineers, Madras). Bearings (National Productivity Council, Madras). Couplings (Institution of Engineers, Madras). Form design (Govt. college of Technology, Coimbatore), Behaviour and selection of materials, (National Productivity council, Madras).

METALLURGY

The research activities in the department continued to maintain a steady progress. The total number of candidates working for post-graduate degrees is as follows:

Ph.D.	24	(9 full-time, 2 QIP, 2 CSIR, 2 External and 9 part-time)
M.S.	8	(6 full-time, 1 part-time and 1 part-time external)
M.Tech	31	(I and II M.Tech.)

During the period under review, the number of degrees awarded is as follows: Ph.D. 3, M.S. 4, M. Tech. 15, B. Tech. 34.

A short-term course on "Cast Metals Technology" under the QIP was organised during December '75 with 32 participants. A one-day Seminar on "Magnetic materials and their application in various devices" was conducted in 1975 by the Magnetics society of India with the active assistance of the Department. A seminar on "Heat Treatment of Metal Castings" organised jointly by the Institute of Indian Foundrymen - Southern Regional Branch, the Department of Metallurgy I.I.T. Madras and the Indian Institute of Metals (I.I.T. Madras Chapter, was held in January 1976.

The department was associated with the Indian Bank - I.I.T. Entrepreneurs Get-Together held on the 30th and 31st of January 1976 in which some items of interest designed and developed in the department were put up for display. Discussions were also held with some of the industrialists interested in the above items. Two items that drew interest were:

1. Surface pyrometer

2. Melt Point apparatus for resin coated sands.

One project has been taken up by this department and the Institute of Welding of the Technical University of Braunschweig, on the development of a monitoring unit for production of satisfactory spot welds and a non-destructive testing method for testing welded automobile wheels. The Project has the support and active collaboration of one of the leading industrial units of Madras Messrs. Wheels India Limited - who are the leading manufacturers of welded automobile wheels in the country.

Proposals for starting an additional stream in the M. Tech. programme - Materials Technology were put up and approved by the Institute.

The Department faculty continued to deliver lectures to HAL/BHEL participants and to other outside organisations.

Technical meetings under the auspices of the local chapter of the Indian Institute of Metals and lectures by visiting professors were arranged regularly as usual.

PHYSICS

Teaching

The Department continued teaching of physics to the B. Tech M. Tech., and Ph.D., courses/programmes. During the year under review 14 students qualified for the award of M.Sc., degree in Physics.

Research

Research work in the department is mainly concentrated in the different areas in solid state physics and technology.

Experimental and theoretical studies are being carried out in the following major fields.

Colour centres in ionic crystals-Electrical conductivity of ionic crystals. Dielectric properties of solids and liquids. Thermoluminescence in crystals. Surface states in semiconductors. Electron spin resonance of defects in crystals. Nuclear Quadrupole resonance in solids. Nuclear magnetic resonance in alloys. Optical and magneto-optical studies in crystals and solids solutions. Stress optic and

thermooptic behaviour of solids. Mossbauer spectra of intermetallic compounds. Laser Physics. Crystal growth. Electrical and magnetic properties of thin films. Low temperature physics. Ultrasonic studies in liquids. X-rays and crystal structure analysis.

Theoretical work is being carried out on third order elastic constants of crystals, thermal expansion, propagation of surface waves in crystals and cohesive energies of crystals.

Seven scholars have submitted their thesis for the award of Ph.D. Degree in Physics. More than 30 papers have been published in various national and international journals.

Seminars and Summer Schools

A seminar in Physics was organised at I.I.T. in collaboration with Indian Physics Association, Madras chapter in March 1976.

Distinctions of faculty

Prof. R. Srinivasan was elected a Fellow of the Indian Academy of Sciences. Prof. C. Ramasastry attended the General Assembly meeting of the International Union of Pure and Applied Physics held at Munich, West Germany during September 1975. Dr. S. Swaminathan attended the tenth International Congress of Crystallography held at Amsterdam in August 1975. Dr. S. Radhakrishna has gone an extra-ordinary leave for a year to work as Scientific Secretary, Committee on Science and Technology in Developing Countries (COSTED), Bangalore and Scientific consultant UNESCO. Dr. K. Viswanatha Reddy is working at the Technological University, Lannion, France on French Government Fellowship. Dr. B. V. R. Chowdari is working in Stuttgart on Humbolt Foundation Fellowship.

Sponsored research projects

(1) Development of Information storage devices (CSIR)

(2) Development of crystals for the study of some properties of materials at low temperature (CSIR).

(3) Development of optical modulators (Defence)

(4) Development of single crystals for IR detectors (Defence)

(5) Cooling system for IR detectors (Defence)

(6) Preparation and investigation of magnetic materials of technical interest (Indo-German)

(7) Design and construction of cryogenic equipment like centrifugal pumps etc. (Indo-German)

REPORTS OF CENTRAL SERVICES AND FACILITIES

CENTRAL LIBRARY

The number of books added to the Library during the year is 8669 due to the purchase of 2304 books amounting to Rs. 1,90,698. The number of staff reprints received during the year is 71. The British Council Division of British High Commission, Madras has supplied 264 British Scientific and Technical books amounting to Rs. 20,670 under ODM Books presentation Program.

The Library is operating a pilot project in collaboration with computer Centre and INSDOC under the NISSAT Programme of the Department of Science and Technology, Government of India for the computerised CHEMICAL ABSTRACTS/SDI Service with Canadian software sending fortnightly SDI output to about 120 scientists all over India and neighbouring developing countries like Nepal and Sr Lanka.

Administration and Bindery Division:

The administration took over a major part of the work like obtaining quotations for various materials, processing them etc which the Central Stores was doing in the previous years. This has resulted in expeditious procurement of stores materials needed by the Reprographic Section and the Bindery for their proper functioning.

The reprophic services fetched an income of Rs. 27,635.

Circulation and Maintenance Division

The additional grants received at the end of the year resulted in our augmenting our Book Bank and Text Book Reference Collections to some extent.

A new service in the form of loan of books to the weaker sections of the students was started this year.

A Catalogue of Films available in the recently established Partia. Archive of Technical Films of the Encyclopaedia Cinematographica Gottingen, was prepared to enable the better use of the films.

An inter library loan code has been prepared and it is hoped that the local libraries and our sister institutions would co-operate.

Statistics on the other Library activities are as follows:

Membership:

1.	Institute members (staff & students)	5,005
2.	Outside Members:	
	Individual	47
	Corporate	34
3	Consultation Permits	104

Circulation:

1.	No. of readers visited	1,02,946
2.	No. of volumes issued	90,720
3.	No. of reservations for Books-Registered	3,756
	No. of reservations for Books-fulfilled	2,684
4.	Amount of overdue and other charges realised	48,547

Inter-Library-Loan:

Borrowed for Institute members	284
Lent out from Institute Library	90

Acquisition:

Books & Bound Volumes of periodicals	6,249
Pamphlets and reports	2,420
Microfilms and Microfiches	52
Total intake during the year	11,694
Total accessions up-to-date	1,44,041

Current Periodicals:

By subscriptions	1,063
From Technical University, Berlin (Under aid)	107
By exchange or Gift	160

Documentation Services:

SDI	recipients	76
	Internal	48
	External	28

LDN Recipients	
Internal	40
External	22

Reprographic Section

Microfilms made	3,911
Photocopies made	2,597
Korestat copies made	17,779
Gavafax copies made	29,914

Bindery:

No. of books & Journals bound for Library	1,705
No. of photocopy articles and form books bound	1,021
No. of books and journals repaired	317
No. of publications bound for other departments	380

CENTRAL WORKSHOP

The outstanding jobs done in the central workshop during year under review are

1. Fabrication and assembly of resonant damper.
2. Dynamic balancing of variable speed pulleys (M/s. South Indian Export Co. (P) Ltd. Madras)
3. Fabrication of 6 hole probe
4. Fabrication of bevel gears for hoists (M/s. K.C.P. Ltd. Madras)
5. Fabrication and assembly of cylindrical lead cell calibrator
6. Repairing and rewinding of 30 HP Motor and testing
7. Rewinding of Armature of a D.C. Motor/generator 40/50 KW
8. Gears for Dynamic analysis of Gear system - Ph.D. project
9. Calibration and testing of Pressure gauges (M/s. Bharat Heavy Electricals Ltd. Trichy)

10. Casting and machining of hand operated eyeletting machine (Leather Goods Development-cum-Demonstration Centre, C.L.R.I. - Madras)

11. Jig grinding and inspection of punches (M/s. Eswaran and Sons Engineers (P) Ltd., Madras-1)

The total number of work orders completed during the year under review are 1949.

INSTITUTE GYMKHANA

Sports and Games Activities

The Institute teams in hockey, football, basket ball, volley ball, swimming, tennis and athletics participated in the Madras Collegiate Athletic Association tournaments and qualified for the finals. The swimming team won the Inter Collegiate Championship. Hockey and ball badminton were the winners in their division.

External Tournaments

The hockey, badminton, basket ball, swimming, table tennis teams were the runners up in the Stanley Medical, Betram Memorial Tournament and winners in the Y.M.C.A., Gymkhana Club and other Open Table Tennis Championships.

XI Inter I.I.T. Meet

Our Institute retained the General Championship Trophy for the fifth year in succession winning tennis, table tennis, basket ball, weight lifting and athletics.

Inter University

The Institute cricket and table tennis teams participated in the Inter University tournaments.

Nationals

Our students Mr. R. Ravi and S. Murali represented the Tamil Nadu in the National Table Tennis Championship.

Cultural and Literary Activity

Cultural and Literary activities of the Gymkhana reached their high mark during January 1976 when the Cultural Festival was orga-

nized. There was a good response from outstation colleges from far-off places like Delhi, Kharagpur, Ooty and Bangalore. An exhibition of photographs and paintings was also organized.

The Institute Gymkhana also made its mark in the field of Literary and Cultural Competitions in the City by winning the following trophies and shields.

Jayees Madras	Inter Collegiate Quiz
Lions Club of Guindy	Inter Collegiate Quiz

INSTITUTE HOSPITAL

Dr. (Miss) Marikar, M.D., D.G.O. (Retired Director of Medical Services, Madras State) was appointed as Honorary Medical Adviser in February 1976.

During the year under review 70,148 were treated as outpatients and 346 in the wards. Regular antenatal check up of pregnant women was done. Obstetrical emergencies were attended. Blood grouping, haemoglobin, total red blood cell count and urine analysis were done to all pregnant mothers.

From 1st April 1976, the Hospital has been recognised for Family Planning, Maternity and Child Health Care by the Director of Health and Family Planning. Eight cases of abdomenal sterilisation and six cases of loop insertion have been done since then. Family Planning advice regarding oral contracepties was given to a number of couples.

Routine immunisation programme was undertaken. A few cases of whooping cough was reported after lapse of five years. A family card and students health card were introduced this year, major illness of individual members of family and their methods of family planning including immunisation procedures were recorded.

There is an addition of bowl sterilizer to the operation theatre. Six hundred and thirty nine emergencies were attended by the duty medical officers outside the working hours. Sixty five cases were referred to outside hospital for expert opinion and treatment. Arrangements are being made to post E.N.T. and Children specialists.

STATISTICS

Outpatient Department: Medical 63,271, Surgical 6,155, Gynaec and obstetric cases (including Loop insertion and Family Planning advice) 722 Total attendance	70,148
Patients treated in the wards	346

Deliveries (11 Normal, 3 Forceps)	14
D & C for Gynaecological purposes 11, M.T.P.8, M.T P with sterilization 2, Puerperal sterilization 7	28
Major surgical procedures	31
Minor surgical procedures	326

Immunisation

Small Pox vaccination 711, Triple Antigen 250, Antipolio (Oral) 250, T.A.B. Inoculation 161 Anti-cholera inoculation 161	1,533

Laboratory Investigation

Urine examination 2,109, Motion examination 1,018 Blood 3,394, Blood grouping 92, Sputum and smear 41	6,654

PLACEMENT OFFICE

The Placement Office was established in 1964 the year in which the first batch of students graduated. Since then this office has been successfully serving as a liaison between the graduating students and employers. Year after year, an increasing number of employees contact the Placement Office for recruitment of young graduates and post-graduates. The Placement Office arranges for campus interviews which yield better results than by advertisement method. Students from graduating classes are sponsored for tests and/or interview; this also facilitates exchange of views between visiting representatives of companies and the Institute faculty with regard to expectations of industry from graduating engineers in general, and the areas of specific requirements of a particular company. The representatives get a first-hand appreciation of the training imparted in the Institute.

During the year 1975–76 this office made contacts with nearly five hundred companies, out of which 175 companies/establishments from both public sector and private sector responded and representatives from many organisations visited this office and interviewed students.

In recent years, there has been an increase in the demand for employment of post-graduates and it is gratifying to note that an increased percentage of our post-graduate students have secured employment as a result of efforts made by the Placement Office.

The Placement Office continues to keep in touch with as many industries and organisations as may require technically qualified

personnel and furnishes them with information about the courses offered, with specialisations in the various branches, to enable them to have detailed information about the talents available from among the graduates of the Institute. Since the Institute has on its rolls students from foreign countries also, Placement Office sponsors these students to employing organisations in their home countries.

This office has also been handling an increasing number of applications from students of B. Tech. and M. Tech. degree courses for practical training during the summer and winter vacations. While enabling the students to acquire practical experience, this training 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 and in addition handles the work relating to the office of the Foreign Students' Adviser.

Information regarding the placement position of the alumni of the year 1974–75 is given below:

Year		1974—1975
Total passed out (Graduates and post-graduates)		591
Engaged in Further Studies	(a) In India	44
	(b) Abroad	20
Employed Abroad		5
Self Employment		4
Engaged in India	(a) Private Sector	155
	(b) Public Sector	279
Position not known		84
		591

NATIONAL CADET CORPS

Two N. C. C. units are located in the Institute. One is an ARMY WING Composite Technical Unit and the other is an AIR WING

Technical Unit. The two Units are: (a) No. 2 (Tamil Nadu) Comp Tech. Coy. N.C.C. and b) No. 4 (Tamil Nadu) Air Sqdn. (Tech.) N.C.C

Enrolment

The N.C.C. training is spread over three academic years i.e. six semesters. New enrolment is confined to the 1st year B. Tech. students. During the academic year 1975–76, 154 cadets were enrolled in the Air Wing and 62 cadets in the Army Wing. The total strength of cadets in the Air and Army Wings was 194 and 95 respectively.

Training

Keeping with the aims of the N.C.C. in view, training was imparted to the I, II and III year B. Tech. students in accordance with the prescribed syllabus. Advanced Military Training was also given by stages to the cadets in all the three years. The specialised technical training covered the three Corps of the Army (Engineers, Signals and EME) for the Army Wing Cadets and the two technical branches (Mechanical and Electronics) for the Air Wing Cadets.

A new dimension had been added to the N.C.C. Air Wing (Technical) training, with the introduction of gliding training for the Technical Air Wing Cadets. During the year 1975–76, 26 cadets of II and III years were given gliding training and each cadet had done an average of 4 launches. Efforts are being made to give gliding training to more number of cadets during the training year 1976–77.

Annual Training Camp

A combined Annual Training Camp for the cadets of both the N.C.C. units was held in Bangalore from 29th Nov. 1975 to 10th Dec. 1975. A total of 118 cadets from both the units attended the camp. During the camp, the cadets were divided into small groups and the competitions in firing, drill, tent pitching, kit-layout and for best cadet of the camp were held between the groups. All the cadets took keen interest in all the camp activities and competitions.

Social Service

The most important feature of the Annual Training Camp was the social service for one full day carried out by the cadets. The work involved was the renovation of a washed out road leading to a tribal village about 30 kms away from Bangalore. The social service task was taken up by the cadets with commendable enthusiasm and hardwork was put in by all cadets. A stretch of road 250 m long and 4 m wide was completed in one day.

Attachments to Regular Army Units and Special Courses

Two Army Wing cadets were attached to the EME Centre, Secunderabad and one Army Wing cadet attached to Madras Engineer Group Centre, Bangalore for a period of 3 weeks. These attachments

to Regular Army Units are of immense value to the cadets, as they give them a first hand knowledge of the organisation and functioning living and working conditions in the Army. As cadets from all states attend these camps, such camps give opportunity to the boys to mix freely and understand the habits and culture of the boys from other states.

Cadet G.M.K. Raju of the Army Wing attended a rock-climbing course held at N.C.C. Academy, Purandhar from 27 Jan. 1976 to 2 Feb. 1976. He performed creditably in the course and obtained "B" grading in the course.

Ceremonial Parades

The Cadets of the two Units presented a Guard of Honour to Shri. P. N. Haksar during his visit to I.I.T. to attend the XIII Convocation of the Institute on 27th September 1975. Ceremonial Parades were also held by the Cadets in connection with N.C C Promise Day on 13th August 1975 and Republic Day on 26th January 1976.

The Promise Day Parade is held during the month of August every year to administer the N.C.C. promise to all the Cadets. Dr K. A. V. Pandalai Director I.I.T. took the salute during the Promise Day Parade and administered the promise to the cadets. He also handed over the "B" and "C" certificates to the cadets who were successful in the certificate examinations. A special feature of the Promise Day Parade held on 13th August 1975 was the display of various training aids and equipment. All the cadets and civilian invitees looked round the exhibits and evinced keen interest in them.

Certificate Examinations

N. C. C. "B" and "C" certificate examinations were conducted for the Cadets of both units in March 1976. 28 cadets (16 Air, 12 Army passed "B" certificate examination and 7 cadets (5 Air, 2 Army) passed "C" certificate examination.

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