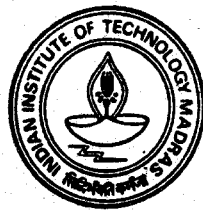


**THIRTIETH**  
**ANNUAL REPORT**

**1988-89**



**INDIAN INSTITUTE OF TECHNOLOGY**  
**MADRAS**



**THIRTIETH  
ANNUAL REPORT**

**1988 - 89**



**INDIAN INSTITUTE OF TECHNOLOGY  
MADRAS**

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## THE VISITOR

Shri R. VENKATARAMAN  
*The President of India*

## The Board of Governors

*Chairman*

Sri A. L. Mudaliar

*Ex-Officio*

Prof. L. S. Srinath  
Director

Indian Institute of Technology, Madras

### *Nominees of State Governments*

Dr. B. N. Krishnamurthi  
Director of Technical Education  
Government of Karnataka, Bangalore

Dr. T. R. Natesan  
Director of Technical Education  
Government of Tamilnadu, Madras

Dr. R. Jayaraman  
Director of Technical Education  
Government of Kerala, Trivandrum

Sri K. Pradeep Chandra, I.A.S.  
Director of Technical Education  
Hyderabad

### *Nominees of the Council*

Dr. V. C. Kulandaiswamy  
Vice-Chancellor  
Anna University of Technology  
Madras

Sri Suresh Krishna  
President, Confederation of Engg. Industry  
23, 26, Institutional Area  
Lody Road, New Delhi

Dr. M. Santappa  
INSA Senior Scientist  
Anna University,  
Madras

Prof. (Mrs) Lila Gulati  
Centre for Development Studies  
Trivandrum

### *Nominees of the Senate*

Dr. M. K. Achuthan  
Department of Electrical Engg.  
I.I.T., Madras (upto 31-5-89)

Dr. G. V. N. Rayudu  
Department of Mechanical Engg.  
I.I.T., Madras

*Secretary*

Sri V. Shanmugam  
Registrar

## The Finance Committee

### *Chairman*

Sri A. L. Mudaliar

### *Members*

Sri I. B. Sangal  
Dy. Educational Adviser (Tech)  
Ministry of Human Resource Development  
Govt. of India, New Delhi

Dr. M. Santappa  
INSA Senior Scientist  
Anna University  
Madras

Sri L. S. Narayanan  
Financial Adviser  
Internal Finance Division  
Government of India, New Delhi

Dr. R. Jayaraman  
Director of Technical Education  
Government of Kerala  
Trivandrum

Prof. L. S. Srinath  
Director  
Indian Institute of Technology  
Madras

### *Secretary*

Sri V. Shanmugam  
Registrar

## **The Buildings and Works Committee**

### *Chairman*

**Prof. L. S. Srinath**  
Director, I. I. T., Madras

### *Members*

**Prof. H Raman**  
Chairman  
Estate and Works Committee  
I. I. T., Madras

**Sri N. Malayalam**  
Executive Engineer  
I. I. T., Madras

**Estate Officer**  
I. I. T., Madras

**Superintending Engineer**  
C.P.W.D. Madras (Ex-Officio)

**Chief Engineer (Buildings)**  
P.W.D. Madras (Ex-Officio)

### *Secretary*

**Sri V. Shanmugam**  
Registrar



## SENATE

Srinath L S (Chairman)

D. R. G. Achar	K. Lakshminarayana
M. K. Achuthan	H. N. Mahabala
P. Achuthan	V. Mahadeva Iyer
H. Achyutha	S. N. Majhi
R. S. Alwar	P. T. Manoharan
S. Ambirajan	Megha Singh
K. Anantha Padmanabhan	Michael Shortland
M. S. Ananth	H. Mohd. Roshan
G. Aravamudan	M. Mukunda Rao
P. K. Aravindan	V. G. K. Murti
P. A. Aswatha Narayana	Y. V. G. S. Murti
B. V. Aswathanarayana Rao	C. R. Muthukrishnan
V. Balakrishnan	R. Nagarajan
K. Balaraman	Nainan, P. Kurian
D. K. Banerjee	M. S. Narasimhan
K. A. Bhaskaran	S. Narasimha Rao
T. K. Bose	K. Narayana Bhat
N. V. Chandrasekhara Swamy	Y. Narayana Rao
K. A. Damodaran	R. Narayan
B. L. Dhoopar	R. Natarajan
Dipak Chaudhuri	V. S. Nazir Ahmed
Ch. Durga Prasada Rao	V. Paramasivam
K. Elango	M. A. Parameswaran
C. Ganapathy	K. R. Parthasarathy
N. Ganesan	K. M. Patil
T. P. Ganesan	H. S. Paul
V. Ganesan	P. K. Philip
K. V. Gopalakrishnan	C. N. Pillai
T. Gopichand	O. Prabhakar
M. S. Gopinathan	B. S. Prabhu
B. H. L. Gowda	M. R. Pranesh
Hans. Juergen Mariejewski	D. Prithvi Raj
S. Jambunathan	H. C. Radhakrishna
D. Johnson Victor	S. Radhakrishna
V. B. Johri	R. Radhakrishnan
C. Kalidas	V. Radhakrishnan
R. Kalyanakrishnan	V. M. Radhakrishnan
V. Kalyanaraman	K. Radhakrishna Rao
P. Kalyanasundaram	J. P. Raina
C. S. Krishnamurthy	N. Rajagopalan
R. Krishnamoorthy	R. Rajagopalan
S. Krishnan	J. Rajaram
A. V. Krishna Rao	V. S. Raju
V. M. Krishna Sastri	S. R. Ramadas
A. Kuppurajulu	T. V. Ramakrishna
J. C. Kuriacose	

SENATE—(Contd.)

V. Ramakrishnan	A. K. Sreekanth
M. Ramakrishna Udupa	G. Sridhara Rao
A. Rama Mohana Rao	S. Srinivasa Murthy
V. Ramamurti	M. Srinivasan
L. N. Ramamurthy	P. S. Srinivasan
H. Raman	R. Srinivasan
R. Raman	R. S. Srinivasan
D. V. Ramana	S. K. Srinivasan
T. S. Ramanatha Iyer	T. M. Srinivasan
M. Ramanujam	V. Srinivasan
K. V. S. Rama Rao	U. N. Srivastava
B. Ramaswami	G. V. Subba Rao
V. Ramjee	P. Subbarami Reddy
R. Ramji Rao	G. Subramanian
G. Rangarajan	N. Subramanian
M. Ravindran	R. Subramanian
G. V. N. Rayudu	S. Subramanian
P. Sankaran	H. Suresh Rao
L. V. K. V. Sarma	Surjit Singh
L. V. L. N. Sarma	C. S. Swamy
C. A. Sastry	T. K. Varadan
S. B. S. Sastry	Y. B. G. Varma
V. V. Sastry	R. Vasudevan
M. Sathyanarayana	Vedam Subramanyam
K. N. Seetharamu	M. A. Veluswami
V. Seshadri	V. Venkat Rao
B. M. Sivaram	N. Venkatrayulu
R. S. Sirohi	B. Yegnanarayana
V. Sivaramakrishnan	S. S. Yegnanarayanan
J. Sobhanadri	

**Three educationists from outside the Institute nominated  
by the Chairman, Board of Governors**

R. M. Honavar

V. Rajaraman

M. V. George

**Members of the Faculty (Nominees)**

P. Bhattacharya

*Secretary*

V. Shanmugam



# REPORT BY THE DIRECTOR

for the period

APRIL 1988 to MARCH 1989

As in the previous years, the Institute continued its progress in various academic spheres during the year under report.

## 1. STUDENT STRENGTH

There were 1057 undergraduate students and 986 postgraduate and Research Scholars at the Institute.

## 2. AWARDS/DISTINCTIONS TO FACULTY

Prof. Mega Singh, Professor, Bio-Medical Engineering was elected Fellow at Royal Society of Medicine, England.

Prof. M. Ravindran, Head, Ocean Engineering Centre was awarded Certificate of merit by Central Board of Irrigation and Power for the paper entitled "Design and performance of a pump turbine for Tidal power".

Prof. P. T. Manoharan, Professor, Regional Sophisticated Instrumentation Centre was awarded the Shanti Ranjan Palit award for Physical Science, Jadavpur, Calcutta.

Prof. S. Subramanian, Professor, Regional Sophisticated Instrumentation Centre was elected to the Fellowship of the Indian Academy of Sciences, Bangalore.

Dr. S. P. Venkatesan, Assistant Professor, Regional Sophisticated Instrumentation Centre was awarded the NASA Class I Technical brief award for his design of "Acoustic Temperature profile Measurement system 1988. The award consisted of a citation and a prize of US \$ 150.00.

Prof. B. V. A. Rao, Department of Applied Mechanics was elected Fellow of the Indian National Academy of Engineering.

Prof. P. A. Aswathanarayana, Department of Applied Mechanics, Prof. H. C. Radhakrishna, Department of Mechanical Engineering were awarded "Sir Rajendra Nath Mookerjee Memorial Gold Medal" for 1987 by Institute of Engineers (India) for the best paper 'Cascade Characteristics' of 'S' Cambered Profiles" in January 1989.

Prof. M. S. Ananth, Department of Chemical Engineering and Sri Sundar Ramachandran were awarded a Gold Medal for the best paper in Indian Institute of Metals (IIM) Transactions for the year 1987 for the paper titled "A Simple two zone mathematical model of the inred process".

Dr. (Mrs.) Vijayalaxmi Sirohi, Assistant Systems Officer, Department of Computer Science & Engineering was awarded Hari Om Ashram Prerit Baikaka Inter University Samarak Trust Prize.

Prof. V. V. Sastry, Professor, Department of Electrical Engineering was awarded the VASVIK award 1987.

Dr. Evangeline Manickam, Lecturer, Department of Humanities & Social Sciences was awarded Mulder Endowment Fund Middle Award by American Studies for the Project "Humanities for a Technological Age" (88-89).

Prof. R. Rajagopalan, Professor, Department of Humanities & Social Sciences was awarded the first prize (Non-fiction category) by Children's Book Trust, New Delhi for the book "The Secrets of Indus Valley".

Prof. V. B. Johri, Professor, Department of Mathematics was elected as Member of the National Executive of the Indian Association of General Relativity and Gravitation. Nominee for INSA- Royal Society short term visiting Fellowship for visiting U. K. in 1989-89.

Prof. K. R. Parthasarathy, Professor, Department of Mathematics was called upon by the Kyoto Prize Committee of Japan to nominate two persons for the award of the Kyoto Prize in Mathematical Sciences for the year 1989.

Prof. H. C. Radhakrishna, Professor, Department of Mechanical Engineering and Prof. M. Ravindran, Ocean Engineering Centre were awarded Merit Certificate by the Central Board of Irrigation and Power for their paper Design and Performance of a Pump Turbine for Tidal Power published in I : P JI. Spl. Issue during 1987.

Prof. K. A. Bhaskaran, Professor, Department of Mechanical Engineering was nominated to "Reference Asia" published by Rifacimento International, New, Delhi.

Prof. R. Vasudevan, Professor, Department of Metallurgical Engineering & Mr. Papa Rao, Project Student were awarded first prize for Portable Thermocouple Welding Unit based on the principle of electrolytic heating in Annual Engineering Design Competition of ISTE held at Mysore, Dec. 1987.

Prof. R. Vasudevan, Professor, Department of Metallurgical Engineering, Mr. Suraj & Mr. Shankar were awarded third prize in Annual Engineering Design competition of ISTE held at Poona, Dec. 1988. "A portable Boring/cutting unit based on the principle of electrolytic heating".

Prof. H. Md. Roshan, Professor, Department of Metallurgical Engineering was awarded the Prof. Banerjee Memorial Award for the best paper published in the Indian Foundry Journal on Ferrous Castings 1988.

Dr. V. Damodara Dass, Assistant Professor, Department of Physics was awarded the "Har Om Ashram Prerit Shri Harivallabhadras Chunilal Shah Research Endowment" prize for the year 1937-88 for the best research papers published in the area of 'Solid State Physics'.

### 3. AWARDS / DISTINCTIONS TO STUDENTS :

Sri V. Nirmalchander, Sri N. Balasubramanian and Sri Elizabeth K. John, Department of Chemistry got the Indian Drug manufacturers Association Award Bombay for the paper "Spectrophotometric Determination of Ascorbic acid".

Sri T. A. S. Srinivas, a M.Sc. Physics student at the Institute during 1986 - 88 was awarded the "Cambridge Nehru Scholarship 1988" in the area of "Microelectronics".

### 4. EXPERIMENTAL FACILITIES :

The Institute continued to update and create modern experimental facilities in all Departments to support its teaching and research activities. One of the important facilities established during the year is a modern Scanning Transmission Electron Microscope (Philips CM 12/STEM). This facilities set up in the Department of Metallurgical Engineering will cater to the need of faculty and Research Scholars of several other departments as well.

### 5. CONVOCATION :

The 25th Convocation was held on 29th July 1988 in the Student Activity Centre. Dr. V. S. Arunachalam, Scientific Adviser to the Minister for Defence, delivered the Convocation address. At this Convocation 247 B.Tech., 304 M.Tech., 52 M.Sc., 54 M.S. and 71 Ph.D. Degrees were awarded.

### 6. INDUSTRIAL CONSULTANCY & SPONSORED RESEARCH :

The value of Consultancy assignment increased from Rs. 83 lakhs to Rs. 87 lakhs. The Institute introduced a new type of consultancy called "Research Based Industrial Consultancy" with the hope that it would facilitate encouraging development oriented consultancy activities at the Institute.

The sponsored research activity increased several fold, as could be seen in the value of the projects sanctioned, from Rs. 278 lakhs in 1987-88 to Rs. 585 lakhs during 1988-89.

Detailed reports of Research Centres, Departments and other sections are given in the accompanying pages.

## DETAILS OF THE REPORT

### Admission, Award of Degrees and Prizes

#### Student Admission 1988-89

The number of students and scholars admitted to various courses 1988-89 is given in Table-1.

**Table-1**  
**Admission 1988-89**

Sl. No.	Department	B. Tech.	M. Tech.	M.Sc.,	M.S.	Ph.D.	Total
1.	Aerospace Engineering	19	11	—	1	5	36
2.	Applied Mechanics	—	15	—	2	8	25
3.	Chemical Engineering	34	23	—	2	9	68
4.	Chemistry	—	—	16	—	6	22
5.	Civil Engineering	27	36	—	4	9	76
6.	Computer Science & Engg.	25	21	—	6	1	53
7.	Electrical Engineering	63	60	—	6	6	135
8.	Humanities & Soc. Sciences	—	20	—	—	3	23
9.	Mathematics	—	—	23	—	5	28
10.	Mechanical Engineering	60	87	—	5	17	169
11.	Metallurgical Engineering	25	20	—	2	8	55
12.	Naval Architecture	14	—	—	3	—	17
13.	Ocean Engineering	—	14	—	—	10	24
14.	Physics (Solid State Tech)	—	8	12	—	9	29
<b>Total</b>		<b>267</b>	<b>315</b>	<b>51</b>	<b>31</b>	<b>96</b>	<b>760</b>

The total 760 includes the following :

Foreign Nationals	: 29	Sponsored Candidates	: 68
Scheduled Castes	: 117	External Registration	: 19
Scheduled Tribes	: 19	Project Staff	: 67
Women	: 166		
QIP Scholars	: 89		

## DEGREES AWARDED

The number of degrees awarded at the Twenty-fifth Convocation of the Institute on 29 July 1988 is given below in Table-2. Dr. V. S. Arunachalam, Scientific Adviser to the Minister for Defence delivered the Convocation address.

**Table - 2**  
**NUMBER OF DEGREES AWARDED**

Sl. No.	Discipline	B. Tech.	M. Tech.	M.Sc.	M S.	Ph.D.	Total
1.	Aerospace Engg.	12	66	—	2	4	84
2.	Applied Mechanics	—	12	—	3	9	24
3.	Chemical Engineering	25	16	—	9	3	53
4.	Chemistry	—	—	19	—	14	33
5.	Civil Engineering	26	33	—	9	3	71
6.	Computer Science	28	25	—	4	—	57
7.	Electrical Engineering	62	44	—	5	2	113
8.	Humanities & Soc. Sciences	—	15	—	4	4	23
9.	Mathematics	—	—	15	—	6	21
10.	Mechanical Engineering	64	69	—	11	12	156
11.	Metallurgical Engineering	23	11	—	4	4	42
12.	Naval Architecture	7	—	—	—	—	7
13.	Ocean Engineering Centre	—	10	—	3	—	13
14.	Physics	—	3	18	—	10	31
<b>TOTAL</b>		<b>247</b>	<b>304</b>	<b>52</b>	<b>54</b>	<b>71</b>	<b>728</b>

With this Convocation in July, 1988, the number of degrees awarded so far by the Institute is:

B.Sc. (TA)	20	DIIT	245
B.Tech.	6189	M.S.	610
M.Tech.	4071	Ph.D.	1111
M.Sc.	903		

Grand Total: 13149

## PRIZES

The names of academic Prize Winners of the year are given below :

### 1. PRESIDENT OF INDIA PRIZE

(For the student of the B. Tech. Degree Courses with the best academic record)

Sri S. V. Krishnan  
B. Tech. (Computer Science and Engineering) and  
Sri A. J. Ganesh  
B. Tech. (Electrical Engg.) (Bracketed)

### 2. GOVERNOR'S PRIZE

(For all round proficiency in B.Tech. degree course/curricular and extra curricular)

Sri G. Sivakumar  
B. Tech. (Mechanical Engg.)

### 3. MERIT / ENDOWMENT PRIZES

(For the students with the best academic record)

### B. TECH COURSE

Civil Engineering  
(Institute Merit Prize)  
Metallurgical Engineering  
(Institute Merit Prize)  
Electrical Engg. (Electronics)  
(Philips India Prize)  
Electrical Engineering (Power)  
(Siemens Prize)  
Mechanical Engineering  
(Banco Foundation Prize)  
Chemical Engineering  
(Reliance Heat Transfer (P) Ltd. Prize)  
Aeronautical Engineering  
(HAL Prize)  
Computer Science & Engineering  
(Alumni Association Prize)  
Naval Architecture  
(American Bureau of Shipping Prize)  
(B. Ravichandran Memorial Prize)

Sri D. V. Rajesh  
Sri S. S. Papa Rao  
Sri A. J. Ganesh  
Sri Prabhakar Venkatraman  
Sri D. Arjun Rao  
Sri Gautam Nayar  
Sri Sujith R. I.  
Sri S. V. Krishnan  
Sri Rama Rao V. N.  
Sri Gautam Nayar  
Sri S. V. Krishnan

### M. TECH COURSE

Civil Engineering  
(Institute Merit Prize)  
Industrial Tribology  
(Institute Merit Prize)  
Electrical Engineering  
(Siemens Prize)  
Mechanical Engineering  
(Prof. B. Sengupto Prize)

Sri K. Gopalakrishna Reddy  
Sri K. Dhamodharan  
Ms. Girija J.  
Sri G. Vagesan



Industrial Metallurgy  
(Sudharshan Bhat Memorial Prize)  
Mechanical Engineering  
(Production Engineering & Machine Tools)  
(Dr. S. Vaidyanathan Memorial Prize)  
Aerospace Engineering  
(Air India Prize)  
Chemical Engineering  
(Dr. K. Subba Raju Memorial Prize)  
Industrial Management  
(K. V. Arunkumar Memorial Prize)  
Computer Science  
(CMC Prize)  
Ocean Engineering  
(American Bureau of Shipping Prize)  
Industrial Management  
(Coka Parthasarathy Prize)

Sri Suresh Babu S.

Sri G. Vagesan

Sri B. Sudhakar

Ms. K. Yamuna Rani

Sri B. Mahadevan

Sri Sourav Bhattacharya

Sri Sundar Prasad

Sri Mahadevan B.

### **M.Sc. COURSES**

Institute Merit Prize  
Chemistry  
(V. Ratna Rao Memorial Prize)  
Mathematics  
Physics

Ms. Bhavani R.

Ms. Radha S.  
Sri Rahul Banerjee

## **RESEARCH CENTRES**

**Centre for Biosciences & Biotechnology**

**Centre for Continuing Education**

**Centre for Systems and Devices**

**Fibre Reinforced Plastics Research Centre**

**Materials Science Research Centre**

**Ocean Engineering Centre**



## CENTRE FOR BIOSCIENCES AND BIOTECHNOLOGY

### 1. Research and Development Activities

Studies on Vitamin B<sub>12</sub> formation using molasses.

Studies on immobilized enzymes and yeast cells to produce ethanol from starch.

Structure and functioning of erythrocytes in hypercholesterolemia.

Ultrasonic characterization of biological tissues.

Industrial wastewater treatment and biogas recovery.

Development of enzyme technology for biotechnology applications.

### 2. Sponsored Projects :

<i>S. No.</i>	<i>Title</i>	<i>Funding agency</i>	<i>Period</i>	<i>Coordinators</i>
1.	Kinetics of <i>L. leucocephala</i> degradation and studies on methanogenic bacteria in mixed cultures.	D.O.B.	1 year	Dr. K. Lalitha
2.	Colour removal from Industrial Wastewater.	CSIR	1990	Dr. C. A. Sastry
3.	Development of flow visualization technique for blood flow analysis.	CSIR	1991	Dr. Megha Singh

### 3. Assistance to students and Major Consultancy Assignments

#### A) Retainer Consultancy

1. M/s. Laxmi Starch, Hyderabad
2. SPIC Ltd., Madras

#### B) Regular Consultants :

1. Tata Oil Co., Madras
2. Indian Space Research Organisation, Bangalore
3. Tamilnadu Housing Board, Madras
4. Kerala State Electricity Board, Trivandrum

### 4. Assistance to Sister Institutions :

1. Regional Engineering College, Tiruchi
2. Regional Engineering College, Suratkal
3. Defence Institute of Physiology and Allied Sciences, New Delhi.

## 5. Papers presented at Conferences

<i>S. No.</i>	<i>Name of the faculty member attending the Conference</i>	<i>Title of paper presented and authors</i>	<i>Name, Dates and Venue of Conference</i>
1.	Prof. Megha Singh	Optical characterization of erythrocyte sedimentation and aggregation Megha Singh E. Muralidharan S. P. Kasthurirangan	International Conference on Clin. Aspects of the Diabetes, Sydney, Australia, 1988.
2.	Prof. Megha Singh	Clinical significance of erythrocyte deformability and blood viscosity in coronary risk factors	International symposium on Updata of Med. and Surg, Madras 1988
3.	Prof. Megha Singh	Influence of inhomogenous magnetic field on mobility and aggregation of erythrocytes Megha Singh E. Muralidharan	International Conference on Biomechanics, New Delhi, 1988
4.	Dr. K. Lalitha	Effect of Selenium on the metabolism of a novel methanogen S. Krishnan N. Vasanthy K. Lalitha	II Congress on Trace Element Research, Grenoble, France 1988
5.	Dr. K. Lalitha	Metabolic control of a cellulose degradation during biomethanation S. Krishnan N. Vasanthy K. Lalitha	14th International Congress of Bio Chemistry, Prague, Czechoslovakia, 1988
6.	Dr. K. Lalitha	Metabolic feature of a novel methanogenic isolate S. Krishnan N. Vasanthy K. Lalitha	14th International Congress of Bio-Chemistry, Prague, Czechoslovakia, 1988
7.	Dr. K. Lalitha	Kinetics of cellulose degradation during biomethanation of <i>L. leucocephala</i> S. Krishnan N. Vasanthy K. Lalitha	8th International Biotechnology Symposium, Paris, France, 1988

## 6. Research Publications :

S. No.	Author(s)	Title	Name of Journal	Vol. and Issue No	Month and Year	Pages
1.	Y. V. Subramanyam and C. A. Sastry	'Perfumary Waste water treatment using anaerobic filter'	<i>Indian J. Env. Prot.</i>	Vol. 8 No. 4,	April 88	
2.	C. A. Sastry	'Treatment disposal of hazardous wastes'	Industrial Safety Chronicals		April-June 88.	
3.	V. Vasudevan, J.P. Predeep Kumar, and C. A. Sastry	'Model for prediction of volatile acid formation from soluble substrates in the upflow anaerobic contact filter'	<i>Indian. J. Env. Prot.</i>	Vol. 8 No. 7	July 88	
4.	P. V. Venkateswara and C. A. Sastry	'Charging of submicron aerosol particles by bipolar ions in electrostatic field'	<i>Indian. J. Env. Prot.</i>	Vol. 8 No. 7	July 88.	
5.	Pramod Kumar and C. A. Sastry	'Charging of aerosol particles by Unipolar Ions with an applied Electric Field'	<i>Indian. J. Env. Prot.</i>	Vol. 8 No. 8	Aug. 1988.	
6.	B. Velayudham and C. A. Sastry	'Mathematical Model for perchlorate removal from Waste Water by Ion-exchange'	<i>Indian. J. Env. Prot.</i>	Vol. 8 No. 9.	Sept. 1988.	
7.	S. Swarnamani, Megha Singh, B. Murali Manohar and A. Sunder Raj	'Ultrasonic detection of tumor in bovine,	<i>J. Acoust. Soc, India,</i>	16, 14-19,	1988.	
8.	E. Muralidharan and Megha Singh,	'Mechanism of erythrocyte aggregate formation in presence of magnetic field and dextran as analyzed by laser light scattering,	<i>Biorheology,</i>	25, 237-244,	1988.	
9.	E. Muralidharan, and Megha Singh,	'Influence of diabetes mellitus and myocardial infarction on erythrocyte sedimentation profiles as determined by He-Ne laser light scanner,	<i>Clin. Hemorheol</i>	8, 715-722,	1988.	

## 7. Books and Monographs brought out

Names of Author(s)	Title of Text Book Monograph	Publishing Co.	Year of Publication
Megha Singh K. V. Thiruvengadam K. Jagadeesan	Update medicine and Surgery	COSTED	1988

## 8. Short term Courses/Continuing Education Programmes

1. QIP Microbial Engg. May 23-June 6 1988.
2. Ministry of Defence Biomedical Laser Technology, Jan 18--Jan 30, 1988.

## 9. Awards and Honours

Prof. Megha Singh  
Elected Fellow of Royal Society of Medicine, England.

## 10. Invited Lectures

Regional Engineering College, Trichy  
Engineering Staff College, Hyderabad  
Productivity Council, Madras  
Anna University, Madras.

## 11. Future Plans

1. Flow visualization in capillaries to detect changes in blood flow in tissue environment.
2. Development of Enzyme technology and tissue culture facilities.

## CENTRE FOR CONTINUING EDUCATION

As the Continuing/Distance Education forms a major component in the New Educational Policy of the Government of India, the Institute established a Centre for Continuing Education in June 1986, merging together the different activities concerned with Continuing Education, Quality Improvement Programmes and the Curriculum Development Programmes.

### A. Quality Improvement Programmes

This programme has been formulated and financed by the Ministry of Human Resource Development, Department of Education, to improve the standard and quality of technical education in the country and to have a continuous updating/upgrading of skills of teachers in the engineering Colleges in India. The scheme in operation under this programme include :

1. Serving Teachers' programme
2. Reinvitation Programme
3. Short term programmes for in-Service Personnel

#### 1. Serving Teachers' Programme

Under this programme, faculty members of engineering colleges are trained for higher degrees (M. Tech. and Ph. D.). During the year 1988-89, the

No. of teachers admitted to M. Tech Programme was	19
No. of teachers admitted to Ph. D. Programme was	11
No. of teachers offered admission to M. Tech. Programme 1989-90 was	24
No. of teachers offered admission to Ph. D. Programme 1989-90 was	11

#### 2. Reinvitation Programme

This Programme provides facility for former QIP/FIP scholars of the Institute, who have already obtained their Ph. D. Degree to visit the Institute for a period of about three months for carrying out some short term experimental work or for publishing the research papers pending from their Ph. D. work. Under this scheme during this year 2 former QIP scholars visited the Institute and benefitted by completing their pending research papers and by updating and upgrading their knowledge in their fields of research.

#### 3. Short Term Programmes for in-Service Personnel

During the year 5 Short Term Courses were conducted under the auspices of the Quality Improvement Programme and 4 Short Term Courses were conducted under the auspices of the ISTE, the details of which are given at the end of this report in Appendix I and II respectively.

### B. Continuing Education Programmes

Under this programme, the Institute faculty members organise short term courses for persons from Industry and R & D establishments on a self financing basis. The list of such programmes conducted during the year are given in Appendix III.

### C. Continuing Education Project

This is a programme sponsored by the Ministry of Human Resource Development for the preparation of continuing education modules for the industries and R & D establishments in the Country. This Institute is presently producing 22 modules as per the details given in Appendix IV.

Three modules marked by the symbol x have already been prepared and forwarded to the Director of the Continuing Education Project, ISTE, who is responsible for getting the short term courses based on these modules throughout the country.

#### **D. Curriculum Development**

Curriculum Development Cells that are functioning at present at this Institute are :

1. CD Cell in Aerospace Engineering
2. CD Cell in Electrical Engineering

The above two cells are engaged preparing curricula in these areas, as per format proposed earlier by them and approved by the Ministry of HRD, while sanctioning the CD Cells.

As part of curriculum development activities, the Centre for Continuing Education encourages the faculty of the Institute to write text books/monographs by providing financial support towards typing and drawing charges and stationery. During the year under review the book writing schemes that have been approved are given in Appendix V.

#### **E. IIT Madras Series in Science and Engineering**

Under the above series, which was launched during the last year one book has just been published by M/s. Macmillan India Limited, the publisher for the series. The book is entitled 'Understanding Combustion' and is written by Prof. H.S. Mukunda of the IISc, Bangalore. Two other books, whose details are given below are presently in the press

- (a) 'The Frontier Between Physics and Astronomy'  
by Prof. J.V. Narlikar, TIFR, Bombay.
- (b) 'Catalysis'  
by Prof. J. C. Kuriacose, IIT, Madras.

Department of Science Technology, Government of India, has given a one time grant of Rs. 50,000/- for this project.

#### **F. Educational Technology Cell**

During the year the Cell has received the various video and other equipment required for the production of print and non-print forms of resource materials needed for improving the standard of engineering education in the country. A studio which will facilitate the production of video films in house is under preparation.

#### **G. ZOPP Seminar**

In collaboration with the German Agency for Technical Co-operation (GTZ), the Institute organised a workshop on the ZOPP (Zeit Orientierte Project Planning) Methodology during the period 4th Oct. to 15th Oct. '88 in which 10 German experts and 13 Institute faculty members participated. The CCE was responsible for organizing this Workshop.



## APPENDIX I

### List of Short-Term Courses Conducted Under Quality Improvement Programme During 19-8-1989

<i>Sl. No.</i>	<i>Title of the Course</i>	<i>Coordinator(s) Department</i>	<i>Duration Period</i>
1.	Recent Development in Internal Combustion Engines	Dr. B. Nagalingam Mech. Engg. Dept.	2 Weeks 16-27 May 1988
2.	Microbial Engineering	Dr. A. Baradarajan Dr. T. Panda Chemical Engg. Dept.	2 Weeks 23-05-88 to 06-0 -88
3.	Marine Structures	Dr. M. R. Pranesh Ocean Engg. Centre	2 Weeks 06-06-88 to 17-06-88
4.	Experimental Techniques	Dr. V. G. Idichandy Ocean Engg. Centre	2 Weeks 13-06-88 to 24-06-88
5.	Dynamics of Floating Bodies	Dr. C. P. Vendhan Shri S. K. Battacharyya Ocean Engg. Centre	2 Weeks 05-12-88 to 17-12-88

## APPENDIX II

### List of Short-Term Courses Conducted Under ISTE DURING 1988-1989

<i>Sl. No.</i>	<i>Title of the Course</i>	<i>Coordinator(s) Department</i>	<i>Duration Period</i>
1.	Modern Digital Techniques and their Industrial Applications	Dr. C. Eswaran Elect. Engg. Dept.	2 Weeks 18-04-88 to 01-05-88
2.	Emerging Trends in Precision Machining	Dr. G. Kuppaswamy Mech. Engg. Dept.	2 Weeks 06-06-88 to 17-06-88
3.	Recent Development in Surface Coating and Finishing Techniques	Dr. M. Mayuram Mech. Engg. Dept.	4 Weeks 20-06-88 20-07-88
4.	Mathematical Modelling in Science and Technology	Dr. V. B. Johri Mathematics Dept.	4 Weeks 01-08-88 to 28-08-88

## APPENDIX III

### List of Continuing Education Programmes Conducted During 1988-1989

<i>Sl. No.</i>	<i>Title of the Course Programme</i>	<i>Coordinator(s) Department</i>	<i>Period</i>
1.	Fibre Optic Application in Service Sector	Prof. J. P. Raina Elect. Engineering	11-04-88 to 23-04-88
2.	STC in Solid Rocket Propulsion	Dr. S. Krishnan Aerospace Engg.	12-09-88 to 23-09-88
3.	Summer School on ESCA and Associated Techniques STC	Prof. P. T. Manoharan R.S.I.C.	25-04-88 to 29-04-88
4.	CAD-CAM an Introduction	Prof. V. Radhakrishnan Mech. Engg.	19-05-88 to 27-05-88
5.	One day W/S on status of Technology in the field materials Handling Equipment	Prof. M. A. Parameswaran Mech. Engg.	17-06-88
6.	Ship Resistance and Propulsion Test - Lab - Course	Shri R. L. Roy Choudhary Shri P. Sambandan Ocean Engg. Centre	20-06-88 to 24-06-88
7.	ASI on Finite Element Analysis for Engineering Design	Prof. C. S. Krishnamoorthy Civil Engineering Prof. K. N. Seetharamu Mech. Engg.	01-08-88 to 10-08-88
8.	Power Electronics	Prof. V. V. Sastri Elect. Engineering	16-09-88 to 22-09-88
9.	Design and Fabrication of FRP Components for Land Transport System	Dr. N. G. Nair FRP, Research Centre	21-09-88 to 26-09-88
10.	CAD-CAM for Executives	Prof. V. Radhakrishnan Mechanical Engg.	23-09-88 to 24-09-88
11.	Dynamics of Floating Bodies	Dr. C. P. Vendan Sri S. K. Bhattacharyya Ocean Engg. Centre	05-12-88 to 17-12-88

<i>Sl.No.</i>	<i>Title of the Course Programme</i>	<i>Coordinator(s) Department</i>	<i>Period</i>
12.	Workshop on Liquid Automation & Combustion Systems	Prof. R. Natarajan Mech. Engg.	07-12-88 to 10-12-88
13.	Principles of Telematics - intensive course on Digital communication	Dr. Ashok Jhunjunwala Elect. Engg.	19-12-88 to 30-12-88
14.	Cellular Radio and Mobile Communication	Dr. Ashok Jhunjunwala Elect. Engg.	02-01-89 to 06-01-89
15.	ASI on Energy Optimisation in Manufacturing and Materials Processing	Prof. V. M. Sastri Mech. Engg. Prof. K. A. Padmanabhan Prof. H. Md. Roshan Metallurgical Engg.	02-01-89 to 13-01-89
16.	Training Programme in Catalysis	Prof. C. N. Pillai Chemistry	03-02-89 to 24-02-89
17.	Fibre Optics	Prof. J. P. Raina Elect. Engg.	27-02-89 to 03-03-89
18.	Workshop on FRP Technology	Dr. N. G. Nair FRP Research Centre	06-03-89 to 18-03-89
19.	Modern Spectral Analysis with Applications	Dr. K. M. M. Prabhu Elect. Engg.	27-03-89 to 07-04-89

## APPENDIX IV

### List of Continuing Education Modules being prepared by IIT, Madras during 1988 - 1989

<i>Sl. No.</i>	<i>Title of the Course Module</i>	<i>Principal Author   Dept.</i>
1.	Induction Motor Drives	Prof. Vedam Subrahmanyam Electrical Engineering
2.	Robotics	Prof. V. Seshadri Electrical Engineering
3.	Computer Aided Engineering - Introduction	Prof. M. A. Veluswamy Mechanical Engineering
4.	Introduction to Semiconductor Lasers	Dr. P. R. Vaya Electrical Engineering
5.	Microelectronics	Dr. P. R. Vaya Electrical Engineering
6.	Stress Analysis and Design of Welded Structures	Prof. V. M. Radhakrishnan Metallurgical Engineering
7.	Planning Implementation and Operations of Irrigation Projects	Dr. N. Indrasenan Civil Engineering
8.	Command Area Development	Dr. N. Indrasenan Civil Engineering
9.	Wear and Wear Control Techniques	Dr. K. Gopinath Mechanical Engineering
10.	Surface Coatings / treatments	Dr. K. Gopinath Mechanical Engineering
11.	Theory and Practice of Lubrication and Lubricants	Prof. B. S. Prabhu Applied Mechanics
12.	Condition Monitoring & Condition Based Maintenance	Prof. B. S. Prabhu Applied Mechanics
13.	Reinforced Earth Structures	Prof. T. S. Ramanatha Ayyar Civil Engineering
14.	An Introduction to the Finite Element Analysis for Engineering Design	Prof. C. S. Krishnamoorthy Civil Engineering and Prof. K. N. Seetharamu Mechanical Engineering

<i>Sl. No.</i>	<i>Title of the Course Module</i>	<i>Principal Author   Dept.</i>
15.	Instrumentation and Control	Prof. Ch. Durgaprasada Rao Chemical Engineering
16.	Experimental Stress Analysis	Prof. R. S. Alwar and Shri G. Thomas Applied Mechanics
17.	Mobile / Portable Drill-Site Foundations Technology	Prof. V. S. Raju Ocean Engineering Centre
18.	Engineering Design for Manufacture	Shri S. D. Kalander Saheb Mechanical Engineering
19.	Engineering Product Development	Shri T. S. Chennabasavan Mechanical Engineering
20.	Energy Conservation in Buildings	} Prof. T. P. Ganesan Prof. P. Kalyanasundaram  Dr. M. S. Mathews Civil Engineering
21.	Appropriate Technology Applied to Materials Construction of Buildings / Housing	
22.	Foundry Mechanisation / Automation	

## APPENDIX V

Financial support extended to Book writing schemes during 1988 — 1989.

<i>Sl. No.</i>	<i>Title of the book/monograph</i>	<i>Author/Department</i>
1.	Concept in Reliability Engineering	Prof. L. S. Srinath Director, IIT, Madras
2.	PERT and CPM Principles & Applications	Prof. L. S. Srinath Director, IIT, Madras
3.	Introduction to Mechanics of Solids	Prof. L. S. Srinath Director, IIT, Madras
4.	Manufacturing Technology	Dr. G. Kuppuswamy Dept. of Mechanical Engg.
5.	Fortran Programming made easy	Mr. R. Deenadayalu Dept. of Comp. Sci. & Engg.
6.	Nuclear Physics and Reactors	Dr. A. V. Narasimham Dept. of Physics
7.	Process Calculation for Chemical Engineers (revised edition)	Prof. Ch. Durgaprasada Rao Dept. of Chemical Engg.

## CENTRE FOR SYSTEMS AND DEVICES

### 1. Research & Development Activities :

Research work on the on going schemes from different agencies was pursued.

### 2. New Facilities added and Major Items of Equipment Procured/Fabricated :

Photoluminescence Facilities with 5w Ar<sup>+</sup> laser and 10°K cryostat.

### 3. (i) Sponsored Projects :

Sl. No.	Title	Funding agency	Period	Coordinator(s)
1.	Computer Assisted Phonetic Shorthand	DOE	1 year	V. N. Shukla
2.	Computer Assisted language learning	DOE	2 years	V. N. Shukla and Ranjana Shukla

### (ii) Sponsored Projects Completed During the year :

Sl. No.	Title	Sponsoring agency and value	Coordinator
	Analytical Technique for Off-frequency and Off Beam Characterisation of the Radar and Communications Antennas above 1GHx	DOE Rs. 2,28,200/-	M.S. Narasimhan

### 4. Papers presented at Conferences :

Sl. No.	Name of the Authors	Title of Paper Presented	Name, Dates and Venue of Conference
1)	K. M. M. Prabhu and N. Venkatesh	'Non recursive Digital Filtering with Fast Hartley Transformers' (pp. 947 - 949).	Signal Processing IV : Theories and Applications, Sept 5-8, 1988, Grenoble, France.
2)	N. Venkatesh and K. M. M. Prabhu	'A Fast Hartley Transform Processor' (pp. 343 - 346).	—do—
3)	K. Bhoopathy Bagan and K. M. M. Prabhu	'Performance of Optimum MTI with FFT and Nonlinear Processors' (pp. 1373 - 1376).	Signal Processing IV : Theories and Applications, Sept 5-8, 1988, Grenoble, France.
4)	K. Ponnuraju Jacob George K. J. Thomas and P. R. Vaya	'Some Results on Homoepitaxial Growth of GaAs by MBE Technique'	National Seminar on GaAs and III-V Compounds, April 29-30, 1988, IIT Kharagpur,



<i>Sl. No.</i>	<i>Name of the Authors</i>	<i>Title of Papes Presented</i>	<i>Name, Dates and Venue of Conference</i>
5)	P. R. Vaya K. Ponnuraju and S. Karthik	'MBE of GaAs: Growth and Characterization'	International Conference & Intensive Tutorial Course on Semi-conductor Materials, Dec. 13-15, 1988, New Delhi.
6)	P. R. Vaya K. Ponnuraju N. Venkataraman and K. J. Thomas	'Study of the Effects of annealing on Au-Ge contacts on n-type MBE GaAs Films'	--do--
7)	P. R. Vaya M. Govindarajan and J. Majhi	'Some Studies on Anodic Oxidation of GaAs Surface'	--do--

#### 5. Research Publications :-

<i>Sl. No.</i>	<i>Author(s)</i>	<i>Title</i>	<i>Name of Journal</i>	<i>Vol. and Issue No.</i>	<i>Month &amp; year</i>	<i>Pages</i>
1)	M. S. Narasimhan and K. R. Govind	'Radiation Characteristics of a corrugated circular cylindrical waveguide horn excited in the TE <sub>11</sub> mode'	IEEE Transactions on Antennas and Propagation	AP-36, No. 8	August 1988	1147-1152
2)	K. M. M. Prabhu and K. Bhoopathy Bagan	FIR Digital Filter Design with Variable Parameter Window Families'	J. of the Institution of Electronic and Radio Engineers	Vol. 58, No. 6	Sept-Dec. 88	295-298
3)	S. Bala Narayanan and K. M. M. Prabhu	'New Method of Computing Wigner Ville Distribution'	Electronics Letters	Vol 25, No. 5	March 1988	336-337
4)	Chitra Dorai and V. N. Shukla	'Shared Memory Access-Boon for Graphics'	IETE	Vol. 5, No. 11	1988	455-458
5)	V. N. Shukla	'Multiscript Display Controller for Direct Telecast'	IETE	Vol. 5, No. 12	1988	481-485
6)	Ranjana Shukla	'A New Approach to Indian Script Character-generation for CRT'	IETE	Vol. 33,	1987	163-166

Sl. No.	Author(s)	Title	Name of Journal	Vol. and Issue No.	Month & year	Pages
7)	P. R. Vaya, J. Majhi and M. Sadhana	'CV and IR absorption Study of Thin Oxide (500A) Films Thermally Grown on Silicon'	Ind. J. Pure and Appl. Phys.	Vol 26,	April 1988	294-296
8)	P. R. Vaya K. R. Murali and Mani Sundaram	'Some Studies on Zinc Phosphide Films Grown by Hot Wall Epitaxy'	Phys. Stat. Sol.	Vol. 105	1988	477-484
9)	K. Ponnuraju P. R. Vaya and J. Sobhanadri	'Structural and Electrical Properties of Molecular Beam Epitaxially Grown $Pb_{1-x}Sn_xTe$ Films'	Phys. Stat. Sol.	Vol. 105	1988	161-169
10)	P. R. Vaya and J. Majhi	'Effect of Surface Treatment on AlSi Schottky Structure'	Phys. Stat. Sol.	Vol. 106	1988	K209-213
11)	V. Suresh Babu P. R. Vaya and J. Sobhanadri	'Electrical and Thermoelectrical Properties of $Zn_3P_2$ Films Grown by HWE'	J. Appl. Phys.	Vol. 64, No. 4	1988	1922-1926
12)	T. Srinivasan P. R. Vaya and J. Sobhanadri	'Growth of $Pb_{0.82}Sn_{0.18}Te$ by Molecular Beam Epitaxy'	Thin Solid Films	Vol. 161	1988	171-180
13)	V. Suresh Babu	'Optical and Photoconductivity Studies on $Zn_3P_2$ Films Grown by Hot Wall Deposition'	J. of Solar Energy Materials	Vol. 18	1988	63-75

#### 6. Short Term Courses/Continuing Education Programmes :

Title	Date	Coordinator
Modern Spectral Analysis with Applications	27.3.1989 to 7.4.1989	Dr. K.M.M. Prabhu

#### 7. Professional Activities :

Dr. P. R. VAYA — IEEE — Nominated as Member

#### 8. Invited Lectures by Distinguished Visitors to IIT :

Dr. V. FUHS

#### 9. Future Plans :

Front line research as projected in Plan Proposal of Seventh Five Year Plan.

## FIBRE REINFORCED PLASTICS RESEARCH CENTRE

### 1. Research and Development Activities :

The following is a list of R & D activities taken up during the year :

1. Development of Ceramic matrix composites by sol-gel process
2. Development of metal matrix composites by sintering
3. Studies on Reinforced Reaction Injection Moulding using Nylon
4. Thermoforming of advanced reinforced Thermoplastics
5. Studies on bolted and bonded joints in composites
6. Computer Aided Mould Design for the compression moulding of SMC
7. Development of Wood grain simulation in SMC
8. Finite element analysis of Composite structures
9. Flutter analysis of composites
10. Studies on the machining of FRP

### 2. New Facilities added and Major items of equipment procured :

- (i) A Resin Transfer Moulding (RTM) machine has been procured and the RTM studies are being carried out
- (ii) A centrifugal casting machine suitable for making FRP pipes fabricated has been commissioned and studies were carried out.

### 3. (i) Sponsored Projects :

Sl. No.	Title	Funding agency	Period	Coordinator(s)
1.	Fibre Reinforced Metal Matrix Composites	ICSR (IRDF)	one year	Dr. Palaninathan and Dr. Gokularatnam
2.	Development of Rehabilitation aids with composites for the mobility of paraplegics	DST, Rs. 1,43,000	Two years	Dr. N. G. Nair and Sri B.J.C. Babu
3.	Advanced composite Development - Fibre Reinforced metal, ceramic and plastic matrices composites	Min. of Edn. Rs. 25 lakhs.	—	Dr. R. Palaninathan Dr. N. G. Nair Sri S. K. Malhotra

### (ii) Sponsored projects completed during the year

Study of bolted joints in composites	Aeronautical Dev. Agency Rs. 1.35 lakhs	—	Sri S. K. Malhotra and Sri B.J.C. Babu
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#### 4. Major Consultancy Assignments :

1. Liquid Propulsion System Centre, ISRO, Trivandrum Stress Analysis of II nd stage Components of PSLV Rs. 1.50 lakh, Investigators: Dr. Palaninathan and C. P. Vendhan
2. SHAR Centre, Sriharikota, Design and Development of FRP Vibration Test Fixtures, Rs. 1.10 lakh, Investigators: S. K. Malhotra and B. J. C. Babu

#### 5. Papers presented at Conferences held abroad :

G. Santhanakrishnan, Technical Officer 'Machinability Characteristics of Fibre Reinforced Plastics Composites', Authors: Santhanakrishnan, R. Krishnamurthy and S.K. Malhotra. CIRP International Seminar on New Manufacturing Technology, 18-8-88 at Singapore.

#### Conferences held in India :

1. S. K. Malhotra, N. Ganesan, M. A. Veluswami, 'Vibration of Composite Plates with cutouts', Presented at 40th AGM of Aero. Society of India, Dec. 19-21, 1988 held at IIT Madras,
2. G. Santhanakrishnan, R. Krishnamurthy and S.K. Malhotra, 'Machining of Carbon fibre reinforced plastics', 13th AIMTDR Conference, No. V25-27, 1988 at Jadavpur Univ. Calcutta.

#### 6. Research Publications :

1. S. K. Malhotra, N. Ganesan & M. A. Veluswami, 'Effect of Fibre orientation and Boundary conditions on the Vibration behaviour of orthotropic Rhombic Plates', Composites, V-19, n 2, pp. 127-132, 1988.
2. S. K. Malhotra, N. Ganesan and M. A. Veluswami, 'Effect of fibre orientation and Boundary Conditions on the Vibration behaviour of Orthotropic square plates (FEM)', Computers and Structures, V-29, n-5, pp. 825-829, 1988.
3. S. K. Malhotra, N. Ganesan and M. A. Veluswami, 'Effect of Fibre orientation and boundary conditions on the Vibration behaviour of orthotropic square plates (R-R)', Composite Structures, V-9, n-3, pp. 247-255, 1988.
4. S. K. Malhotra, N. Ganesan and M. A. Veluswami, 'Vibrations of orthotropic Square plates having variable thickness (Linear variation)' Composites, V-19, n-6, pp. 467-472 1988.
5. G. Santhanakrishnan, R. Krishnamurthy and S. K. Malhotra, 'Machinability characteristics of Fibre reinforced Plastics Composites', J. Mech. working Technology, V-17, pp. 196-204, 1988.
6. R. Kari Thangaratnam and Palaninathan', Buckling of Composite Cylindrical Shells', J. of Aero. Soc. of India, Vol.-41, pp. 47-54, 1989.
7. D. Dhanraj, and Palaninathan, Selection of Stress Parameters for Hybrid Stress Finite Elements', J. Aero. Soc. of India, Vol. 41, pp. 81-85 1989.
8. Kari R. Thangaratnam and Palaninathan 'Thermal Stress Analysis of Laminate Composite Plates and Shells', Computers and Structures, Vol. 30, 1988, pp. 1403-1411.

#### 7. Short Term courses conducted :

1. Workshop on FRP Technology — 24.4.88 to 6.5.88 : 25 participants.
2. Workshop on FRP Technology — 16.3.89 to 18.3.89 : 27 participants.

#### 8. Invited Lectures :

Dr. N. G. Nair, delivered lectures on 'Composites' at Indian Plastics Institute, TI Cycles Ltd. and at a Conference arranged by DST, New Delhi at Bangalore.

#### 9. Future Plans :

The Centre is setting up an advanced composites Laboratory for research on Ceramic Matrix and Metal Matrix Composites.

## MATERIALS SCIENCE RESEARCH CENTRE

### 1. Research & Development Activities :

A large number of high temperature oxide superconductors have been synthesized and efforts are on to grow single crystals of high Tc superconductors and also studies on materials for solar energy conversion.

### 2. New facilities added and Major items of equipment procured / fabricated :

High temp. furnaces ; Glove box for handling moisture and air sensitive materials; Digital multimeter (Keithley Instruments); Programmer current sources; Micro ohm-meter; Precision pressure transducer, susceptibility and low field hysteresis apparatus; Vacuum extrusion unit.

### 3. (i) Sponsored Projects :

1. 'Studies on High Tc oxide superconductors', PMP project, New Delhi, Rs. 18.95 lakhs, 1988 - 1991.  
Dr. U. V. Varadaraju & Prof. G. V. Subba Rao
2. 'Indo-USSR (ILTP) research programme on electronic ceramic materials under ILTP', Indo-USSR (ILTP), Rs. 2.00 lakhs (5-year Programme)  
Prof. G. V. Subba Rao and Dr. U. V. Varadaraju

### (ii) Sponsored Projects completed during the year :

'Solid state studies on ternary oxide pyrochlores, A B O'. CSIR Project, New Delhi, Rs. 1.938 lakhs, 1985 - 1988 (31st August).  
Prof. G. V. Subba Rao & Dr. U. V. Varadaraju

### 4. Assistance to Students and Major Consultancy Assignments :

More than 10 students did Projects during vacation period on various research programmes of the Centre.

### 5. Assistance to sister Institutions :

Anna Univ., Madras; Madras Univ., Madras.

### 6. Patents taken :

One patent has been filed in connection with the 'Development of high Tc oxide superconductors'.

### 7. Papers presented at Conference :

#### a. International Conferences :

1. 'Photoelectrochemical studies on Mo-Cluster compounds in  $\text{GaMo}_4\text{S}_8$  and  $\text{ZnMo}_2\text{Re}_2\text{S}_8$ ', M. Paranthaman, G. Aravamudan and G. V. Subba Rao, Seventh Intl. Conf. on Photochemical conversion and storage of solar energy, Illinois, USA (1988).
2. 'Photoelectrochemical studies on  $\text{CuInS}_{2-x}\text{Se}_x$  system', R. Balakrishnan and G. V. Subba Rao, *ibid.*, (1988).
3. 'Photoelectrochemical studies on  $\text{Mg}_2\text{TiO}_4$  and related Ti oxides' R. Balakrishnan and G. V. Subba Rao, *ibid.*, (1988).
4. 'Photoelectrochemical studies on the Oxyfluoride,  $\text{Sr}_2\text{FeO}_5\text{F}$  with the  $\text{K}_2\text{NiF}_4$  structure', M. Paranthaman, T. Narasinga Rao, G. Aravamudan and G. V. Subba Rao, *ibid.*, (1988).

5. 'Photoelectrochemical studies on  $\text{LaA}_2\text{Fe}_2\text{O}_8$  (A = Ca, Sr, Ba)', T. Narasinga Rao, M. Paranthaman and G. V. Subba Rao, *ibid*, (1988).
6. 'Superconductivity studies on  $(\text{Ln}_{1-x}\text{Lu}_x)\text{Ba}_2\text{Cu}_3\text{O}_7$  (Ln = La, Sm)', R. Balakrishnan, U.V. Varadaraju and G. V. Subba Rao, First Asia-Pacific Conference on Condensed Matter Physics, Natl. Univ. of Singapore, Singapore (1988).

**b. National Conferences :**

1. 'Search for Superconductivity in Li or Na doped  $(\text{Sr}_{0.15}\text{Ca}_{0.85})\text{CuO}_2$ ', R. Balakrishnan, U. V. Varadaraju and G. V. Subba Rao, Proc. of the Solid State Physics Symposium organised by Dept. of Atomic Energy, Govt. of India, Bhopal (1988).
2. 'High  $T_c$  superconductivity studies on  $(\text{La}_{1-x}\text{Ho}_x)\text{Ba}_2\text{Cu}_3\text{O}_7$ ', K. Chandrasekharan, U. V. Varadaraju and G. V. Subba Rao, *ibid*, (1988).
3. 'Superconductivity studies on  $(\text{Bi}_{1-x}\text{Pb}_x)\text{Sr}_2\text{Ca}_2\text{Cu}_3\text{O}_x$ ,  $x = 0, 0.2, 0.4$  and  $(\text{Bi}_{1-x}\text{Tl}_x)\text{Sr}_2\text{Ca}_2\text{Cu}_3\text{O}_x$ ,  $x = 0.0 - 2.0$ ', S. Natarajan, U. V. Varadaraju and G. V. Subba Rao, *ibid*, (1986).
4. 'Enhancement of  $T_c$  by Fb addition to the system Bi-Sr-Ca-Cu-O', J. K. Ghosh, S. Natarajan, U. V. Varadaraju and G. V. Subba Rao, *ibid*, (1988).
5. 'Studies on  $\text{La}_{1-x}\text{Pr}_x\text{Ba}_2\text{Cu}_3\text{O}_7$ ', K. A. Thomas, U. V. Varadaraju and G. V. Subba Rao, *ibid*, (1988).
6. 'Lithium insertion into  $\text{NbO}_2\text{F}$  with the  $\text{ReO}_3$  structure', J. K. Ghosh and U. V. Varadaraju, Proc. of the solid state physics, symposium organised by Dept. of Atomic Energy, Govt. of India, Bhopal, (1988).
7. 'Crystal growth of high temp. superconductivity oxides', H. Krishnan and U. V. Varadaraju, *ibid* (1988).

**8. Research Publications :**

**a. Indian Journals :**

1. 'Super conductivity behaviour in screen printed  $\text{YBa}_2\text{Cu}_3\text{O}_7$  films', U. V. Varadaraju, G. V. Subba Rao, K. D. Chandrasakaran and A. Baradarajan Bull. Mater. Sci. (India), **10**(3), L263-266 (1988).
2. 'Specific heat of  $\text{YBa}_2\text{Cu}_3\text{O}_7$  from 4.2 to 60K', N. Sankar, V. Sankaranarayanan, R. Srinivasan, G. Rangarajan and Subba Rao, *Pramana - Phys.*, **30**, 419-421 (1988).
3. 'Superconductivity Studies on  $(\text{Y}_{1-x}\text{Ln}_x)\text{Ba}_2\text{Cu}_3\text{O}_7$ , Ln = La, Gd, Ho and Tm', S. Natarajan, U. V. Varadaraju, G. V. Subbarao, V. Sankaranarayanan, N. P. Raju and R. Srinivasan, Proc. of INSA (India), **54**, 702-706 (1988).
4. 'Measurement and understanding of magnetization in AC and DC fields and the determination of intragrain  $H_{c1}$  in high  $T_c$   $\text{REBa}_2\text{Cu}_3\text{O}_7$  superconductors', A. K. Grover, C. Radhakrishnamurthy, P. Chaddah, G. Ravikumar and G. V. Subba Rao, *Pramana: J. Phys. (India)*, **30**, 569-595 (1988).
5. 'High  $T_c$  oxide superconductor: Synthesis and Characterization', G. V. Subba Rao, in 'High  $T_c$  superconductors', Eds., S. V. Subramanyam and E. S. R. Gopal, Wiley Eastern Publ., New Delhi, (1988).

**b. International Journals :**

1. 'Superconductivity behaviour in screen printed  $\text{YBa}_2\text{Cu}_3\text{O}_7$  films', U. V. Varadaraju G. V. Subba Rao, K. D. Chandrasekaran and A. Baradarajan, *J. Thin Solid Films*, **164**, 119-122 (1988).
2. 'Superconductivity studies on  $(1-x)\text{Ln}_x\text{Ba}_2\text{Cu}_3\text{O}_7$ , Ln = La, Tb', S. Natarajan, K. Chandrasekaran, U. V. Varadaraju, G. V. Subba Rao, *Physica C* **153-155**, 926-927 (1988).

3. 'Anomalous magnetic hysteresis loops and small Hc1 values in high Tc superconductors', A. K. Crover, C. Radhakrishnamurty, P. Chaddah, G. Ravikumar and G. V. Subba Rao, *Pramana-J. Phys.*, **30** L167 (1988).
4. 'Anomalous Variation of the c lattice parameter of a sample of YBa2Cu3O7 through the superconducting transition', R. Srinivasan, K. S. Girirajan, Vijayashree Radhakrishnan and G. V. Subba Rao, *Phys. Rev. B* **38**, (July) 1988).
5. 'Specific heat of Pr doped Yttrium Barium Copper Oxide', N. Sankar, V. Sankaranarayanan, L. S. Vaidyanathan, G. Rangarajan, R. Srinivasan K. A. Thomas, U. V. Varadaraju and G. V. Subba Rao. *Solid State Communications*, **67**, 391-395 (1988).
6. 'Search for superconductivity in mixed niobium oxides' G. V. Subba Rao, U. V. Varadaraju and S. Natarajan - *Physica C* **153-155**, 501 (1988).
7. 'Pressure Induced Structural Phase Transition in the High Tc Superconductor, YBa2Cu3O7 - ' N. Victor Jaya, S. Natarajan and G. V. Subba Rao, *Solid State Commun.*, **67**, 51-54, (1988).
8. 'High Tc superconductivity in SnBa2Cu3O7 (Ln=La-Yb, Y) compounds', G. V. Subba Rao, U. V. Varadaraju, S. Natarajan, K. A. Thomas, V. Sankaranarayanan, N. P. Raju, R. Srinivasan and T. S. Radhakrishnan, *Proc. of Siberian Acad. Sci. of USSR* (1988).
9. 'Estimation of oxygen content in high Tc superconductors; an accelerator based method', J. G. Prasad, M. B. Kurup, P. Singh, A. K. Grover and G. V. Subba Rao, *Nucl. Instr., & Methods* (in press).
10. 'Studies on High Tc oxide superconductors', G. V. Subba Rao, U. V. Varadaraju and R. Srinivasan - in 'Chemical and structural aspects of high Tc superconductors', Ed. C. N. R. Rao, World Scientific Publ., Singapore, PP 42-50 (1988).
11. High Tc Superconductivity in LnBa2Cu3O7 (Ln=La-Yb, Y) compounds', G. V. Subba Rao, in 'Chemistry of oxide superconductors', Ed. C. N. R. Rao, Blackwell Sci. Publ., Oxford, P. 63 (1988).

#### 9. Professional activities :

Prof. G. V. Subba Rao

1. Member, Editorial Board, *International Journal, Materials Chemistry and Physics*.
2. Member, Editorial Board, *Bull. Mater. Sci. (India)*.
3. Member, National Task Force on 'Chemtrapse', DNES, New Delhi.
4. Member, National Task Group on Superconductivity (Basic & Research), DST, New Delhi.
5. Member, National Representative for the IUPAC, Div. of high temp. and solid state chemistry, INSA, New Delhi.

#### 10. Invited Lectures :

- (i) By IIT Faculty in other institutions :  
The faculty gave more than 10 invited talks at various Institutions/Universities in India and abroad.
- (ii) By Distinguished Visitors to IIT :  
20 scientists from various Institutions/Universities (from India & abroad) gave lectures at this Centre.

#### 11. Visitors to the Dept./Centre :

20 scientists from India and abroad visited the Centre, gave lectures and discussed with faculty and students on various research topics of current interest.

#### 12. Future Plans :

##### (a) Basic Research

- Superconductivity studies on non-copper systems based on mixed oxides, chalcogenides, pnictides - structure property correlations.

- \* Fast ion conductors (Li, Na and O ions) based on Nasicon and related 3D-network structures
  - \* Magnetic materials based on hexaferrite, Nd-Fe-B and related systems.
  - \* Light element ceramics based on TT-Alumina, silicon carbide and related systems.
  - \* Shape memory and Heusler alloys and structure - property correlations.
- (b) Applied Research:
- \* Scaling-up of synthesis of high T<sub>c</sub> oxide super conductors ; explosive bonding and wire fabrication.
  - \* Ceramic oxide heating elements based on transition metal mixed oxides.



## OCEAN ENGINEERING CENTRE

### 1. Research and Development Activities :

Research and Development activities have been carried out in the following major areas namely

- 1) Structural Analysis, Design and Testing
- 2) Wave Hydrodynamics
- 3) Floating and Submerged Bodies
- 4) Marine Geotechniques
- 5) Materials in Ocean Environment
- 6) Ocean Energy

The projects in the area of Ultimate Strength of Ships, Integrated Monitoring of Offshore Platforms and Flow Visualisation using light sheet techniques have been sponsored during this year. The major consultancy work in the areas like resistance and propulsion tests for pusher tugs, development and evaluation of design/analysis for jacket platforms, container berths etc. have been undertaken in this year.

Various computer oriented engineering capabilities developed for R & D activities in the above mentioned areas are:

- i. Static and dynamic analysis of fixed offshore structures, ship structure, nearshore structures and flight structures
- ii. Equilibrium and nonlinear dynamical problems of cables, cable systems and underwater towed bodies
- iii. Installation stresses on submarine pipeline
- iv. Pile drivability analysis
- v. Linear spectral fatigue analysis of framed structures with fluid-structure interaction
- vi. Wave data analysis
- vii. Hydrostatic, intact and damaged stability calculations of ships and other floating bodies.
- viii. End and sidelaunching calculation of ships, etc.

Academic Research Activities :

#### A. Master of Science (Completed in 1988)

1. Wave induced sediment transport near Paradeep Port.

#### B. Master of Science (ongoing)

1. Motion response of underwater towed array
2. Hydrodynamic behaviour of semisubmersibles
3. Behaviour of piles subjected to lateral loads
4. Coastal geomorphology of Kanyakumari in relation to Outflow

#### C. Ph.D. Completed :

1. Wave and Wave current forces on Horizontal Tubular Members
2. Strength Behaviour of a Marine clay subjected to repetitive loading
3. Longshore sediment Transport Model with particular reference to Indian coast.

**D. Doctor, of Philosophy (ongoing) :**

1. Installation operations of offshore Steel jackets
2. Dynamic response of offshore guyed towers
3. Wave propagation in underwater shells
4. Ultimate strength of ships under cyclic loading
5. Development of optimal and economic tug barge systems for Inland and Coastal water ways
6. Dynamics of articulated tower
7. Buckling analysis of underwater shells
8. Action of waves on pipelines
9. Damping effects on concrete ocean structures
10. Floating body dynamics by finite element method
11. Effect of waves and currents on seabed scour
12. Behaviour of anchors subjected to monotonic and cycline loading
13. Studies on piles subjected to wave loads
14. Strength and deformation behaviour of Marine clays
15. Corrosion behaviour of reinforcing Steel in marine environment
16. Deterioration of concrete in marine environment.
17. Performance studies of oscillating water column wave energy device.
18. Development of profiles for self rectifying air turbine of a wave energy device.

**2. New Facilities Added and Major items of Equipments Procured/Fabricated :**

1. The 3m wide wave absorber system for the 30m × 30m × 3m wave basin has been designed, got fabricated and installed.
2. Under the German assistance programme a 30m wide wave maker has been ordered with M/s. Kempf & Remmers, Hamburg for the wave basin. It will have capabilities for generating sea conditions of predefined characteristics.
3. The 45m long Random wave flume is being extended to 90m and the civil work will be completed by April/May 1989.
4. A 4 channel FM Instrumentation tape recorder has been procured.
5. A Mechanical oscillator for studies on dynamic behaviour of foundation has been added.
6. Computational facilities have been strengthened by additional Personal Computers (PCs)
7. A wave height gauge has been designed and fabricated indigenously.
8. A pair of propulsion dynamometers have been procured to facilitate the measurement of thrust and torque in the propellers of model ships being tested in the Towing and Sea Keeping basin.

## 5. Sponsored Projects:

Total value of all projects upto Feb, 1989 : Rs. 171 lakhs

The details of the project are :

<i>S. No.</i>	<i>Title</i>	<i>Funding Agency/ Value &amp; Period</i>	<i>Coordinator/s</i>
1.	Ultimate Strength Design of Ships	Ministry of Surface Transport Rs. 3,15 lakhs 2 years	Prof. C. Ganapathy/ Dr. R. Sundaravadivelu
2.	Instrumentation for Integrity monitoring of fixed offshore platforms	ONGC Rs. 5.7 lakhs	Dr. V. G. Idichandy/ Prof. C. Ganapathy
3.	Flow Visualization using light sheet techniques	VW Foundation FRG DM 85210	Dr. V. G. Idichandy/ Prof. H. Kaldenhoff, T. U. Berlin
4.	Development and behavioural studies on concentration materials	DOD, New Delhi Rs. 9,36,520 3 years	Dr. K. Ganesh Babu
5.	Sea Trial of a 150 KW Wave Energy Device off Coast	DOD, New Delhi 106 Lakhs 2 years	Prof. V. S. Raju/ Prof. M. Ravindran
6.	Configuration and dynamics of towed bodies	NPOL, Cochin 6.70 lakhs 3 years	Prof. C. Ganapathy/ Dr. C. P. Vendhan
7.	Computer software development for processing ocean wave data obtained from NRSA	DOD/NRSA Rs. 1,37,000/- 2 years	Dr. R. Mahadevan
8.	Development of Numerical Model for storm surge Prediction along the East coast of India	DST, New Delhi Rs. 3.1 lakhs 3 years	Dr. R. Mahadevan/ Dr. D. Srinivasan
9.	Experimental investigations on motion behaviour of floating bodies	DST, New Delhi Rs. 6.35 lakhs 3 years	Dr. C. P. Vendhan/ Sri S. K. Bhattacharya Sri V. Ananthasubramanian
10.	Geochemistry of Saline soils of Ennore coastal tract and its impact on environmental projects	MEF 2.55 lakhs 2 years	Dr. SP. Subramanian

#### 4. Major Consultancy Assignments :

Total value of all consultancy projects taken up during the year upto Feb. 1989 : Rs. 26.1 lakhs

<i>Name of the faculty</i>	<i>Name of the firm</i>	<i>Title of the Consultancy</i>
Sri V. Ananthasubramanian/ Sri S. Meenakshisundaram/ Sri R. Natarajan Sri R. Natarajan	Cochin Shipyard Ltd.  Sese Goa Ltd.	Resistance and propulsion Tests for passenger Launch  Resistance and Propulsion Tests for pusher Tug
Dr. C. P. Vendhan/ Dr. R. Palaninathan/ Sri S. K. Bhattacharyya Sri S. K. Bhattacharya/ Prof. C. Ganapathy/ Dr. C. P. Vendhan/ Dr. V. G. Idichandy Prof. C. Ganapathy/ Dr. R. Sundaravadivelu Prof. C. Ganapathy/ Dr. R. Sundaravadivelu/ Dr. V. G. Idichandy Dr. K. Ganesh Babu	ISRO  SHAR  Gopalpu Port Project  Fidelity Containers  TEAM  Madras Port Trust	Static dynamic and buckling analysis of stage 4 of PSLV  Preliminary studies of recovery of GSLV booster  Design of Fishin Harbour at Kasaphal Kassphal  Analysis of load transfer  Design, Development & Evaluation of a self rectifying CP system  Development of construction and repair materials for MPT
Dr. K. Ganesh Babu  Dr. V. G. Idichandy/ Prof. M. Ravindran Dr. V. G. Idichandy/ Prof. V. S. Raju Dr. K. Muthukrishnaiah	K. C. P. Ltd.  NLC, Neiveli  Cochin Refineries Ltd. SIPCOT L & T L d. (ECC) T A Sugars Ltd. I T C Ltd. TTD, Tirupati ONGC Gandhigram Trust Goa Shipyard	Volumetric and Residual stretch measures and analysis  Ground vibration measurements in the mine  Analysis and Recommendations of Foundations  Foundation problems at Tirupati Oil rig foundation slope stability Improvement in rural technical units Model investigation of tugs, passenger vessels Dev. of design of fishing vessels  Foundation consultancy-Subsurface
Dr. SP. Subramanian/ Prof. V. S. Raju Prof. V. S. Raju	NFLC, Kakibada Kakinada Hinustan Photo Films, Ooty	-do-
Prof. V. S. Raju/ Dr. C. P. Vendhan/ Dr. R. Sundaravadivelu	Mazagon Dock Ltd.	Development of software for analysis and design of jacket platforms

Dr. C P Vendhan/ Prof. C. Ganapathy	SPIC, Tuticotin	Rehabilitation of Ammonia cooling
Prof. V. S. Raju/ Dr. S. R. Gandhi	IFFCO, New Delhi	Foundation for Aonla Phase II Expansion programme for IFFCO
Prof. V. S. Raju/ Dr. R. Sundaravadivelu	Madras Port Trust	Analysis of design of Container berth
Prof. V. S. Raju/ Dr. S. R. Gandhi	Visagapatnam Port	Construction of Dry Dock at Visakha- patnam Fishing Harbour-Advice on Instrumentation and monitoring
Prof. V. S. Raju/ Dr. R. Sundaravadivelu	Through RITES	Foundation consultancy for Addl. Barges Berths for Mormugao Port.

**5. Assistance to Sister Institutions :**

**A. Continuing Education Programme :**

Serving Teachers Programme		
No. on rolls	: Ph.D.	5
Serving Officers Programme		
No. on rolls (Sponsored)	: M.S.	2
Serving Officers Programme		
No. on rolls	: Ph.D.	4
User Oriented M.Tech. (Post Graduate Programme)	: M. Tech.	7

**B. Title of Ph.D(QIP)**

Strength behaviour of a Marine clay subjected to Repetitive loading.

**6. Papers Presented at Conferences :**

1. V. G. Idichandy and C. Ganapathy, International Conference on Tech. Diagnostics, Sep. 15-1988, Shenyang, China.
2. C. P. Vendhan and C Ganapathy, Dynamic response of Offshore Structures, National Workshop on Wave Studies and Application, CESS, Cachin, December 1988
3. K. Ganesh Babu, P. V. S. N. Raju, K. V. Rao and D. Sundaram, Resistivity Behaviour of the Concrete Secon NCP International Seminar New Delhi, Jan.-Feb. 1989.
4. Wave basin at Ocean Engineering Centre, IIT Madras 'A comparative Sfdy with similar facilities Workshop on Ship Hydrodynamic and rest facilities 28-29, November 1988, Visakhapatnam C-2 - C-10.
5. D. Sen and Pawlowski, J. S. 'Simulation of unsteady propation of steep waves by boundary element Method' 7th Int. OMAE Conf. Vol. 2, pp 181-190, 1988.
6. Lever J.H., Sen, D. and Attwood, D., 'The influence of shape on Iceberg induced Wave Studies,' 7th Int. OMAE Conf. Vol. 4, pp. 125-132, 1988.
7. Sen, D. and Pawlowski, J.S, 'Two dimensional Modelling of large motions of Floating Bodies in steep waves', 3rd Int Workshop on Waterwave, Floating Bodies, MIT, 1988.
8. K. Muthukrishnaiah, 'Problems of shallow Foundations in Highly Plastic clay with high sulphate Groundwater - A Case Study Proc. Seminar on Concrete in Foundation Systems, December 1988.
9. D. Srinivasan, T. V. Ramana Murthy and R. Mahadevan, 'Inverse Problem in Ocean Acoustic Tomography Studies, National Symposium-cum-Workshop on Adv. in Imaging and Image Processing, December 1988, Bombay SI 5.1 to 5.3.

10. S. Narasimha Rao, V. S. Raju and N. Sankar (1988), 'Studies on the strength Behaviour of an Indian Marine Clay,' Indian Geotechnical Conf. Allahabad, December 1988.
11. S. Narasimha Rao, C. V. Prasad and M. A. M. Sakr (1988), 'Experiences with the Behaviour of underreamed piles in the Coastal regims of India, IGC, Allahabad, December 1988.
12. M. R. Pranesh and K. Siva Prasad, 'Stress distribution in soil medium due to dynamic loads', Proc. IGC 1988, Allahabad, December 15-17, Vol. I, pp 291-295.
13. V. S. Raju and S. R. Gandhi, 'Foundation Problems on soft clay for a Fertilizer Plant', Int. Conf. on Regional soils, August 11-15-1988.
14. V. S. Raju, M. Ravindran, K. Ganesh Babu and V. C. Baby, 'Sea Trial of 150 KW multi purpose Wave Energy System off Trivandrum, Seminar on 'Alternative Sources of Energy for Kerala by KSEB, Ernakulam 20th and 21st June 1988.
15. R. Ramasamy, SP. Subramanian and K. Shepherd. 'Fluid Inclusion Studies in Cast Iron Slags', Seminar on Industrial Minerals in National Economy, Madras 25, Dec. 14-16, 1988.
16. R. Ramasamy, SP. Subramanian and K. Shepherd, 'Microscopic Investigation of saline Minerals extracted from Alkaline Soils and Brine collected from Ennore Area, Madras City', Seminar on Industrial Minerals in National Economy, Madras 25, Dec. 14-16, 1988.
17. R. Ramasamy, SP. Subramanian and K. Shepherd, 'Experimental Studies on Scientific Designing of Salt-Pan', Seminar on Industrial Minerals in National Economy, Madras 25, Dec. 14-16, 1988.
18. R. Ramasamy, SP. Subramanian, K. Shepherd and R. Ashokkumar, 'Mineral Processing of Sands from the Coastal Tracts of Ennore Marakanam Areas of Tamil Nadu', Seminar on Industrial Minerals in National Economy, Madras 25, Dec. 14-15, 1988.
19. R. Ramasamy, SP. Subramanian, K. Shepherd and R. Ashokkumar, 'Foundry Sand-Characterization', Seminar on Industrial Minerals in National Economy, Madras 25, Dec. 14-16, 1988.
20. K. Usha, SP. Subramanian and S. M. Ramasamy, 'Fracture Pattern Modelling for Groundwater Targetting in Hard Rock Terrain - A Study aided by Remote Sensing Technique', International Workshop on Appropriate Methodologies for Development and Management of Groundwater Resources in Developing Countries, IGW-89, Feb. 28-Mar. 4, 1989, National Geophysical Research Institute, Hyderabad, India.
21. M. Ravindran, G. Swaminathan and P. M. Koola, 'Model Studies for the Sea Trial of a 150 KW Wave Energy System', paper presented in the Conference on Offshore Mechanics and Arctic Engineering organised by American Society of Mechanical Engineers, OMAE Divn., Hauge, March 19-23, 1989.
22. S. Neelamani and V. Sundar, Wave Induced Pressure distribution around a vertical Cylinder'. Proc. First Carrebean Conf. in Fluid Dynamics, Trinidad, West Indies, Feb. 8-11, 1989, pp 112-120.
23. Ananth P. N. and Sundar V., 'Sediment transport rate and its distribution across the Surf zone off Paradeep Port, India', proc. First Carrbbean Conf. in Fluid Dynamic, 8-11, 1989, pp 306-313.
24. Anand P. N. and Sundar V., 'Wave diffraction through Breakwater gaps', P roc. Conf. on Coastal Zone Management, Cochin, Feb. 21-23, 1989.

## II. Research Publications

1. S. K. Bhattacharyya and C. P. Vendhan, Similitude Analysis of Bending of Stiffened Plates, *International Journal of Structures*, Vol. 1, No. 2, pp 95-105, 1988.
2. V. S. Raju and S. R. Gandhi, 'Foundation Problems on soft clay for a fertiliser plant' *International Conference on Engineering Problems on regional soils, China Academic of Railway Science, Beijing, August 11-15, 1988.*
3. S. R. Gandhi, P. K. Suresh and V. S. Raju, 'Lateral Load tests on Large Diameter Bored Pile and Analysis' *Indian Geotechnical Conference Allahabad, Vol. 1 pp 373-377.*
4. R. Sundaravadivelu, M. Hariharan, C. Ganapathy - Formulas for variation of Stress Concentration around intersection in Tubular joints. *Journal of Energy Resources Technology* published by American Society of Mech. Engg. Vol. 110, pages 237-245, December 1988.
5. M. R. Pranesh and J. S. Mani, Similitude Engineering - Ocean Structure interaction, *OEC Journal*, Vol. 15, pp 189-200, 1988.
6. Sen, D., Hanchey M. J. and Lever, J. H. 'Numerical Simulation of Unsteady Free Surface Motions Using an Integral Equation Formulation', *Journal of Ocean Engineering*, Vol. 15, No. 4, pp 291-304, 1988.
7. Lever, J. H. Attwood, D. and Sen, D. 'Factor affecting the Prediction of Wave Induced Iceberg Motion, *Journal of Cold Regions Science & Technology*, Vol 15, pp 177-190, 1988.
8. S. Narasimha Rao, and C. V. Prasad-Fabric Index in Polimineral Soils-Clays and clay Minerals.
9. M. Ravindran, S. Nilavalagan and H. C. Radhakrishna Analysis of Mixing Characteristics of Flow in a jet Pump using a finite-difference Method, *The Chemical Engineering Journal*, 39 (1988) 97-109.
10. K. Rajagopalan, 'Finite Element analysis of Ship Structures' *Ocean Science & Technology*, Vol I, July-Sept. 1988, pp 34-42.
11. P. R. Gopu and Dr. R. Sundaravadivelu, 'Analysis of Subsurface Buoy Systems', *Journal of Institute of Engineers (India)*, Vol. 68, Part MA 2, pp 22-25, May 1988.
12. K. G. S. Sarma, and V. Sundar, 'Analysis of Nearshore Profiles off Paradip Port, East Coast of India', *Indian Journal of Marine Sciences*, Vol. 17, June 1988, pp 94-98.
13. V. Sundar and P. N. Ananth, 'Wind Climate For Madras Harbour, India', *Jl. of Wind Engineering and Industrial Aerodynamics*, 31, 1988, pp 323-333.
14. V. Sundar, S. Neelamani and C. Ramachandran, 'Effect of a Base Structure on the Wave Forces and Pressures on a Vertical Cylinder, *Ocean Engineering*, Vol. 15, No. 4, 1988, pp 359-371.
15. M. R. Pranesh, 'Corrosion Control of Marine Concrete Structures, *Transactions of the SAEST*, Vol. 23, no. 2-3, pp 129-144, 1988.

## 12. National and International Conferences/Symposium Organised

International Training Programme on Management and Conservation of Marine Resources organised by the International Ocean Institute, at Ocean Engineering Centre, IIT Madras during Jan. 16th to February 17, 1989. Number of participants attended from Developing Countries, Canada etc. : 16.

### 13. Short Term Courses/Continuing Education Programmes Conducted

1. Dynamics of floating Bodies (PIP/CEP) Dec. 5-17/1988, Dr. C. P. Vendhan and Sri S. K. Bhattacharyya
2. Short term Course on 'Experimental Techniques in Ocean Engineering', 5-16, Dec. 1988 under QIP.
3. Short term Course on 'Design of Coastal Structures' March 14-19, 1988.
4. Short Term Course on 'Marine Structures', June 6-17, 1988 under QIP.

### 14. Awards and Honours

Prof. M. Ravindran - Awarded Certificate of Merit by Central Board of Irrigation and Power for the paper entitled 'Design and Performance of a pump Turbine for Tidal Power-1 & P Journal, Special Issue, 1987.

### 15. Professional Activities

(Chairing) Seminars etc. membership on Editorial Boards, Professional Societies etc.

1. Prof. C. Ganapathy — International Ship and Offshore Structures Committee, Correspondent for India 1988-1990
2. Prof M. R. Prenesh — Member, Executive Committee, IGC Madras Chapter Reviewer for Journal
3. Prof. V. S. Raju — Member, Ocean Science Tech. Board, Govt. of India, 1986-89  
Member of the Offshore - Installation Sectional Committee BDC 74.  
Member, Planning Commission Working Group for Dept. of Ocean Development for 8th Five Year Plan  
Prepared Theme paper on Coastal Engg. for DST Eighth Plan Thrust areas
4. Sri R. L. Roy Choudhury — Chairman of a Committee constituted by the Govt. of India to oversee the design of Ferro-cement Fishing vessels  
Member, MCPD 2:3 Inland Vessels Committee of the Bureau of Indian Standards

### 16. Invited Lectures

- i. By IIT faculty in other institutions : 1
- ii. By Distinguished Visitors to IIT : 8

### 17. Visitors to the Centre

1. Dr. S. N. Dwivedi  
Additional Secretary  
Department of Ocean Development  
Govt. of India  
New Delhi-110 003
2. Mr. J Elias  
Head, South Asian Section of Foreign  
Office,  
F R G, West Germany



3. Mr. Ritt Muller  
Consul  
Consulate of F R G  
Madras
4. Mr. M. R. Kolhatkar  
Adviser (Education)  
Union Planning Commission  
Govt. of India  
New Delhi

#### **18. Miscellaneous**

Faculty members from (a) Ocean Engineering Centre (b) Universities of F R G as well as BSHC, Varna, Bulgaria will be having Academic exchange programme under the German Assistance as well as UNIDO Assistance Programme.

#### **19. Future Plans**

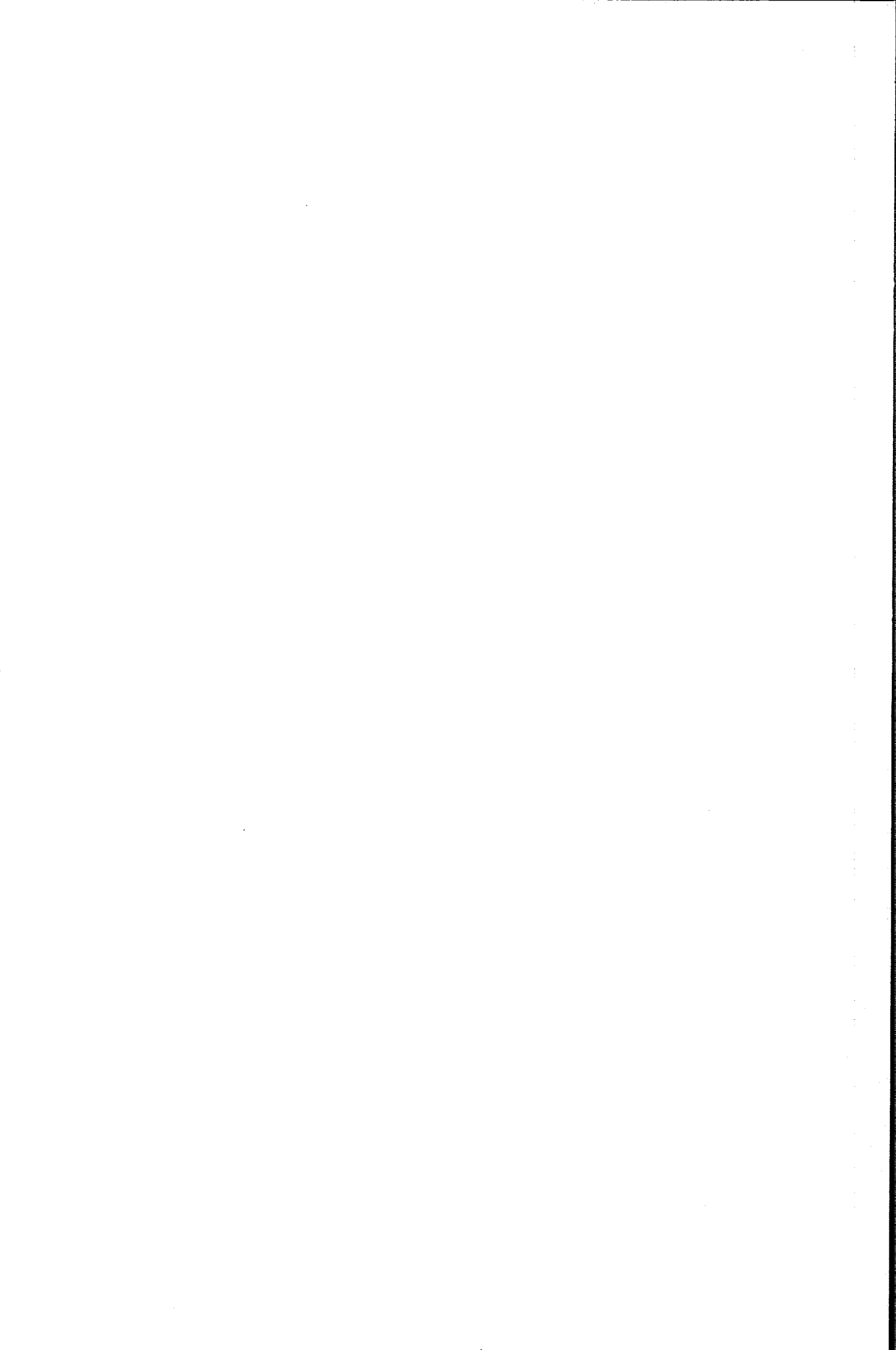
It has been contemplated to strengthen activities in the area of platform in deeper water as well as Ocean mining and dredging.

**SPECIAL FACILITIES FOR INTERACTION WITH  
OTHER INSTITUTIONS**

Central Electronics Centre

Centre for Industrial Consultancy & Sponsored Research

Regional Sophisticated Instrumentation Centre



# CENTRAL ELECTRONICS CENTRE

## 1. Introduction :

This Centre was established in 1971 to take care of maintenance of wide variety of Electronic Equipment available in the Institute. To facilitate this job, the need for conducting special training programmes in this field was felt and a professional training programme, the first of its kind in the Country was started in the same year. Since then, conducting such programmes has become one of the important activities of this Centre. After the training programmes, the technicians are engaged in all the departments of the Institute to take care of the Maintenance of Electronic Equipment. Because of the spurt in the number of sophisticated electronic equipment in various departments and number of sponsored projects, training programme has nowadays become compulsory.

The Centre also conducts Short term courses from time to time for the benefit of practising engineers and technicians from numerous industries.

The Centre is involved in conducting Electronics Laboratory Courses for M.Sc (Chemistry) students.

The Centre plays an active role in offering unstinted help to the research scholars of non-electrical departments in their Instrumentation work.

The PCB laboratory has been acquired by this Centre and has been serving effectively to the needs of the entire Institute. In the present Indo-German project provision has been made to modernise the PCB facilities.

Apart from the above activities, the Centre undertakes several assignments from industries. The assignments include servicing of electronic systems, measurement of physical parameters, development of electronic system/controller for various industrial applications and preparation of feasibility/technical reports for manufacturing electronic equipment.

With the already existing trainer kits, and with the help of modern training facilities that are received under Indo-German project, the Centre organises technical training programmes for the benefit of electronic technicians and service engineers.

Modern training facilities include latest trainer kits on various topics, sophisticated electronic measuring instruments and semiautomated diagnostic aids. New test and calibration standards that are being acquired updates the facilities for servicing and calibration of electronic equipment. Specially acquired video lessons, text books and manuals on various topics accelerate the process of learning.

## 2. New Courses introduced during the year :

<i>Course No.</i>	<i>Title</i>	<i>Offered to</i>	<i>Staff offering the course</i>
CY632	Electronics for chemists	I M.Sc (Chemistry)	M. Kumaravel

**3. New facilities added and Major items of equipment procured/fabricated :**

<i>S. No.</i>	<i>Description</i>
1.	Analog Trainer Kits
2.	Digital Trainer Kits
3.	Thyristor Trainer Kits
4.	Universal Trainer Kits
5.	PLC Trainer Kits
6.	Microprocessor Trainer Kits
7.	Troubleshooting Kits
8.	Precision Digital Multimeters
9.	Programmable Pulse/Function Generators
10.	Frequency Synthesizer
11.	Electronic Counter
12.	LCR Meters
13.	Distortion Measuring Set
14.	Calibration Standards
15.	Video Lessons

**4. Assistance to Students and Major Consultancy Assignments :**

**a. Assistance to Students :**

Fabrication and Calibration of Drilling Dynamometer  
Measurement of forces on centreless grinding  
Development of Ultrasonic Generator  
Development of Microbalance  
Development of Data Acquisition System  
  
Development of Electronic Sealing Unit.  
Harmonic Measurements on the furnace.  
Servicing of Harmonic Analyser.  
Servicing of Dynamic Balancing Machine.  
Development of Cuiz Controller Calibration of Current / Voltage Source.  
Servicing of PID controller.

**5. Assistance to Sister Institutions :**

- (i) Assistance is being rendered in setting up Printed Circuit Board Laboratory at REC, Warangal.
- (ii) Participated in the Science Fair for Rural Development & Demonstration of Trainer Kits for Science Teachers, organised by CECRI at Karaikudi.

**6. Books & Monographs brought out : Laboratory Manuals for Training Programmes**

**7. Short term Courses/Continuing Education Programmes conducted :**

- (i) Apprentice Training Programme for Technicians 23-04-87 to 31-03-89
- (ii) Two weeks Refresher Course for Service Technicians 16-12-88 to 30-12-88  
in Electronics Instrumentation

**8. Visitors to the Centre :**

Dr. Ing. Karl Heinz Georgi visited as Short Term Expert in July-August 1988 under Indo-German Project.

**9. Staff matters :**

Shri. T. N. Ranganathan attended the two weeks Course on Executive Development Programme on Managerial skills for Technical Personnel.

**10. Miscellaneous :**

- (i) Zopp seminars were conducted under Indo-German Project.
- (ii) CEC User's Committee was formed.

**11. Future plans :**

Centre plans to organise the Apprentice Training Programmes for Service Personnel as a regular feature as part of Indo-German Project and to modernise the servicing and training facilities.

## CENTRE FOR INDUSTRIAL CONSULTANCY & SPONSORED RESEARCH

During the year 1988-89 the following programmes were taken up by the Centre for IC & SR.

- 1) **Consultancy :**  
The value of consultancy assignments increased from Rs. 83 lakhs to Rs. 87 lakhs. The Institute introduced a new type of consultancy called "Research Based Industrial Consultancy". This it is hoped would facilitate encouraging development oriented consultancy activities at the Institute.
- 2) **Sponsored Research :**  
The sponsored research activity increased several fold, as could be seen in the value of the projects sanctioned, from Rs. 278 lakhs in 1987-88 to Rs. 585 lakhs during 1988-89.
- 3) **New Plan Schemes :**  
The major schemes sanctioned earlier continued during the year. A number of new schemes were also funded by the Ministry of Human Resource Development taking the total number of such schemes at IIT to more than 20.
- 4) **ISRO-IIT(M) Cell :**  
The Space Technology Cell Programme at IIT, supported by ISRO continued during the year. Eight new projects of relevance to ISRO were approved and four short term courses were conducted under this programme.
- 5) **Collaborative Research Programme :**  
The Indo-German Research Programme in the areas of catalysis, materials science, electronics and production engineering were continued during the year.
- 6) **Industrial Associateship Scheme :**  
This scheme introduced during 1987 has received continued support from industry. The membership increased to 111 during 1988 and has reached 129 as on 31st March 1989. Six technology appreciation programmes were organised during the year. Also a new publication "NEWSTECH", to be circulated to the Associates of IIT was released in January 1989.
- 7) **Entrepreneurship Development Programme :**  
Three of the candidates admitted to this programme completed the requirements of IIT and are eligible for the award of M.S. (Entrepreneurship degree). Six of the candidates, including the above, have started their own industries.
- 8) **Two patent applications were filed during the year and four patents were received by the Institute.**

# REGIONAL SOPHISTICATED INSTRUMENTATION CENTRE

## 1. Introduction :

The Regional Sophisticated Instrumentation Centre (RSIC), was established in IIT/Madras in 1974 by the Department of Science and Technology, Government of India. The objectives of the centre are to provide analytical and investigative spectroscopic and allied services to scientists from the Southern Region in sophisticated electronic equipment. RSIC, Madras was the first of a series of such centres established in DST, the others being at IIT, Bombay, CDRI, Lucknow, Bose Institute, Calcutta, Nagpur University, NEHU, Shillong, Punjab University, Chandigarh. RSIC, Madras has been concentrating on spectroscopic instrumentation in general, besides facilities for SEM, XRD, Mass spectrometry, etc. Although regional by nomenclature, scientists from the length and breadth of India are using our facilities regularly. Currently equipment worth nearly 4 crores are being maintained and a band of faculty, electronic and operations personnel man these equipment to provide service to scientists. Apart from managing the services to internal/external areas, RSIC faculty are involved in research in frontier areas of chemical physics including Magnetic Resonance spectroscopy (NMR/EPR), Magnetic susceptibility, IR/Raman spectroscopy, UV/VIS spectroscopy, ESCA, Mossbauer spectroscopy, Heat and Mass transfer, solute solvent interactions, molecular force fields, magnetic exchange interactions in condensed phase as well as three dimensional structure of molecules. The centre has 5 Faculty members and nearly 20 supporting staff.

## 2. Research & Development Activities

- a. Exchange interactions in low dimensional heisenberg magnetic systems
- b. Spin label studies in molecular conformation
- c. NM studies of 3D structure of Via Nuclear overhauser effect
- d. Phase transition in Nitrates and perchlorate crystals by Raman spectroscopy
- e. IR, Raman and theoretical studies of solute solvent interactions
- f. Heat conduction in one dimension and development of devices for temperature profile measurements
- g. Theoretical calculation of magnetic parameters and coherence transfer in NMR.

## 3. New facilities added/major items of equipment procured fabricated

- a. A 12 bit microprocessor based data acquisition system for instrumentation.
- b. Variable temperature controller for vibrating sample magnetometer from RT to 77K.
- c. An S-band (3000 MHR) accessory for the Existing X-Q Band spectrometer is under fabrication.
- d. A Canberra Mossbauer spectrometer with facilities to measure down to liquid helium temperature has been installed.
- e. An ARL Inductively Coupled Plasma Emission spectrometer has been installed.

## 4. (1) Sponsored projects completed during the year

S. No.	Title	Agency & Value	Coordinators
1.	Design and Development of Data Acquisition system for instrumentation	DST 1,24,000	S. P. Venkateshan & G. Palanisamy



5. (i) Sponsored Projects (Taken up during the year)

<i>Title</i>	<i>Agency / value</i>	<i>Coordinators</i>
(i) Matrix isolation IR/Raman spectroscopy IR Thermography	DST 4.2 lakhs	Dr. Surjit Singh Dr. S. P. Venkateshan Dr. Y. G. Srinivasan G. Palanisamy

(ii) Sponsored project (on going/completed during the year)

<i>Title</i>	<i>Agency/value</i>	<i>Coordinator</i>
(i) Matrix isolation	Volkswagen W. Germany DM 96,000	Dr. Surjit Singh & Dr. W. A. P. Luck (Marburg)
(ii) Monoradicals Biradicals ..... species	CSIR Rs. 3.00 lakhs	Dr. P. T. Manoharan
(iii) NMR Investigations on Structure and dynamics	DST 7.8 lakhs	Dr. S. Subramanian
(iv) Design and Development of Data Acquisition system for Instrumentation	DST 1.2 lakhs	Dr. S. P. Venkateshan G. Palanisamy

6. Assistance to students and Consultancy Assignments

Apart from guiding students for M.S /M.Sc. and Ph.D. Program the RSIC faculty are regularly involved in providing routine consultancy from sophisticated equipment to scientists from all over the country in Universities, National Labs. and Industry. Some of the special assignments undertaken during the current year are

<i>Faculty</i>	<i>Client</i>	<i>Consultancy work</i>
a. S. P. Venkateshan	ISRO Bangalore	VHRR cooler thermal analysis
b. P. T. Manoharan	American remedies Madras	determination of heavy elements
c. P. T. Manoharan	IEL Ltd Madras	Particle size by SEM

7. Assistance to sister institutions

Our engineers have helped in the trouble shooting of electronic equipment in sister institutions.

- (1) RSIC, Bombay-NMR spectrometer
- (2) Agarwal Eye Institute, Madras - IR Refractometer
- (3) Indian Radiators Limited - Leak detector
- (4) SPIC - Tuticurin - IR Spectrometer

## 8. Patent taken

U. S. Patent No. 4,762,425 on "System for temperature profile measurement in large furnaces and kilns and method therefore". (S. P. Venkateshan).

## 9. Papers presented at conferences

### a. International conferences

- (i) Raman Spectral studies on anion molecular interactions: K. Venkataramana and Surjit Singh for solutions of electrolytes in polar aprotic solvents. Proceedings of XI International Conference of Raman spectroscopy, Sept. 5-9, London (UK), 1988.
- (ii) K. Venkataramana and Surjit Singh. Resolution Enhancement of Raman Spectral bands by Fourier self deconvolution. Proceedings of International conference on Raman Spectroscopy and Raman Centenary celebrations, Nov. 2-6, 1988, Jadavpur, Calcutta.
- (iii) T. K. K. Srinivasan and T. Devanathan. Raman spectral studies on stepwise dehydration of  $Zn(BrO_3)_2 \cdot 6H_2O$ . XI International conference on Raman spectroscopy, Sept. 5-9, London (UK), 1988.
- (iv) T. K. K. Srinivasan and M. Mylrajan. Torsional Modes and phase transitions in alkyl substituted ammonium nitrates and perchlorates—IX International conference on Raman spectroscopy, London, Sept. (5-9), 1988.
- (v) T.K.K. Srinivasan and M. Mylrajan. IR reflectance studies and phase transactions in  $CH_3NH_2 \cdot ClO_4$ —IV International conference on infrared physics, Zurich, Aug. 1988.

### b. National Conferences

- (i) Surjit Singh. Raman spectroscopy and intermolecular interactions Raman Centenary celebrations — Oct. 28-29, Andhra University, Waltair, 1988.
- (ii) P. T. Manoharan. Exchange interactions in Metals dialkyl carbamates "Modern trends in Inorganic Chemistry", Madras 1988.
- (iii) T.K.K. Srinivasan. Time Resolved Raman spectroscopy, Raman Centenary celebration, IIT/Madras, 1988.
- (iv) S. Subramanian. Ring puckering in crown ethers by 2D NOESY. Review symposium on NMR, IISc, Bangalore, 1983.
- (v) S. Subramanian. Jahn-Teller effect in copper antipyrine complexes "Modern Trends in Inorganic Chemistry", Madras, 1988.
- (vi) Dr. S. P. Venkateshan. Real time modelling studies on repetitive NMR spectra. National symposium on current trends in process instrumentation and control, IGCAR, Kalpakkam, 1988.
- (vii) Dr. T.K.K. Srinivasan, Babu Varghese and T. Devanathan. Topotactic dehydration of hydrated metal bromates—symposium on Modern Trends in Inorganic chemistry, Madras, Jan. 1988.
- (viii) Dr. T.K.K. Srinivasan and T. Devanathan. Photoelectron spectra of some divalent metal bromates—Modern Trends in Inorganic Chemistry, Madras, Jan. 1988.

## 10 Papers published

<i>Authors</i>	<i>Title</i>	<i>Vol. &amp; issue no.</i>	<i>year</i>	<i>Pages</i>
N. Sreehari & P. T. Manoharan	Triplet state EPR studies of exchange coupled Cu(II) and Ag(II) pairs in Zn(II) bis (N, N-diisopyldithiocarbamate	Mol-phys 63	1988	18
A. P. Koley S. Purohit S. Chosh L. Sreeramachandra Prasad & P. T. Manoharan	Studies on gold(II) complexes with o-amino-benzen ethiol	J. Chem. Soc. Dalton Trans. 2607	1988	7
S. Lalitha G. V. R. Rao & P. T. Manoharan	Spectroscopic investigation of Intermolecular Interactions in Dithiolate Complexes of Nickel	Inorg. Chem 27	1988	7
S. Venkatachalama, K. V. C. Rao & P. T. Manoharan	Electrically conductive nickel-phthalocyanine polymer	Synthetic Metals	1983	10
M. C. Shivaglal R. Brakaspathy & Surjit Singh	Effect of Cooperativity on the O-H stretching force constant in associated water species	Proc. Ind. Acad. Sci. (Chem. Sci.) 100, 413	1988	
R. Brakaspathy Surjit Singh	Studies on self association of nitromethane using CNDO/Force method	J. Mol. Struct (Theochem.) (164) 319	1988	
K. Venkataramana Surjit Singh	Raman spectral studies in solutions of lithium bromide in binary mixtures of water and acetonitril in C-H and C-H stretching regions.	Spectrochim Acta 44A, 277	1988	
S. P. Venkateshan & O. Sokiappan	Approximate solution of non-linear transient heat conduction in one demension Journal: Warme and Stoffubertragung	23(4)	1988	5
T. Devanathan & T. K. K. Srinivasan	Raman Spectra of Single Crystal Cd(BrO <sub>3</sub> ) 2H <sub>2</sub> O and Polycrystalline Cd (BrO <sub>3</sub> ) <sub>2</sub> 2D <sub>2</sub> O.	J. Solid. State. Chem. 74, 88	1988	
M. Mylrajan T. K. K. Srinivasan	Vibrational Studies of Phase transition in (CH <sub>3</sub> ) <sub>3</sub> NNO <sub>3</sub>	J. Phys. C. Solid State Phys, 21, 1673	1988	
T. K. K. Srinivasan	Raman and infrared spectra of phase transitions in (CH <sub>3</sub> ) <sub>3</sub> NHClO <sub>4</sub>	Spectrochim Acta, 44A, 485	1988	

Authors	Title	Vol. & issue no.	year	Pages
M. Mylrajan and T. K. K. Srinivasan	Raman and infrared of structural phase transitions in $(\text{CH}_3)_2\text{NH}_2\text{NO}_2$	J. Phys. and Chem. Solid., 49,929	1988	
M. Mylrajan T. K. K. Srinivasan	Vibrational studies of phase transition in $(\text{CN}_3)_3\text{NHNO}_2$ Structural phase transitions in $(\text{H}_2\text{NH}_2\text{CCH}_2\text{NH}_2)_2$	J. Chem. Phys, Phase transitions 12,285	1988 1988	9
S. V. Santhana Mariapapn S. Subramanian N. Chandrakumar K. R. Rajalakshmi & S. S. Sukumaran	Proton Relaxation Times in Cancer Diagnosis	Magnetic Resonance in medicine 8,		

#### 11. National & International Conferences organized

(1) Modern Trends in Inorganic Chemistry—Convener Dr. P. T. Manoharan (Jan. 1988).

#### 12. Short term course

Southern School on ESCA and its Applications  
Convener: P. T. Manoharan  
April 25-29, 1988

#### 13. Awards / Honours

- (1) Prof. P. T. Manoharan was awarded the Shanti Ranjan Palit award for Physical Sciences by Indian Association for Cultivation of Science, Jadavpur, Calcutta.
- (2) Prof. S. Subramanian was elected to the Fellowship of the Indian Academy of Sciences, Bangalore.
- (3) Dr. S. P. Venkateshan was awarded the NASA class I Technical brief award for his design of "Acoustic Temperature Profile Measurement System", 1988. The award consisted of a citation and a prize of US \$ 150.00

#### 14. Professional Activities

- a. Prof. P. T. Manoharan is a Member of the Editorial boards of Proceedings of the Indian Academy of Sciences, Bangalore.
- b. Prof. Surjit Singh is a Member, Board of Governor, PEC, Pondichery, Chairman, VMC/KV, IIT Madras  
Member, Research Adv. Com. IPCL, Baroda  
Member, Adv. Com. Chem., Dept. II Sc, Bangalore  
Member, Editorial Board, Proc. Ind. Acad. Sci. (Chem. Sci)  
Involved in various RSIC activities like procurement of new equipment, their maintenance and operation as well as coordination with users.

#### 15. Invited Lectures by RSIC Faculty

1. P. T. Manoharan
  - (1) Indian Chem. Soc. Jabalpur

- (2) ANJA college, Sivakasi
- (3) IACS, Jadavpur
- (4) ETA, Zurich
- (5) CNRS, Paris
- (6) Univ. of Florence, Italy
- (7) Univ. of Geneva, Geneva

2. Surjit Singh

- (1) Punjab Univ. Chandigar
- (2) IIT, Delhi
- (3) AM Jain College, Madras
- (4) INSA chapter, Madras
- (5) Jodhpur Univ. Jodhpur
- (6) Chem. Teachers Assn. Madras

3. S. Subramanian

- (1) Central Univ. Hyderabad
- (2) CLRI, Madras
- (3) RRL, Hyderabad
- (4) CCMB, Hyderabad
- (5) Vivekananda College, Madras
- (6) W. C. C., Madras
- (7) INSA Chapter, Madras
- (8) National Cancer Institute Bethesda, MD, USA
- (9) Lab of Chemical Physics NIH, Bethesda, MD, USA
- (10) Max Planck Institute for Polymer research Mainz, W. Germany

**By Visiting Faculty**

- a. Dr. Jefery R. Algar, NIH, Bethesda, USA
- b. Prof. Antony T. TU. Colorado State University Fort, Collins, U.S.A.
- c. Dr. Bruce Hudson, University of Oregon.
- d. Dr. Thomas G. Spiro, Princeton University, USA.
- e. Dr. Animesh Chakravorty, Indian Association for the Cultivation of Science, Jadavpur, Calcutta
- f. Dr. P. T. Narasimhan, IIT, Kanpur
- g. Dr. A. Gopalakrishna, International Heart, Lung and Blood Institute, National Institute of Health, USA

- h. Dr. D. H. Little, University of South Carolina, USA
- i. Dr. P. Raghunathan, I.I.T. Kanpur
- j. Dr. N. R. Nirmala, University of Michigan, USA
- k. Dr. R. Yamdagni, University of Calgary, Canada
- l. Prof. R. Dasari, MIT, USA
- m. Prof. K. D. Sen, University of Hyderabad

#### 16. Staff Matters

M. Mylrajan, STA has been given leave to do post-doctoral work at University of Oregon, USA

Two Pool Officers, Dr. T. P. Radhakrishnan and Dr. P. Sambasiva Rao have given Research Associate in 1988-89.

#### 17. Future plans

Expansion of spectroscopy investigations to molecular structure, conformation and dynamics, biomolecular, physics, time resolved Raman/EPR spectroscopy and Mossbauer spectroscopy of Iron-sulphur proteins. Flash photolysis and picosecond spectroscopy are envisaged.



**CENTRAL SERVICES FACILITIES**

Airconditioning Unit

Central Gas Supplies

Central Glass Blowing Section

Central Photographic Section





## CENTRAL GAS SUPPLIES UNIT

Activities of the Central Gas Supplies Unit are as follows.

To procure gases like Nitrogen, Oxygen, Argon etc. from suppliers and distribute to various departments, sections and centres.

"All the gases like Nitrogen, Oxygen, Argon, Hydrogen and Acetylene needed by the various departments and sections were procured and distributed by the Unit.

## CENTRAL GLASS BLOWING SECTION

The Central Glass Blowing Section represents the important infrastructural facility that enables the Section to cater to the needs of scientific glass blowing and design of glass equipment of this Institute since 1972. Being a Central facility, the Central Glass Blowing Section offers help in the design of new apparatus and fabrication of any complicated glass instruments needed for the R & D section of the various Departments/Workshops/Centre of this Institute. Not only CGBS meets the requirements of the in-house needs but also goes out of the way in helping the other Educational Institutions and Industries for fabricating the special glass and quartz items. Some times CGBS undertakes the precision glass-ware fabrication for Hospitals and Cancer Research Centre in and around Madras. This section works under the rules and regulations of the ICSR of this Institute.

This section has a range of modern equipments largely procured from the Federal Republic of Germany as a component of the collaborative programme between Federal Republic of Germany & IIT Madras. The Section is well equipped with a good number of precise glass apparatus, manufacturing equipments and tools. This Section has adequate facilities for Quartz work and has developed a high level expertise in this area. As part of the Industrial Consultancy programme this section has to its credit many specialised works carried only in Industries in recent years.

### 2. Research & Development Activities

The service regarding glass apparatus repair work and fabrication of precision glass instruments, sophisticated glass systems of this section is fully utilized by the Departments. This Centre is also procuring new tools to help in the fabrication of most sophisticated equipments for R & D of the department.

### 3. Professional activities

Sri. N.T. Kumarasamy, Technical Officer (—) Executive member of the Board of Indian Society of Scientific Glass Blowers.

Sri. A. G. Venugopal, S. T. A. Treasurer of Indian Society of Scientific Glass blowers.

### 4. Future Plans

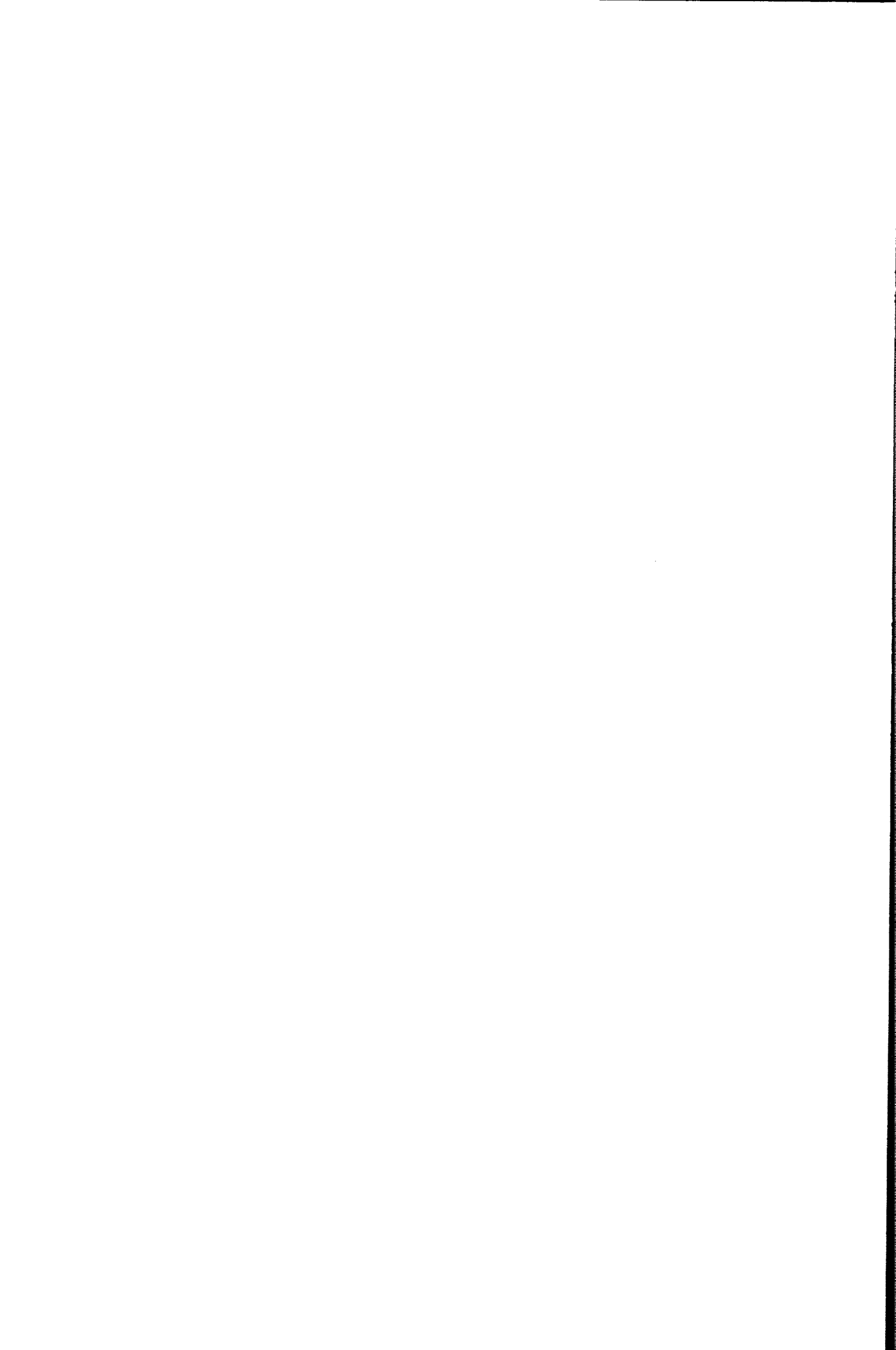
Construction of a separate building with safety precautions.

## CENTRAL PHOTOGRAPHIC SECTION

The Section with the staff strength of five experienced technical personnel caters to the need of various departments / centres of the Institute. It is mainly involved in Slide Preparations, Photo-taking of research activities of the faculty members and research workers. It also undertakes development, enlarging and printing and helps various IC and SR activities. It covers the different Institute functions such as Convocation, Sports-meet, Seminars, Symposia etc.

### **FUTURE PLAN :**

It is proposed to introduce Video facilities to assist the faculty in preparing Audio Visual programmes and Colour slide preparations.



## **DEPARTMENTS**

**Aerospace Engineering**

**Applied Mechanics**

**Chemical Engineering**

**Chemistry**

**Civil Engineering**

**Computer Science and Engineering**

**Electrical Engineering**

**Humanities and Social Sciences**

**Mathematics**

**Mechanical Engineering**

**Metallurgical Engineering**

**Physics**



## AEROSPACE ENGINEERING

### 1. Research and Development Activities :

The department is actively contributing its share of research/development for nation building. Sponsored projects which have relevance for industry/defence are continually being taken up and completed. The department also undertakes consultancy work, like the computational and experimental jet efflux studies on nozzles, successfully completed during 1988-89, for SAIL, Ranchi. Sponsored projects that improve basic understanding are also encouraged. These objectives many times underline the choice of the thesis topics for the various degrees. Following are the number of degrees awarded and papers published in Journals / presented in Conferences during the year.

B. Tech.	:	12
M. Tech. (Regular)	:	6
M. Tech. (A/C Production Engineering)	:	60
M.S.	:	2
Ph. D.	:	4
Papers published/presented	:	22

### 2. New Facilities added and major equipment procured/fabricated :

Vidispac System Complete, Scanivalve Accessories, Modern Laser Diffraction Particle — Analyser complete with computer printer and measurement cells, Hewlett Packard Laser Jet Series II printer, Hewlett Packard Scanner suitable for Laser Jet printer, Digital Strain Measuring System.

### 3. Sponsored Projects :

	Rs. Lakhs
i) Taken up during the year :	
1. A higher order theory of laminated composite shells under transverse loads — Dr. T. K. Varadan	[1988 — ] 3.21
2. Studies on supersonic combustion (Dr. K. A. Damodaran, Dr. V. Sreeramulu, Dr. U.S.P. Shet)	[1988 — ] 7.49
ii) Completed during the year :	
1. Wake boundary layer interaction on an airfoil (ARDB) (Dr. E. G. Tulapurkara and Dr. V. Ramjee)	[1984 — 88] 7.09
2. Development of low cost launcher (ARDB) (Dr. A. K. Sreekanth, Dr. S. Santhakumar and Mr. T. S. Chennabasavan)	[1982 — 88] 6.60
3. Theoretical and experimental investigations in rarified gas flows (Dr. A. K. Sreekanth)	[1985 — 88] 10.69
4. Numerical studies of rotating viscous flows past a body (DAE) (Dr. G. Subramanian)	[1986 — 89] 0.93

### 4. Assistance to Students and Major Consultancy Assignments :

<i>Name of faculty</i>	<i>Name of client</i>	<i>Title of consultancy work</i>
Dr. A. K. Sreekanth Dr. S. Santhakumar	SAIL, Ranchi	Jet Efflux Studies on Indian LD Nozzles



**5. Paper presented at Conference**  
(India and Overseas) :

<i>S. No.</i>	<i>Name of the faculty</i>	<i>Title of the paper presented &amp; authors</i>	<i>Name, Dates and venue of Conference</i>
1.	Dr. T. K. Varadan	Ritz finite element approach to nonlinear vibrations of laminated anisotropic plates Sarma, B. S. and Varadan, T. K.	Int. Conf. on Composite Materials and Struc., Jan. 1988, IIT Madras
2.	Dr. T. K. Varadan	Linear vibrations of isotropic laminated plates using field consistent triangular elements Ganapathy, M., Varadan, T.K. and Prathap, G.	Int. Conf. on Composite Materials, Struc, Jan. 1988, IIT Madras.
3.	Dr. A. Krishnan	Analysis of cantilevered laminates	Int. Conf. on Composite Materials & Struc., Jan. 6-9, 1988, IIT Madras
4.	Dr. A. K. Sreekanth	Design and development of a low cost launcher for subsonic aerodynamic testing A. K Sreekanth, S. Santhakumar and T. S. Chennabasavan	IV National Conf. on Aerodyn., Dec. 19-21, 1988, IIT Madras
5.	Dr. A. K. Sreekanth	Separated transonic interaction characteristics of an afterbody configuration in presence of a central propulsive jet Mathur, N. B. and A.K. Sreekanth	— do —
6.	Dr. Job Kurian	Untersuchung der reBbildung in flammen mittels laserlicht extinktion Job Kurian, M. Huth and W. Lenckel	Report of the 23rd International Seminar, Univ. of Karlsruhe, West Germany
7.	Dr. A. K. Sreekanth	Rarefied gas flow through rectangular tubes Sreekanth, A.K. and Davis Antonio	16th RGD Symposium, July 1988, Pasadena, California.

**6. Research publications :**

- \*\*1. Venkatakrishnaiah, T. and Damodaran, K A. 'Computerised Design of blade elements in Turbomachines' *Journal of Ae.S.I.* Vol. 41, No. 1, Feb. 1989.
- \*2. Job Kurian and Sreekanth, A. K , 'Shock tube study of vibrational relaxation in air' *Journal of Aero. Soc. of India* Vol. 40, No. 4., Nov.-Dec., 1988
- \*3. Subash Babu, Seetharamu, K.N. and Subramanian, G , 'Consistent penalty method in fluid mechanics' *J. Ae. S.I.* , 40(1). Nov. 19 8, pp. 247-253.
- \*\*4. Subramanian, G. and Balasubramanian, T.S., 'Effect of steps on the free vibration characteristics of short beams' *J. Ae. S.I.*, 41(1), Feb. 1989, pp. 71-74.

5. Gokhale, S.S. and Bose, T.K., 'Reacting solid particles in one-dimensional flow' Intern. J. Multiphase Flow, 1989.
6. Krishnan, A. and Shastry, C. G., 'Static analysis of beams on immovable supports' Int. J. of Mech. Engg. Education, Vol. 17, Jan. 1989, pp. 63-68.
7. Varadan, T.K., and Deshane Joseph 'Inelastic finite deflections of cantilever beams' J. Ae. S.I., 1988.
8. Sarma, B.S., and Varadan, T.K., 'Nonlinear panel flutter by finite element method' AIAA Journal, Vol. 26, No. 5, May 1988, pp. 566-574.
9. Tulapurkara, E. G., Ramjee, V. and Rajasekar, R. 'Experimental investigation of wake and boundary layer interaction' J. Ae.S.I. Vol. 40, No. 4, Nov.-Dec. 1988, pp. 297-300.
10. Tulapurkara, E.G., Gowda, B.H L and Balachandran, N., 'Laminar flow through slots' J. of Fluid Mechanics Vol. 190, 1989, pp. 179-200.
- \*11. Santhakumar, S., 'Transonic flow over a single wedge' J. Ae.S.I., 40(4), Nov.-Dec. 1988, pp. 293-296.
12. Sarma, B.S., Varadan, T.K. and Prathap, G., 'On various formulations of large amplitude free vibrations of beams' Computers and Structures, Vol. 29, No. 6, pp. 959-966, 1988.
13. Bose, T.K., 'One—dimensional analysis of wall region for multiple temperature organ plasma' Chem. Engg. and Plasma Processing, 1989
14. Bose, T K , 'Plasma in Manufacturing and processing' Inst. of Engrs. J. (India) Vol. 68, (AE) March, 1988 pp. 1-4.
15. G. Joseph, T. K. Bose, B. S. Pillai 'Three-dimensional thermal response analysis of a weld material' J. Ae.S.I., Vol. 41, No. 1, Feb. 1989, pp. 33-37.

\* Also presented at the IV National Conference on Aerodynamics, 1988 IIT Madras.

\*\* Also presented at the 40th AGM of AESI, 1988, IIT Madras.

#### 7. Books & Monographs brought out :

1. Computational Fluid Dynamics - Dr. T. K. Bose, Mechanical Engineering Monograph Series, IIT Madras 1984 — Wiley (I Edition) 1988, (II Edition) 1989.
2. Advances in Aerospace Structures and Allied Fields — Pandalai's 60th Anniversary Volume — Edited by Dr. T.K. Varadan, 1988.
3. Proceedings of the International Conference on Composite Materials and Structures — Edited by Dr. K. A. V. Pandalai and S.K. Malhotra, IIT Madras, 1988.

#### Lecture Notes :

1. Lecture notes on Solid Rocket Propulsion - compiled by Prof. S. Krishnan IIT Madras and Dr. Rajaram Nagappa, ISRO, Tvm., Sept. 1988.

8. National & International Conferences/Symposium organised :  
40th Annual General Meeting of Aeronautical Society of India 19 - 21, December 1988.

#### 9. Short Term courses/Continuing Education Programme :

- Short Term courses on "Solid Rocket Propulsion" 12-23, September 1988, for the Scientists and Engineers of ISRO and Defence Laboratories - Prof. S. Krishnan.

#### 10. Professional activities :

Most members of the staff of our department are members of the Aeronautical Society - a few of them are Members of AIAA, SEM, BSSM, etc. Many of them participated and also Chaired the Technical Sessions of the 40th Annual General Meeting of Aero. Soc. of India held during 19 - 21, December, 1988 under the auspices of the Department and the Society.

Also, during this year in August 1988, the students of the department revived the "Aerospace Association" and many films in various fields of interest to Aerospace community were screened.

#### 11. Invited Lectures :

'Recent Developments in Transonic Flow' by Dr S. Santhakumar Aeronautical Association-MIT Madras-44.

#### 12. Visitors to the Department / Centres :

Professor C. J. Cremers, University of Kentucky, USA visited this department during Winter 1988.

#### 13. Staff matters :

1. Dr. Joh Kurian, Senior Scientific Officer, visited West Germany under DAAD Scholarship to work on Laser Light Extinction Method for measuring small particle concentration in "Gas Flows" at Engler Bunte Institute at the University of Karlsruhe, West Germany during 1988.
2. Dr. E. G. Tulapurkara is in Australia since 4-5-1988 for a year in the University of New Castle on Research Fellowship.
3. Dr. Ing. T. K. Bose visited University of Kentucky, USA during Summer 1988 in connection with NSF (USA) project titled "Heat Transfer in ARC Welding" awarded by the National Science Foundation of USA involving the University of Kentucky USA and IIT Madras.

#### 14. Miscellaneous :

1. Number of NASA Reports are available in the Departmental Library and action has been initiated to classify the publications. It is also understood that nowhere these report are available.
2. Flight Training Programme at IIT Kanpur - 10 final year B Tech students of this department had participated and benefitted during November - December 1988.

#### 15. Future plans :

The Department has got several R & D projects from the various Defence Organisations/Laboratories in India. The main thrust of these projects is to supplement the national effort in its Defence activities. Besides improving and updating the research activities, it is also aimed at improving the self-sufficiency of the country in the specified areas of research.

## APPLIED MECHANICS

### 1. Research & Development Activities :

1. Theoretical and experimental study of flow past rough and smooth cylinders of different cross-section.
2. Aerodynamics of buses and lardbore vehicles.
3. Theoretical and experimental study of the aerodynamics of wind mills.
4. Study of Flow through cyclone separators and synamic Separators.
5. Studies on Wind energy Systems.
6. Design Analysis and Evaluation of a New Modular polycentric above knee prosthesis.
7. Image processing applications in Food Pressure Measurements.
8. Structures and Functioning of Erythrocytes in Hypercholesterolemia.
9. Ultrasonic characterisation of biological tissues.
10. Study flow characteristics in models of arterial stenoses.
11. Assessment of hand pressures in ncrmals and patients.
12. Static and dynamic analysis of Composite plates and shells.
13. Linear and nonlinear analysis of axisymmetric bimodules structures.
14. Development of software for Image processing in holography and photoelasticity.

### 2. New facilities added and Major items of equipment procured/facricated :

1. FFT Analyser
2. Image processing system
3. Carrier frequency analyser
4. A device for measurement of handgripping force
5. Two personal computers with RGP Monitor, CCD Camera.

### 3. Sponsored Projects (Taken up during the year) :

1. Volkswagenswerk Stiftung - Blade disk dynamics  
2 years - Value 77000 DM  
Co-ordinators : Dr. V. Ramamurthi, Dr. S. Swarnamani & Mrs. C. Sujatha
2. Homopolar Generator. BARC - Value Rs. 1.25 lakhs  
Co-ordinators : Dr. B. S. Prabhu, Dr. S. S. Yegnarayana
3. Reswitching transients and their effects on the design and operation of large induction motor drives for power station auxiliaries - sponsored by Central Board of Irrigation and Power, for two years - Value Rs. 7 lakhs  
Co-ordinator : Dr. S. Narayanan, Dr. S. S. Yegnarayana, Dr. G. Sridhara Rao,  
Dr. C. Venkateshaiah
4. Generation of aerodynamic data for blade section of wind blade sections of wind energy system - Value Rs. 5.2 lakhs - 2 years - Co-ordinators : Dr. N. V. C. Swamy,  
Dr. P. A. Aswathanarayana
5. Development Pump Turbine: Design and analysis of 'S' cambered profiles for fully reversible axial flow pump turbines - CBIP Rs. 3.2. lakhs - 3 yaers - Co-ordinators :  
Dr. H. C. Radhakrishna, Dr. V. Balabaskaran and Dr. P. A. Aswathanarayana
6. Studies around Three Dimensional Bluff Bodies Relevant to Building and environmental Aerodinamics - DST Rs. 3.5 lakhs - 3 1/2 years - Co-ordinators : Dr. B. H. L. Gowda and  
Dr. N. V. C. Swamy

7. Fluid Mechanical and Combustion Aspects of Interference Effects in Spray Combustion - ISRO Rs. 5 lakhs - 3 years - Co-ordinators : Dr. R. Natarajan and Dr. B. H. L. Gowda
8. Wake development in Longitudinally curved stream - ARDB Rs. 7.5 lakhs - 3 years- Dr. V. Ramjee, Dr. J. Lakshminarasimhan
9. 20 Kwh Vertical Axis wind Turbine - DNES Rs. 5 lakhs (with BHEL R and D Hyderabad) - Co-ordinator : Dr. N. V. C. Swamy
10. Three dimensional Thermal Stress Analysis of Horizontal flange joints of Industrial Steam Turbines - BHEL Rs. 133 lakhs - Co-ordinator : Dr. R. S. Alwar

**Sponsored Projects completed during the year :**

1. Influence of inhomogeneous magnetic field on the mobility of erythrocytes-CSIR Rs. 4 lakhs- Co-ordinators Dr. Megha Singh, and Dr. S. Swarnamani.

**4. Assistance to students and Major Consultancy Assignments ;**

<i>Name of the faculty</i>	<i>Name of the client</i>	<i>Title of consultancy work</i>
Dr. M. Balakrishnan Dr. R. S. Alwar	Ashok Leyland, Madras Triveni Engg. Works, Bangalore	Aerodynamic study of truck and bus bodies Thermal Stress analysis of Axisymmetric problems
Dr. R. S. Alwar	-do-	Theoretical analysis of thermal fatigue of turbine casing
-do-	ONGC, Madras	Dynamic testing of IPS. cardwell oil drilling rig at Godavari basin.
-do-	-do-	Computer analysis of IPS cardwell oil drilling rig.
Dr. J. Ramachandran	Metallic Bellows (P) Ltd., Madras.	Stress Analysis of Bellows.
Mr. G. Thomas	IGCAR., Kalpakkam	Natural frequency & mode shapes determination of PFBR roof slab model.
-do-	S & S Power Switch Gear Ltd., Madras	Fixing of Strain gauges and calibration of strain measuring equipments.

Apart from the above over 70 Projects at a total value of Rs. 7.25 lakhs are handled by the Machine Dynamics Laboratory.

**5. Assistance to Sister Institutions**

QIP Scholars :

M. Ananda Rao, Andhra University—Ph.D.—1988

K. S. R. nakrishnan, Kerala University—Ph.D.—1988

Given training to two Scientists from Gas Turbine Research Establishment, Bangalore in 'Experimental Stress Analysis Methods'.

6. Papers presented at Conference attended:

<i>S. No.</i>	<i>Name of the faculty member</i>	<i>Title</i>	<i>Name, Dates and venue of Conference</i>
1.	C. Unnikrishnan M. Balakrishnan P. S. Srinivasan	'A discrete vortex computation model for flow around amooth and rough cylinders at higher Reynolds number'	40th AGM and 4th National Conference on Aerodynamics. Dec., 88 IIT., Madras.
2.	J. Lakshminarasimhan and P. S. Srinivasan	'Prediction of Low speed flow development in diffusers with inlet velocity distortions'	-do-
3.	K. M. Patil I. Sailaja C. Eswaran, K.S. Rao	A Microcomputer based foot pressure measurements in Leprosy.	National Conference on Biomechanics IIT New Delhi 1988.
4.	K. M. Patil J. K. Chakroborty K. Janardhanam	A six-bar linkage mechanism above-knee prosthesis for walking and squatting.	-do-
5.	Megha Singh A. T. V. Ramesh	Tomographic analysis of erythrocyte distribution in capillary tube flow	Preparator meeting of Ind. Soc. Microcirculation, Bangalore.
6.	-do-	Clinical significance of erythrocyte deformability and blood viscosity in coronary risk factors.	International Symp. on Update of Med. and Surg. Madras. 1988
7.	Megha Singh E. Muralidharan	Influence of inhomogeneous magnetic field on mobility and aggregation of erythrocytes	International Conference on Biomechanics, New Delhi. 1988.
8.	S. Radhakrishnan M. Naga Ravindra	Biomechanical Assessment of Hand Strength	National Conference on biomechanics, IIT., Delh., Dec., 1988.
9.	S. Radhakrishnan M. Naga Ravindra	Assessment of hand Strength by Imaging	National Symposium on Advances in imaging and Image Processing, BARC., Bombay, Dec., 1988.
10.	R. S. Alwar	Cyclic Expenditure at Notcher in steam turbine rotors	International Conference on residual life of power plant equipment - prediction & extension Hyderabad. Jan., 89.
11.	J. Ramachandran	Thermal Buckling of Laminated composite shells	AGM of the Aeronautical Society of India, IIT., Madras. Dec. 1988.
12.	-do-	Flutter of Composite cylindrical shell.	ISTAM Congress, BHU., Varanasi. Dec. 1988.

<i>S. No.</i>	<i>Name of the faculty member</i>	<i>Title</i>	<i>Name, Dates and venue of Conference</i>
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#### HELD OVERSEAS

- |    |  |   |  |
|----|--|---|--|
| 1. | K. M. Patil  | Microcomputer based analysis of foot pressure in anaesthetic and deformed feet of leprosy patients. | 13th International Leprosy Congress 1981. The Hague, The Netherlands               |
| 2. | Megha Singh<br>B.H.L. Gowda and<br>B. Prakash              | Theoretical analysis of influence of shape and size of stenosis on steady flow through tubes        | International Symposium on Biofluid Mech. Rancho Mirage, U.S.A. 1988.              |
| 3. | Megha Singh<br>E. Muralidharan and<br>S. P. Kasthurirangam | Optical characterization of erythrocyte sedimentation and aggregation.                              | International Conference on C in aspects of the diabetes, Sydney, Australia, 1988. |

Apart from the above, the Department has published papers (Totalling 41) in the National and International conferences.

#### 7. Research Publications :

- 'Finite Element Analysis of Shell and turbine heat exchangers'. P.A. Aswathanarayana, S. G. Ravikumar, K. N. Seetharamu. Int. Communication in Heat and Mass Transfer, 15, 151-163, 1988.
- 'Complete smooth wall velocity profile in a turbulent boundary layer' — P.A. Aswathanarayana, G. V. Ramana — AIAA, 26, 748-751, 1988.
- 'Numerical prediction of boundary layer development in a two dimensional plane diffuser' — P. A. Aswathanarayana, V. Ganesan, K. Suzuki and N. V. C. Swamy — Journal of the Institute of Energy LXI, 192-200, 1988.
- 'Influence of Ground clearance on the forces on a three-dimensional bluff body' — B. H. Lakshmana Gowda — Journal of the I.I.Sc., Vol. 68, 1988, pp. 79-80.
- 'The characteristic decay region of a class of three-dimensional wall jets' — B. H. Lakshmana Gowda and G. Padmanabhan — Journal of the Aero. Soc. of India, Vol 40, No. 4, 1988, pp. 309-315.
- 'Generation of wind velocity profiles using grids' — B. H. L. Gowda — Journal of Structural Engineering, Vol. 14, No. 4, 1918, pp. 109-112.
- 'Interference effects on the flow-induced vibrations of a circular cylinder in side-by-side and staggered arrangement' — B. H. L. Gowda, K. P. Deshkulkarni — Journal of Sound Vibration, Vol. 122, No. 3, 1988, pp. 465-478.
- 'Laminar flow through slots' — E. G. Tulapurkara, D. H. Lakshmana Gowda, and N. Balachandran — Journal of Fluid Mechanics, Vol. 190, 1988, pp. 179-200.
- 'Drag reduction of non-circular cylinders' — B. N. Pamadi, G. Pereira, and B.H Lakshmana Gowda — AIAA Journal, Vol. 26, No. e, 1988, pp. 292-299.
- 'Jet impingement on a rotating sphere' — B. H. Lakshmana Gowda, M. V. Lakshmi Prakash — Fluid Dynamic Research, Vol. 4, 1988, pp. 205-213.

11. 'Prediction of Low Speed flow development in diffusers with inlet velocity distortions' — J. Lakshminarasimnan and P. S. Srinivasan — to be published in J1. of Aero. Soc. of India (April, 89).
12. 'Development of Airfoil wake in a longitudinally curved stream, V. Ramjee, E.G. Tulapurkara and R. Rajasekaran — AIAA, Aug., 88, Vol. 26, pp. 948-953.
13. 'Development of wake of a rectangular cylinder in a curved stream' — V. Ramjee and D. Neelakandan — Experiments in Fluids 1989.
14. 'Experimental Studies on Wind Turbine Rotors and Blades — V. Geethaguru, P. S. Srinivasan and N. V. C Swamy — Proceedings of the 16th National Conference on Fluid Mechanics and Fluid Power, 1988, pp. 205-209 — Ed. NL Kachara and A P. Verma, Tata McGraw-Hill.
15. 'Finite Element Analysis of Two Dimensional Steady Flow in Model Arterial' — K. M. Patil, K. Subbaraj — Journal of Biomechanics, 1988 — Vol. 21 and 3 pp. 219-233.
16. 'A Mathematical Model of Tractor-occupant system with a new seat suspension for minimization of vibration responses' K. M. Patil, M. S. Palanichamy — Journal of Applied Math. Modelling, U.S.A., Vol. 12, 63-71, 1988.
17. 'Kinematic analysis of knee-ankle Mechanism for an above knee prosthesis' — Chakroborty J. K. and Patil K.M. — Journal of Mechanics Research Communications, U.S.A. Vol. 15, No. 5, pp. 261-268, 1988.
18. 'Tractor-occupant vibration response and its minimization by a new seat suspension' — Patil K. M. — Journal of Mechanics Research Communications, U.S.A., Vol. 15, No. 6, 341-352, 1988.
19. 'Ultrasonic detection of tumor in bovine' — Journal of Acoust. Soc. India, 16, 14-19, 1988 — S. Swarnamani, Megha Singh, B. Murali Manohar and A. Sunder Raj.
20. 'Mechanism of erythrocyte aggregate formation in presence of magnetic field and dextran as analyzed by laser light scattering' E. Muralidharan and Megha Singh — Bioeology, 25, 237-244.
21. 'Influence of diabetes mellitus and myocardial infarction on erythrocyte sedimentation projects as determined by He-Ne laser light scanner' — E. Muralidharan and Megha Singh — Clin. Hemorheol, 8, 715-722, 1988.
22. 'Thermal Buckling of Composite Laminated Plates' — R. Karithangaratnam, R. Palaninathan and J. Ramachandran — Computers & Structures, USA, 1988.
23. 'Buckling of composite cylindrical shell' — R. Karithangaratnam, R. Palaninathan and J. Ramachandran — J1. of Aeronautical Soc. of India — Feb. 89.
24. 'Bending of circular plates supported at number of points' J. Ramachandran and C.G. Bhaskar Reddy — J1. of Engg. Mechs. Proc. ASCE, USA — Feb., 89.

#### 8. Books & Monographs brought out

1. Computer aided Design in Mechanical Engineering - V. Ramamurti - Tata Mograw Hill Publishing Co., New Delhi, Reprinted in 1988.
2. 'Update Medicine and Surgery' - Megha Singh, K. V. Thiruvengadam, K. Jagadeesan COASTED 1988.
3. 'Preparation of CCE module in Expremental Stress Analysis for the Ministry of Human Resources Development'.

#### 9. National & International Conferences/Symposium organised

40th AGM at IIT Madras between 15 to 21 December, 1988 with Aerospace Department.



#### 10. Short Term Courses/Continuing Education Programmes :

Prof. Megha Singh : On request from Defence Institute of Physiology, New Delhi conducted a short term course on Biomedical laser Technology.

#### 11. Awards and Honours :

Fellow - Indian National Academy of Engineering — Dr. B. V. A. Rao  
Gold Medal awarded by Institute of Engineers (India) for the best paper in Jan., 1989 - P. A. Aswathanarayana, H. C. Radhakrishna

#### 12. Professional activities :

1. President, Association of Machines & Mechanisms — Dr. B. V. A. Rao
2. National Secretary, Indian Institute of Plant Engineers — Dr. B. V. A. Rao
3. Editorial Advisor, Journal of Diagnostic Engg. U. K. — Dr. B. V. A. Rao
4. Member of Aerosociety of India & FMFP Societies — Dr. V. Ramjee
5. Chaired one session on Biomechanics in the National Conference on Biomechanics held at IIT Delhi during Dec., 1988 — Dr. K. M. Patil.
6. Fellow Royal Society of Medicine, England Vice President In. Soc. of Biomechanics Joint Secretary Ind. Soc. of Microcirculation — Dr. Megha Singh
7. Member Biomedical Engineering Society of India — Dr. S. Radhakrishnan  
Member of National Society of Biomechanics

#### 13. Invited Lectures: (By IIT Faculty in other institutions)

Dr. V. Ramjee - Lecture at Anna University - Effect of Turbulance in curved flows.

Given lectures at Brakes India Ltd., Madras during July, 1988.

Given lectures at CMERI, Durgapur during Dec., 1988.

(By Distinguished Visitors to IIT)

Prof. A. Husen, Chairman, Department of Anotomy, Leiden University, Leiden visited and gave lecture on Finite Element Modelling of human knee joint.

Dr. K. Munusamy, Memorial University of Newfoundland, St. Johns, Canada, on Experimental Fatigue Analysis of Tubular Joints' - Aug., 1988.

Prof. H. Aben Director, Institute for Cybernetics, USSR, on 'Optical Tensor field Tomography' - Jan., 1989.

Prof. Dr. Ing. K. H. Laermann, Bergische. Universitat, Federal Republic of Germany, on 'Current trend in Experimental Mechanics & Digital Fringel processing' - Feb., 89.

#### 14. Visitors to the Department :

Prof. N. C. Nigam, Director, Thaper Corporate R & D Centre, Patiala

Prof. A. Huson from Leiden University, visited Biomedical Engg., Division during March, 1989.

Dr. K. Munuswamy, Memorial University of Newfoundland, St. Johns, Canada

Prof. H. Aben, Director, Institute of Cybernetics, USSR

Prof. K. H. Laerman, Bergische Universitate, Federal Republic of Germany.

#### 15. Future Plans :

Cyclone tunnel, Flow visualisation tunnel - Dr. M. Balakrishnan

To carryout research in Foot pressure measurement in health and disease using image processing techniques - Dr. K. M. Patil

To carry out research in i/Blood flow anayisis, ii/ cardiac functional analysis by laser speckle interferometry - Dr. Megha Singh

To develop further research In 'Hand Pressure Measurements, Spinal deformities and correction and study of problem of Atherosclerosis - Dr. S. Radhakrishnan

It is proposed to create such facilities so as to make the Elasticity Division a centre of excellence in experimental stress analysis and computer aided design.

## CHEMICAL ENGINEERING

### 1. Research and Development Activities :

Existing facilities in the laboratories (1) Chemical Reaction Engineering including Thermodynamics (2) Process Control, (3) High Polymer Engineering, (4) Biochemical Engineering, (5) Transfer Operations, (6) Mechanical Operations are being actively put to use for M. Tech., M. S. and Ph. D Projects.

### 2. New facilities added and Major items of equipment procured :

- a. Rheovibron—Viscoelasticitymeter
- b. Thermogravimetric analyser
- c. U. V. Spectrophotometer
- d. High temperature fluidized Bed Furnace
- e. On-line computer control equipment
- f. Laser particle size analyser

### 3. Sponsored Projects : (Taken up during the year) :

S. No.	Title	Funding Agency	Value [Rs.in lakhs]	Period	Coordinator(s)
1	Development of Environmental Engg. Laboratory	Ministry of HRD HRD	Rs. 15.00	3 years	Dr. C. A. Sastry Dr. T. K. Ramanujam
2	Colour Removal from Industrial wastes	CSIR	3.00	2 years	Dr. C. A. Sastry
3	Mathematical modelling of the flow in transportation network system	IRDF (IITM)	—	1 year	Dr. T. Panda Dr. SM Majee Dr. SB Patnaik
4	Scaling up, synthesis of High Tc super conductors using fluidized bed reactor.	PMB [DST]	6.45	3 years	Dr. K Krishnaiah Dr. U. V. V. Raj Mr. K. D. Chandrasekaram
5	Research and Development of Halors	Shriram Fibres	0.75	3 years	D. K Krishnaiah Dr. C. N. Pillai Dr. M. Srinivasan

### 4. Assistance to students and Major Consultancy Assignments :

Two faculty members have acted as student counsellors.

Major Consultancy Assignments :

Name of Faculty	Name of Client	Title of Consultancy work
i. Dr. C. A. Sastry	M/s. Harihar Polyfibres M/s. Lakmi Starch M/s. SPIC	Retainer Consultancy
ii. Dr. M. Ramanujam and Dr. R. Vedaraman	M/s. Snam Abrasives M/s. National Council for Cement	Design of classifier for microgrids Electrostatic separation of lime stone
iii. Dr. Y. B. G. Varma	M/s. Hindustan Latex Ltd	Retainer Consultancy
iv. Dr. R. Vedaraman	M/s. Fuller KCP Ltd.	Bond's work Index

5. Assistance to Sister-Institutions :

1. Network programmes — Regional Engineering College, Tiruchirapalli  
Karnataka Regional Engineering College, Surathkal.  
Regional Engineering College, Warangal
2. QIP Scholars — Ph.D. — 2; M.Tech. — 2

6. Papers presented at Conference attended :

(a) Conference held in India:

1. P. Salam Rajendra Babu, T. Venkatram & M. Satyanarayana "Studies on Gelatinization and Dextrinization of Tapioco starch using Free and Immobilized  $\alpha$ -Amylase"
2. P. Salam Rajendra Babu, T. Venkatram & M. Satyanarayana "Integrated Ethanol Production from Tapioco Starch" Seminar on Application of Biotechnology for Agriculture and Rural Development Sept. 12-15 (1988) National Institute of Rural Development (NIRD) Rajendra Nagar, Hyderabad-500 020
3. Papers presented at the 41st IChE Conference Dec 16-19, 1988 at MS University Baroda  
P. Salam Rajendra Babu, T. Venkatram & M. Satyanarayana "Saccharification of Tapioco Starch using Cellulose linked Gluco Amylase"
5. R. Jayaram & Venkatram, Heat Transfer & Pressure drop characteristics of Extended Surfaces
6. P. S. R. Babu & T. Panda, Cellular Control Mechanism for the Biosynthesis of penicillin amidase in *E Coli* Proc. Seminar on "Application of Biotechnology for Agriculture and Rural Development" Hyderabad PP 116-135, 1988
7. J. Prakash and T. Panda, Bioconversion of condensed Truimin for VPA synthesis" Symp in Biotechnology relevance to Indinn Need: Seminar on "New Opportunites in Chemical Engineering The Institution of Engineers (India), Ranchi, 6th Nov. 1988 pp III 1-1 in III 1-2
8. P. S. R. Babu & T. Panda: Chemo- and Stereo Specificity in Penicillin amyase: Chemical Engineering Congress-1988 (I.Ch.E 41st Annual Session) M. S. University, Baroda, Dec. 1988 I.C.A. p. 19
9. Y. R. Reddy, P. S. R. Babu and T. Panda, Studies on a convenient Unique Method for the Estimation of Fungal Cell Mass in presence of Insoluble Substrate: Chemical Engineering Congress 1988 (I.I.Ch.E 41st Annual Session) M. S. University, Baroda, Dec. 1988, III C-3, P 82.
10. P. S. R. Babu & T. Panda: Studies on the Biosynthesis of Penicillin Amidase from *E Coli*: Dec 1988, Abt. In Proc. Symp on Recent Advances in Bioprocess Engineering BERG, IIT, Delhi
11. R. Annamalai, R. Sampath and K. Krishnaiah "Verification of the Design of a Shift Reactor Neyveli Fertilizer Plant Optimal Operion" Proc. of the Seminar on Fertiliser Industry Process Problems and Perspectives B.H.U. Varanasi, Jan 23 (1988) (p 195-203)
12. R. Nigan and K. Krishnaiah "Effect of Intraparticle Forced Convectoor on Effectiveness Factor in a Porous Catalyst" Catalytic, Concepts and Application, IX National Symp on Catalysis Pos 21-9 Madras 1988
13. D. V. S. Murthy and C. A. Sastry "Utilization of Fly Ash" National Seminar on Pollution Control measures in thermal power plants June 198g, NASIK ID, ID
14. A. A. Patel and D. V. S. Murthy "Studies in generation and characterization of aerosols" Dec. 1988, Baroda
15. S. K. Rakshit & V. Sahai "Optimal PH Control for production of Cellulose enzyme in a batch culture *Trichoderma Reesei* E-10 Symposium on Recent Advance in Bioprocess Engineering 20-21, Dec. 1988, New Delhi

16. S. K. Rakshit & V. Sahai, Modelling of Cellulose enzyme production using a meet cut of Indian Chemical Engineering Congress (IChE) Dec. 1988 Baroda p. 81
17. Chitra, S. K. Rakshit and A. Baradarajan "Transient modelling of a Biochemical reactor using a cell-Enzyme immobilised systems" IChE Dec. 1988 Baroda, p 16
18. International Conference on Mathematical Modelling, IIT, Madras Aug. 1988  
Systems approach for Modelling Natural Convection Phenomena: One Dimensional Systems, Part-II Mathematical Aspects, T. Gopichand
19. S. N. Pal, A. V. Ramani, N. Subramanian "Permanence of PVC-based polymer blends for Biomedical Applications" 4th International Meeting of Polymer Processing Society, Orlando, Florida USA, May. 1988
20. Jha R. K., and C. Chandra Prasad, "Simulation and Optimization of Cascade Control Systems" pp 25 Indian Chemical Engineering Congress, Sindri (1987)
21. Computer Process Control, a strategy 20 pp current Trends in Process Instruments and Control IChE, Kalpakkam on 26-78, 1988
22. T. V. Subramanyam and C. A. Sastry "Perfumery Wastewater treatment using Anaerobic filter" *Indian J. Env. Prot. Vol. 8 No. 4 April 1988*

**(b) Conferences in Overseas**

1. Studies on Coimmobilizate (amyloglucosidase and Yeast Celss) for Ethanol production N. Chitra & A. Baradarajan 10th International Conference on Biotech & Biochemical, Bombay, India, November, 1988
2. Partipated at the International Conference as Deligate of IIT, Madras Dr. G. S. Davies "First world Congress on Engineering Education and Technology at Khatmandu, Nepal Nov-13-15, 1988
3. S. N. Pal, A. V. Ramani, N. Subramanian "Performance of PVC based polymer blends intended for Biomedical Applicacions" 4th International Meeting of Polymer Processing Society, Orlando, Florida, USA, May, 1988

**7. Research Publications**

- (i) K. Krishniah & Y. B. G. Varma "A down-comer for Gas-solid multistage fluidized bed" *Indian Journal Technol*, Vol. 261 p. 265-268 (1988)
- (ii) S. Rajagopalan and D. V. S. Murthy, "Granulation of NK fertilisers" *Jl. of Institution of Engineers (Chem. Engg, Division)* 68 pp 46-9, Feb. 1988
- (iii) R. Chandrasekharan & T. Venkatram "Augumentation of Thermal Coefficients during the condensation of Organic Vapors on mild steel substrates, *Indian J, of Technol.* 26 (1) 41-44 (1988)
- (iv) P. S. J. Sai and Y. B. G. Varma, "Flow pattern of the phases and liquid saturation in Gas-liquid concurrent downflow through packed beds" *the Can. J. Engg.* 66 353 360 (1988)
- (v) K. Krishniah and Y. G. B. Varma "A downcomer for Gas-solid Multistage fluidised bed" *Indian J. of Technology* 26 265-268 (1988)
- (vi) A. Prabhakar, G. Srinikethan and Y. B. G. Varma, "Dispersed phase holdup and drop size distribution in pulsed plate columns" *The Can. J. Chem. Engg.* 66-232-240 (1988)
- (vii) Rechard H. Duncon and G. S. Davies "Alkylolation of IN INA Bases by caroinogenic-N-Nitrosamini metabolite - A Theoretical Study" *International Journal of Quantum Chemistry*, Vol. 35 1989 (No. of pages 13)

- (viii) U. V. Varadaraju, G. V. Subba Rao, K. D. Chandrasekaran & A. Baradarajan "Superconductivity behaviour of screen printed  $\text{YBa}_2\text{Cu}_3\text{O}_7$  ( $L_n = \text{Eu. Y}$ ) films Bulletin of Natl. Sc 10. 1263-1266 (1988)
- (ix) U. V. Varadaraju and G. V. Subba Rao, K. D. Chandrasekaran & A. Baradarajan Superconductivity behaviour in screen printed  $\text{YBa}_2\text{Cu}_3\text{C}_7$  film Thin Solid films-164 112-119 (1988)
- (x) C. A. Sastry and R. Namatchiammal, 'Effect of paper mill effluents on fish life" Indian J. Env. Prot. Voo. 8 No. 1 January 1988
- (xi) B. Velayutham and C. A. Sastry, "Application of Ion Exchange resine in various fields Indian Journal Inv. Prot. Vol. 8 No. 2. Feb. 1988
- (xii) Y. V. Subramanyam and C. A. Sastry, "Perfumary Wastewater treatment using anaerobic filter" Indian J. Env. Port. Vol. 8 No. 4, April 1988
- (xiii) C. A. Sastry, "Environment Pollution and development" Indian J. Envi. Prot. Vol. No. 5, May 1988
- (xiv) V. Vasudevan. J. P. Pradeep Kumar and C. A. Sastry "A Mathematical model for prediction of volatile acid formation from soluble substrates in the upflow anaerobic contact filter" Indian J. Env. Prot. Vol. 8 No. 6, June 1988
- (xv) P. V. Venkateswara Rao and C. A. Sastry, "Charging of sub-micron aerosol particles by Bi-polar-ions in electrostatic field" Indian J. Env. Prot. Vol. 5 No, 7, July, 1988
- (xvi) Promodkumar and C. A. Sastry, "Charging of aerosol particles by Unipolar Ions with an applied electric field" Indian J. Env. Prot. Vol. 8, No. 8, August, 1988
- (xvii) B. Velayudham and C. A. Sastry "Mathematical Model for perchlorate removal from waste water by ion-exchange" Indian J. Env. Prot. Vol. 8 No. 9, Sept. 1988

#### 8. Short Term Courses/Continuing Education Programmes :

- (a) Microbial Engineering, 23rd May to 4th June 1988

#### 9. Awards and Honours (Faculty/Students)

A Gold medal has been awarded to Prof. M. S. Ananth and Sunder Ramachandran for the best paper in Indian Institute of Metals (IIM) Transactions for the year 1987. The paper title is "A Simple two zone mathematical model of the inred process" Vol. 40 (5) pp 407-414 (1987)

#### 10. Professional Activities :

##### i) Prof. M. Satyanarayana

- a) Member, Reviewing Committee, IGCAR, Kalpakkam
- b) Member, Bureau of Indian Standards, Govt of India
- c) Expert Member, Central crisis group for chemical disasters, Department, Govt. of India

##### ii) Prof. Ch. Durgaprasada Rao

Chaired in a seminar on computer control, Indian Institute of Plant Engineering 14 and 15 December 1988, Hotel Connemara, Madras

##### iii) Prof. N. SUBRAMANIAN

- a. Member, Board of Studies in Chemical Engineering, Bharathi Dasan University, Continuing.
- b. Member, Board of Studies in Polymer Science and Rubber Tech., Cochin University of Science and Technology.
- c. Member, Organising Committee of the 3-day Seminar "Recent Trends in Instrumentation and Process Control"—IIChE Regional Centre, Kalpakkam.

- d. Member of the Committee of Ministry of HRD for the recognition of PG and other diploma courses conducted by CIPET.
- e. Expert Member in the Selection Committee for VSSC for promotion of their scientists.

**11. Invited Lectures :**

Dr. G. S. Davies: Gave 5 lectures on Corrosion Engineering to Executory of Gujarat State Fertilizer Corporation Ltd., Baroda.

Dr. K. Krishnaiah: A lecture was given in 'Advances in Biochemical Engineering', Summer School conducted in the Department on Fundamentals of Biochemical Reactor Design-I.'

Dr. T. Panda: Delivered invited lecture on 'Role of Biotechnology in agriculture & Food Sectors' at AIT, Bangkok, Thailand on 15 Nov. 1988.

**By Distinguished visitors to IIT :**

Prof. R. K. Gupta, Assoc. Professor, State University of New York, USA.

Dr. J. Raghuraman, Industrial Risk Management, Sydney, Australia

Prof. R. Angalino, Director of the French National School for Higher studies in Chemical Engg. in Toulouse, France.

**12. Visitors to the Department / Centre :**

Prof. Prof. P. H. T. UHLHERR from Monash University, Australia.

**13. Staff Matters :**

Dr T. Venkatram: Visited West Germany for 3 months (July - Oct. 1988) on DAAD Invitation Programme. Visited Technical Universities of Clausthal, Karlsruhe and stuttgart.

**14. Future Pians**

Grants have already been received in connection with the development of our Environmental Engineering Laboratory. Initiation is already there for making available necessary space for the same and procuring equipments.

Plans are there to start the P. G. M. Tech. Course in Environmental Engineering and Biochemical Engineering which are now part of Chemical Engineering course. It is also planned to increase the strengte of M. Tech. to operate all the sections (7) in the year (minimum only 5 out of them are being operated alternating Biochemical Engineering and Catalists and reactors and Environmental Engineering and Mineral Process Engineering.

Starting of a Centre of Process Synthesis and Equipment Development/Engineering Experimental Centre using the facilities available in the Transfer Operation Laboratory is also thought of.

## CHEMISTRY

### 1. Research & Development Activities

1. Advancement made in theory and application of valency concept. Development of a Local Density potential (Dr. M. S. Gopinathan)
2. Selective solvation of ions in mixed solvents, Organic electrochemistry and thermodynamic aspects of ion solvation (Dr. C. Kalidas)
3. Research in various aspects of Catalysis (Dr. J. C. Kuriacose)
4. Electrochemistry, electrochemical mechanism, photoelectrochemical studies and electrochemistry in molten amides. (Dr. R. Narayan)
5. Fundamental studies in Catalysis for the development of an FCC Catalyst R & D project sponsored by NRL, Development of Fluorobromocarbons, Research consultancy project with SRF and Retainer consultancy with M/s. Shasum Chemical P. Ltd. (Dr. C. N. Pillai)
6. Organic sulphur chemistry: Synthesis of several polythiopolycycles (A few of them identified as potential anti Aids and anti cancerous compounds. (Dr. S. R. Ramadas)
7. Trace analysis and monitoring and control of environmental pollution. (Dr. T.V. Ramakrishna)
8. Organic mass spectrometry and synthetic organic chemistry (Dr. D. V. Ramana)
9. Oscillatory chemical reactions, mechanistic aspects of the uncatalysed and catalysed bromate oscillator (Dr R. Ramaswamy)
10. Radiation catalysis and Radioisotope exchange studies (Dr. V. R. Satyanarayana Rao)
11. Substoichiometry (Dr M. S Subramanian)
12. Co-ordination chemistry of selenium and Tellurium (Dr. T. Subramanyam)
13. Inorg. heterocycles & Polymers, Nonmetal & Organometallic Chemistry  
(Dr. M. N. Sudheendra Rao)
14. Organometallics and homogeneous catalysis. (Dr. S Vancheesan)
15. Catalytic properties of heteropolyacids and their salts - decomposition of propan-2-ol, use of superconductors as catalyst - decomposition of propan-2-ol (Dr. T. K. Varadajan)
16. High Tech polymer synthesis (Dr. M. Srinivasan)
17. (i) Photocatalysis of CdS and H<sub>2</sub>S decomposition in CdS based FEC cells.  
(ii) Flashphotolysis studies - A new borate radical identified and studied.  
(Dr. V. Ramakrishnan)
18. (i) Spin-flip ESR transition and its relevance to lattice properties (ii) Fluidity of erythrocyte membrane as a function of cholesterol intake has been investigated; (iii) Calculation of exchange interactions indications in exchanged coupled dimers and the nature of variation of line intensities as a function of temperature in biradicals using Louiville density matrix theory (Dr. P. T. Manoharan)
19. (i) Fundamental reaction mechanism in the field of electrochemistry, (i) Electro adsorption & Electrochemical Kinetics and (iii) Large scale electrolysis leading to synthesis of new organic compounds (Dr. C. S. Venkatachalam)
20. Development of complex oxide catalysts for oxidation reaction and development of intermetallics for storage of hydrogen (Dr. V. Srinivasan)
21. Coordination chemistry, Solid State Chemistry (Dr. G. Aravamudan)

**2. New facilities added and Major items of equipment procured / fabricated.**

1. PC AT/386 with three terminals procured
2. BAS Electrochemical analyser
3. Ultrasonic interferometer
4. Hydrogen plant, Elemental analysis equipment and FT-IR spectrometer commissioned
5. Atomic Absorption spectrophotometer (Varrian)
6. Additional set up for homogeneous hydrogenation
7. G. C. and Haake viscometer
8. (i) Mossbauer spectrometer procured & installed  
(ii) Construction of low temperature (liq N<sub>2</sub> down to 96K) controller for the VSM nearing completion.
9. Biochemistry Lab designed & set up procured equipments for biochemical research high speed centrifuge Spectrophotometer.
10. New X-ray unit.

**3. i) Sponsored Projects: (Taken up during the year)**

<i>S. No.</i>	<i>Title</i>	<i>Funding Agency and Value</i>	<i>Period</i>	<i>Coordinator(s)</i>
1.	Preferential solvation of studies of some Gr. IIA and IIB metal salts in primary solvent mixtures	CSIR 2.0 lakhs	2 Yrs.	Dr. C. Kalidas
2.	Fundamental studies in catalysis preparation of an FCC catalyst.	MRL 25 lakhs	3 Yrs.	(Drs. B. Viswanathan, V. Srinivasan, C. N. Pillai, C. S. Swamy & J. C. Kuriacose)
3.	Preparation and investigation of Hydrogen storage Alloys for catalytic Hydrogenation	CSIR 0.9 lakhs	2 Yrs.	(Drs. V. Srinivasan, C. S. Swamy and C. N. Pillai)
4.	Preparation, Characterisation and catalytic reaction on complex metal oxides	CSIR 0.9 lakhs	2 Yrs.	(Drs. V. Srinivasan, C. S. Swamy and C. N. Pillai)
5.	Influence of ionising radiation on cracking of hydrocarbons adsorbed on oxide catalysts	CSIR 2.66 lakhs	2 Yrs.	Dr. V. R. S. Rao
6.	End capping of TD for HTPB resin	ISRO 6.53 lakhs	3 Yrs.	Dr. M. Srinivasan
7.	Migration of chemical ingredients in Rocket fuel grains	ISRO 4.53 lakhs	3 Yrs.	Dr. M. Srinivasan & Dr. S. Krishnan (Aero Space)



<i>S.No.</i>	<i>Title</i>	<i>Funding Agency and Value</i>	<i>Period</i>	<i>Coordinator(s)</i>
8.	Development of Halons R-22 as fire extinguisher	M/s. Shriram Fibres 0.75 lakhs	1 yr.	Drs. M. Srinivasan & C. N. Pillai
9.	Kinetics of methanation & biomethanation	DNES 10.75 lakhs	4 Yrs.	Drs. K. Lalitha & V. Mahadevan
10.	Development of agrochemicals	SPIC 8 86 lakhs	5 Yrs.	Dr. V. Srinivasan
11.	Studies on High Tc materials	DST 13.73 lakhs	3 Yrs.	Drs G.V. Subba Rao & G. Aravamudhan
12.	Production of hydrogen	DNES 13.98 lakhs	3 Yrs.	Drs. G.V. Subba Rao & G. Aravamudan

**6. ii) Sponsored projects completed during the year**

<i>S.No.</i>	<i>Title</i>	<i>Sponsoring Agency and Value</i>	<i>Coordinator(s)</i>
1.	A new technology for the synthesis of novel heterocycles as potential mole contraceptives	DST 4.09 lakhs	Drs. S. R. Ramadas & D. V. Ramana
2.	Influence of ionizing radiation on perovskite type solids and its role in catalysis	CSIR 0.27 lakh	Drs J. C. Kuriacose & V. R. S. Rao
3.	Cyclophosphathiazenes PS N chemistry	DST 3.68 lakhs	Drs. M N.N. Rao & G. Aravamudhan

**4. Assistance to Students and Major Consultancy Assignments**

<i>Name of Faculty</i>	<i>Name of client</i>	<i>Title of Consultancy work</i>
Dr. P. T. Manoharan	N. Venkatalakshmi Ph. D.	Structural and Magnetic studies of some novel metal dithiolene complexes.
	N. Shreehari Ph. D.	Magneto structural correlations in some Exchange coupled Transition Metal Dialkyl Dithiocarbomato Dimers.
	R. Bhavani M.Sc.	Exchange interactions in Exchange coupled Dimers.

**Consultancy**

1.	Determination of heavy elements	Americal Remedies	Rs. 5,000/-
2.	Particle size determination of pesticides	IEL Ltd Madras	Rs. 5,000/-
Drs. V. Srinivasan & C. S. Swamy	SPIC Tuticorin	Characterization of Catalysts	

## 5. Assistance to Sister Institutions

1. One QIP scholar working under Dr. M. S. Gopinathan
2. Development of software for the analysis of saturates and aromatics by mass spectrometry for Madras Refineries Ltd. (Dr. D. V. Ramana)
3. i) Has given series of lectures to ANJA College Sivakasi on Quantum Mechanics and Group Theory using UGC-COS program.  
ii) The computer programs developed in RSIC have been supplied free of charge to IACS Calicut. (Prof. P. T. Manoharan)
4. Gave lectures on Quantum Chemistry at Sathya Sai Institute of Higher learning Prasanthinagar. (Dr. V. Ramakrishnan)
5. Took part in DST sponsored contact programme for under privileged final year M.Sc. students of Southern India (Dr. M. N. S. Rao)

## 6. Papers presented at Conferences attended

S. No.	Name of faculty member	Title of paper presented & authors	Name, Dates and Venue of Conference
1.	Dr. M. S. Gopinathan	Chemical Valency	Magnetic & Theoretical Chemistry Kanpur 1988
2.	Dr. M. S. Gopinathan	Quantum theory and chemical valency	Annual Meeting of Indian Academy of Science, Calcutta 1988
3.	Dr. C. Kalidas	Recent developments in regard to pH scales in sea water environment	International seminar on Analytical Techniques in monitoring environment Tirupati 10-12 January '89.
4.	Mr. T. K. Sreekumar Dr. C. Kalidas	Solubilities and Gibbs transfer energies of some copper (II) salts in DMSO-water mixtures	3rd International symposium on solubility phenomene University of Surrey UK, 22-25 Aug. '89.
5.	Dr. J. C. Kuriacose	Catalysis concepts to Applications	IX Catalysis symposium Dec. 1988 Madras.
6.	Dr. V. Mahadevan	—	"
7.	Dr. V. R. Satyanarayana Rao	—	"
8.	Dr. V. Mahadevan Ms. J. Mathews & Ms. R. Xavier	Transition metal ions supported on hydrogels as catalysts for hydragenation	Annual Chemistry Symposium 4-5 March 1989 IIT, Madras.
9.	Dr. V. Mahadevan Ms. K. S. Ramah	Electroinitiated copolymerisation of a few vinyl monomers with acrylamide	Annual Chemistry Symposium 4-5 March 1989 IIT, Madras
10.	Dr. C. N. Pillai Mr. K. Ganesan	Alkylative decarboxylation reaction over Alumina	4th National workshop on catalysis IIT, Kharagpur 22 Jan. '88
11.	Dr. C. N. Pillai Mr. Y. V. S. N. Murthy	Oxygen Heterocycles of cage structures based on bicyclo (2.2.1) heptane	National conference on Heterocycles, Bharathidasan University, Tiruchi 23-25 March 1989.

<i>S. No.</i>	<i>Name of faculty member</i>	<i>Title of paper presented &amp; authors</i>	<i>Name, Dates and Venue of Conference</i>
12.	Dr. C. N. Pillai	Alkylation over oxide catalysts	9th National Symposium on Catalysis MRL Madras 15-17 Dec. '88.
13.	Dr. S. R. Ramadas Mr. B. Ramesh	A new approach towards the synthesis of (1,2,3) benzthiozolo (6, 7-d) thiozole derivative	International Syposium Organic Chemistry of sulphur University of Odense, Denmark 7-12 Aug. 1988
14.	Dr. S. R. Ramadas	Organic pollutants Monitoring by spectroscopic methods	International Seminar on Analytical Techniques in Monitoring the environment Tirupati 10-12 Jan. 1989.
15.	Mr. K. P. Palanivel Dr. T. V. Ramakrishna	Concentration & Determination of Trace amounts of arsenic and phosphorous in Natural waters	International Seminar on Analytical Techniques in Monitoring the environment Tirupati 10-12 Jan. 1989.
16.	Mr. B. Srinivas Dr. V. R. S. Rao Dr. J. C. Kuriacose	XPS characterisation of gamma irradiated LaMnO <sub>4</sub>	Advance methods for characterisation of the surface/Interface materials. Boston, USA 28-30 Nov. 1988.
17.	Ms. K. Suba Dr. M. R. Udupa	Thermochemical investigation of reactions in potassium perchlorate and ammonium dichromate system	Fifth National Seminar on High Energy Materials Feb. 22-24 1989 ERDL Pune.
18.	Mr. V. Kameswara Rao Dr. C. S. Venkatachalam Dr. C. Kalidas	Electrochemical behaviour of some biologically important hydrazones	Symposium on Electrochemistry Karaikudi July 1988
19.	Dr. D. V. Ramana Mr. M. George	Oxygen transfers from the nitro group to sulfur in allyl o-nitrophenyl sulfide and sulfoxide on electron impact	4th National Symposium on Mass Spectrometry Indian Institute of Science, Bangalore 1988
20.	Dr. D. V. Ramana Mr. N. V. S. Ramakrishna	Novel oxygen transfers to acetylenic carbon in 2-nitrotolans on electron impact	"
21.	Mr. B. Chandra Sekhar Dr. S. R. Ramadas Dr. D. V. Ramana	A very simple and convenient method for the synthesis of novel condensed benz-1,5-oxazepin	Indian Council of Chemists eight conference S. V. University, Tirupati 24-26 Oct. 1988
22.	Dr. D. V. Ramana Mr. M. George	Competing oxygen transfers from nitro group to sulfur and olefinic double bond in 2-nitrophenyl styryl sulfide on electron impact	25th Annual convention of chemists, University of Calcutta 23-27 Dec. 1988

<i>S. No.</i>	<i>Name of faculty member</i>	<i>Title of paper presented &amp; authors</i>	<i>Name, Dates and Venue of Conference</i>
23.	Dr. D. V. Ramana Mr. N.V.S. Ramakrishna	Electron impact induced cyclizations in 2-methoxy-phenyl-acetylene and 2-methoxytolans	36th American Society for Mass Spectrometry conference San Francisco, USA 5-10 June 1988
24.	Dr. D. V. Ramana Mr. N. V. S. Ramakrishna	Ortho interactions of nitro group in 1-(2-nitrophenyl-thio)-2-propynes on electron impact	XIII International Symposium of Organic Sulfur Chemistry Odense, Denmark 7-12 August 1988
25.	Dr. D. V. Ramana Mr. N. V. S. Ramakrishna	Competing oxygen transfers to sulfur and acetylenic carbon in 2-nitrophenyl-phenylethynyl-sulfides on electron impact	11th International Mass Spectrometry Conference Bordeaux, France 29th Aug-2nd Sept. 1988
26.	Dr. S. Vancheesan Dr. J. C. Kuriacose Mr. K. Jothimony	Phase transfer catalysis	International symposium on Homogeneous Catalysis 22-26 Aug 1988 Vancouver, Canada
27.	Dr. S. Vancheesan	Homogeneous hydrogenation	IX Catalysis Symposium, Madras 15-17 Dec. 1988
28.	Dr. T. K. Varadarajan Dr. B. Viswanathan	Surface acidity of HPA and salts and its relation in hydrocarbon conversion reactions	
29.	Dr. T. K. Varadarajan Dr. B. Viswanathan	XPS & XRD studies of $USb_3O_{10}$ partial oxidation catalyst	IV National workshop-cum-seminar on Techniques in Catalysis 22-24 June 1988 IIT, Kharagpur
30.	Mr. S. Sampath Dr. R. Narayan	Photoelectrochemistry of layered semi-conductor in amide solvents	VII International Conference on PEC and storage of solar energy Aug. 1988 Evanston USA
31.	Dr. R. Narayan	EC Transfer Coefficient	National Symposium on Electrode kinetics CECRI Karaikudi, July 1988
32.	Dr. R. Narayan	E. C. at high temperatures in Reference Electrode	National Symposium on EC Techniques and Instrumentation IGCAR, Kalpakkam Dec. 1988.
33.	Mr. P. Subramanian Dr. J. Rajaram Dr. V. Ramakrishnan Dr. J. C. Kuriacose	Duality of mechanisms in the reactions of aliphatic amines - A flash photolysis study	XII IUPAC Symposium on Photochemistry July 1988, Italy.
34.	Ms. S. Padmaja Dr. V. Ramakrishnan Dr. J. Rajaram Dr. J. C. Kuriacose	Reactions of Borate Radical-A flash photolysis study	XII IUPAC Symposium on Photochemistry July 1988, Italy.

<i>S. No.</i>	<i>Name of faculty member</i>	<i>Title of paper presented &amp; authors</i>	<i>Name, Dates and Venue of Conference</i>
35.	Mr. B. Rufus Dr. B. Viswanathan Dr. V. Ramakrishnan Dr. J. C. Kuriacose	P. E. C. & Surface studies on Pt-CdS	XII IUPAC Symposium on Photochemistry July 1988, Italy.
36.	Mr. B. Rufus Dr. B. Viswanathan Dr. V. Ramakrishnan Dr. J. C. Kuriacose	Rh-CdS as a Photocatalysis for the photochemical evolution of H <sub>2</sub> from H <sub>2</sub> S (aq)	7th International Conference on Solar Energy Evanston USA August 1988
37.	Mr. B. Rufus Dr. B. Viswanathan Dr. V. Ramakrishnan Dr. J. C. Kuriacose	PEC studies on platinised CdS	5th National workshop on Techniques in Catalysis June 1988 IIT, Kharagpur
38.	Mr. B. Rufus Dr. B. Viswanathan Dr. V. Ramakrishnan Dr. J. C. Kuriacose	Effect of electro-deposition of Pt on PEC properties of CdS photoanode	National symposium on electro-chemical material Science, November 1988 CECRI, Karaikudi
39.	Mr. B. Rufus Dr. B. Viswanathan Dr. V. Ramakrishnan Dr. J. C. Kuriacose	Metallised Cds as a photocatalyst for H <sub>2</sub> S decomposition	9th National symposium on Catalysis, Madras December 1988
40.	Mr. N. Sreehari Dr. P. T. Manoharan	Exchange interactions in Metals Dialkyl Carbamates	Modern Trends in Inorganic Chemistry Madras 1988
41.	Dr. P. T. Manoharan	Structure of Reconstituted hemoglobin	Invited talks Jabalpur, 1988
42.	Mr. P. Selvam Dr. B. Viswanathan Dr. C. S. Swamy Dr. V. Srinivasan	Surface studies of some hydrogen storage materials	International Symposium on metal hydrogen system Sept 1988 Stuttgart, W. Germany
43.	Dr. V. Srinivasan	Surface Analysis by ESCA, AUGER and IR: Spectroscopy - Plenary lectures	Fourth National Workshop on Catalysis June 1988, IIT, Kharagpur,
44.	Mr. M.P. Sridhar Kumar Dr. B. Viswanathan Dr. C. S. Swamy Dr. V. Srinivasan	Catalytic Properties of systems generated from Hydrogen Sorbing Nickel containing Intermetallics Catalysis - Concepts and Applications	Ninth National Symposium on Catalysis, December 1988 MRL, Madras
45.	Mr. R. Sundararajan Dr. V. Srinivasan	Catalytic Decomposition of Nitrous Oxide on Ni <sub>x</sub> Cu <sub>1-x</sub> Co <sub>2</sub> O <sub>4</sub> Catalysis- Concepts and Applications	Ninth National Symposium on Catalysis, December 1988 MRL, Madras

S. No.	Name of faculty member	Title of paper presented & authors	Name, Dates and Venue of Conference
46.	Mr. T. Mohan Dr. G. Aravamudan Dr. M. N. S. Rao	Reactions of $S_4N_4$ and cyclic S-N chlorides with unsym. Phosphines, Ph P R (R=i) morpholino-ii) N-methylpiperazino-iv) pynolidino and v) hexamethylamine isolation and characterization of $R-S_2N_2$ heterocycles (R—phosphinimino group) and their reaction with norbornadiene.	DST group monitoring workshop IICB, Jadharpur Calcutta, 1988
47.	Mr. T. Mohan Dr. M. N. S. Rao Dr. G. Aravamudan	Synthesis and mass spectral behaviour of assymmetric phosphines Ph (DCA) P (R) (R = i) piperidino, ii) morpholine and iii) N-methylpiperazino and DCA=dicyclohexylamino)	Fourteenth Annual Symposium in Chemistry IIT, Madras 1988
48.	Mr. C. Xavier Rajan Dr. M. N. S. Rao	Synthesis and characterization of (R) $Ph_2PN-S_2N_2$ (R = amilino and t-butylamine) ring systems and their transformation in solution to cyclophosphathiazene $Ph_2PS_2N_2$	
49.	Ms. Shanthi, K. Ms. Vasanthi, N. Dr. Lalitha, K.	Effect of Selenium on the metabolism of a novel methanogen	II Congress on Trace Element Research-Selenium in Medicine and Biology, Grenoble, France March 1988
50.	Ms. Shanthi, K. Ms. Vasanthi, N. Dr. Lalitha, K.	Metabolic control of cellulose degradation during biomethanation	14th International Congress of Biochemistry Prague, Czechoslovakia July 1988.
51.	Ms. Shanthi, K. Ms. Vasanthi, N. Dr. Lalitha, K	Metabolic feature of a novel methanogenic isolate	
52.	Ms Shanthi, K. Ms. Vasanthi, N. Dr. Lalitha, K.	Kinetics of Cellulose degradation during biomethanation of <i>L. leucocephala</i>	8th International Biotechnology Symposium, Paris, France July 1988.

## 7. Research Publications

<i>S. No.</i>	<i>Author(s)</i>	<i>Title</i>	<i>Name o Journal</i>	<i>Vol &amp; issue No.</i>	<i>Month &amp; Year</i>	<i>Pages</i>
1.	Dr. K. Srinivasan Dr. T. V. Ramakrishna Dr. N. Bala- subramaniam	Fluoride removal of water	Indian council of Chemistry	IV	1988	71-76
2.	Dr. V. Nirmalchandar Dr. N. Bala- subramaniam	Spectrophotometric determination of thiamine	Indian Drugs	Feb.	1989	233-237
3.	Dr. M. S. Gopinathan	Determination of Atomic hybridiza- tion in M.O. theory	J. Molecular Structure Theoretical Chemistry	199	1988	379-388
4.	Dr. M. S. Gopinathan	Quantum Mechanics and chemical velancy	Current Science	58	1989	126-127
5.	Dr. T. R. Bala- subramanian Dr. V. Mahadevan	Electroinitiated polymerization of Acrylonitrile	J. Polymer Science (Polymer Chem Edn.)	26	1988	301-311
6.	Dr. P. R. Srinivasan Dr. V. Mahadevan Dr. M. Srinivasan	Poly (maleimides) and (maleimide- amine) ethers	J. Eur polymer	24	1988	255-258
7.	Dr. A. M. Ibrahim Dr. V. Mahadevan Dr. M. Srinivasan	Synthesis of phosphorous con- taining copolymers	J. Eur polymer	24	1988	385-388
8.	Mr. M. Krishnarathnam Dr. B. Viswanathan Dr. R. Ramaswamy	Effect of gamma irradiation on the uncatalysed bromine oscillator	J. Radio anal Nucl chem letters	120	1988	353-359
9.	Dr. V. R. S. Rao Dr. G. Erdtmann Dr. H. Petri	Preparation of Radio bromamine— T by isotopic ex- change with radio- active bromine	..	135/4	1989	247-256
10.	Dr. V. R. S. Rao Dr. Erdtmann Dr. H. Petri	Extent of Exchange of bromine-82 with bromamine-T in strong acid medium	..	135/4	1989	257-264
11.	Ms. M. Subhashini Dr. M. S. Subramanian Dr. V. R. S. Rao	Kinetics of Exchange between chloramino-B and radioactive chlorine	..	135/5	1989	359-371

<i>S. No.</i>	<i>Author(s)</i>	<i>Title</i>	<i>Name of Journal</i>	<i>Vol &amp; Issue No.</i>	<i>Month &amp; Year</i>	<i>Pages</i>
12.	Ms. V. Nirmala Dr. M.S. Subramanian	Determination of traces of palladium using radioactive zinc dithiorate as reagent	..	128/1	1988	23-28
13.	Ms. V. Nirmala Dr. M.S. Subramanian	Substoichiometric determination of zinc with thiocyanate & brilliant green	..	128/1	1988	29-34
14.	Dr. T. Subramanian	Complexes of copper with thiosalicylic acid	J. Ind Chem	65(8)	1988	589-90
15.	Mr. C. J. Thomas Dr. M. N. S. Rao	Reactions of $S_4N_4$ with (morpholinio) diphenylphosphine: First time observation of a ring contraction of 1,5- $(OC_4H_8N)_2Ph_2PN-S_4N_4$ to $(OC_4H_8N)_2Ph_2PN-S_3N_3$ in solution	J. C. S. Dalton		1988	1445
16.	Mr. Anil J. Elias Dr. M.N.S. Rao	Reaction of $Ph_3PN-S_3N_3$ with ammonia and amines-observation of ring expansion reactions leading to 1, 5- $(Ph_3PN)_2S_4N_4$ .	Phosphorus & Sulphur	37	1988	
17.	Mr. L. Altaf Hussain Mr. Anil J. Elias & Dr. M.N.S. Rao	A convenient and high yield synthesis of tertiary (amino) phosphines by transamination route	Tetrahedron letters	29	1988	
18.	Dr. T. P. Elango Dr. S. Vancheesan Dr. V. Ramakrishnan Dr. J. C. Kuriacose	Radiation Chemical Studies of Nickel-Glycine Reaction with Carbonate Radical	J. Radioanal and NuCl. Chem. Articles	125	1988	
19.	Ms. G. Caroling Dr. J. Rajaram Dr. J. C. Kuriacose	Kinetics and mechanism of $Ru(III)$ catalysed oxidation of organicsulphides and triphenyl-phosphine by N-methyl-morpholine N-oxide	Proc. Ind. Acad. Sci.	100	1988	



<i>S. No.</i>	<i>Author(s)</i>	<i>Title</i>	<i>Name of Journal</i>	<i>Vol &amp; Issue No.</i>	<i>Month &amp; Year</i>	<i>Pages</i>
20.	Ms. Padmaja Dr. V. Ramakrishnan Dr. J. Rajaram Dr. J. C. Kuriacose	Generation and Reactions of the borate radical- A flash photolysis study	Proc. Ind. Acad. Sci.	100	1988	
21.	Mr. P. Subramanian Dr. J. Rajaram Dr. V. Ramakrishnan D. J. C. Kuriacose	The Effect of substituents on the Reactivity of Aniline with Phosphate Radical	Tetra hedron	44	1988	
22.	Ms. G. Caroling Dr. J. Rajaram Dr. J. C. Kuriacose	Kinetics and mechanism of RuCl <sub>3</sub> (PPh <sub>3</sub> ) <sub>3</sub> catalysed oxidation of sulphides by N-methyl morpholine-N-Oxide (NmO)	J. Mol Cat.	49	1988	
23.	Ms. G. Caroling Dr. J. Rajaram Dr. J. C. Kuriacose	Kinetics and Mechanism of Ru (III) catalysed oxidation of Olefins by N-methyl marpholine-N-Oxide	Ind. J. Chem	27A	1988	
24.	Ms. K. Shanthi Dr. C. N. Pillai Dr. J. C. Kuriacose	Hydrodenitrogenation of Simple Aromatic Amines on Molybdenum Catalysts	Applied Catalysis	46	1989	
25.	Mr. S. Muralidharan Mr. K. S. Nagarajan Dr. M. R. Udupa	Nicotine complexes of zinc (II), cadmium (II) and Mercury (II)	Ind. J. Chem. 27A	27A	1988	
26.	Ms. K. Suba Dr. M. R. Udupa	Thermochemical investigation of solid state reactions in Molybd tung-states system	Thermo chem Acta	133	1988	191-196
27.	Dr. B. Viswanathan Mr. N. S. Raman Ms. S. Suchitra Dr. R. P. Viswanath Dr. T. K. Varadarajan	Cyclic Voltametric study of cuprate based high temperature superconductor in non aqueous medium	J. Electro chem Soc India	37	1988	147-9

<i>S. No.</i>	<i>Author(s)</i>	<i>Title</i>	<i>Name of Journal</i>	<i>Vol &amp; Issue No.</i>	<i>Month &amp; Year</i>	<i>Pages</i>
28.	Dr. B. Viswanathan Ms. M. J. Omana Dr. T. K. Varadarajan	Catalytic properties of heteropolyacids conversion of isopropyl-alcohol to saturated hydrocarbon	Ind. J. Chem	27A	1988	674-6
29.	Mr. D. Vasudevan Dr. C. S. Venkatachalam Dr. C. Kalidas	Electrochemical behaviour of naphthyl hydrazones & its analogue	Bull Ele Chem	4	1988	187-191
30.	Dr. S. R. Ramadas Ms. S. R. Jayanthi Dr. W. Walter	A possible route to 12-thiasteroid synthesis	Sulfur Letters	7	1988	159-169
31.	Dr. S. R. Ramadas Mr. T. Natarajan Babu	Attempted Synthesis of 2- (m - methoxyphenethyl)-2-methyl-cyclohexane -1, 3-dione-A wellknown Steroid intermediate-Based on synthon concept-Part-I	Sulfur Letters	7	1968	121-126
32.	Mr. B. Ramesh Babu Dr. D. V. Ramana Dr. S. R. Ramadas	New polyhetero polycyclic ring systems: Part XXXIV Synthesis of new heterogonane systems	Sulfur Letters	7	1988	225-230
33.	Mr. M. Balasubramanian Dr. S. R. Ramadas	New steroidal heterocycles Part XX: Total synthesis of B-homo-6-oxa-estra-1, 3, 5 (10), 8, 14-pentaen-17-one	Ind. J. Chem	27B	1988	59-60
34.	Mr. P. V. Padmanabhan Dr. D. V. Ramana Dr. S. R. Ramadas	Synthesis of 11-oxo-indeno (1',2',:2,3) pyrrolo (5,1-a) isoquinolines	Ind. J. Chem	27B	1988	729-730
35.	Dr. S. R. Ramadas Dr. C. N. Pillai Mr. R. Bakthavatchalam	Synthesis of New Bridged polycyclic polyfunctional organic molecules	ISRO Respond TR-64		1987	25-37
36.	Mr. P.V. Padmanabhan Dr. D. V. Ramana Dr. S. R. Ramadas	Synthesis of Indeno (1,2-d) (1,3)-diazepines	Ind. J. Chem	27B	1988	726-72

<i>S. No.</i>	<i>Author(s)</i>	<i>Title</i>	<i>Name of Journal</i>	<i>Vol &amp; Issue No.</i>	<i>Month &amp; Year</i>	<i>Pages</i>
37.	Mr. P. V. Padmanabhan Dr. D. V. Ramana Dr. S. R. Ramadas	A convenient synthesis of indeno (1, 2-b) pyrroles	Ind. J Chem	27B	1988	957-958
38.	Mr. P. V. Padmanabhan Dr. D. V. Ramana Dr. S. R. Ramadas	Synthesis of indeno-pyrrolo-isoquinolines	Ind. Chem	27B	1988	
39.	Mr. D. Vasudevan Dr. S. R. Ramadas Dr. C. S. Venkatachalam Dr. C. Kalidas	Electrochemical behaviour of 2-naphthylhydrazino-5, 5-dimethyl-cyclohexane-1, 3-dione	Ind. Chem	25A	1986	
40.	Mr K. P. Shariff Dr. R. Narayan	Electrochemical behaviour of Aluminium in NaCl-open circuit potentials, British corrosion Journal			Paper accepted	
41.	Mr. G. Prabhakar Rao Mr. O. V. K. Chetty Dr. R. Narayan	Application of TEM to anodic smoothing	J. of Mech. working Tech.	17	1988	289-296
42.	D. V. Ramana Mr. S. Kasi Dr. B. Viswanathan	Two parallel ortho effects in 5-(O-Tolidene) barbituric acid and related compounds on electron impact	Ind. Chem.	27B	1988	613-616
43.	B. Ramesh Babu Dr. D. V. Ramana Dr. S. R. Ramadas	Condensed polyhetero polycyclic ring systems : Part II: Synthesis of 5, 5, 8-trimethyl-4H, 5H-1, 2, 3-Benzo - thiadiazolo (7', 6' : 4, 5) Thiazolo (3, 2-a) porimidin-10-one	Sulfur Letters	8	1988	125-128
44.	Dr. D. V. Ramana Dr. N. Sundaram Mr. M. George	Ortho effects in organic molecules on electron impact Part I. Oxygen transfers from nitro group to both sulfur and olefinic double bond in allyl O-nitrophenyl sulfide	Org. Mass Spectrom	24	1989	63-65

<i>S. No.</i>	<i>Author(s)</i>	<i>Title</i>	<i>Name of Journal</i>	<i>Vol &amp; Issue No.</i>	<i>Month &amp; Year</i>	<i>Pages</i>
45.	Dr. D. V. Ramana Mr. N. V. S Rama- krishna	Ortho effects in organic molecules on electron impact Part 16, Novel oxy- gen transfers from the nitro group to acetylenic carbons in 2-nitro-diphenyl- acetylenes	Org. Mass Spectrom	24	1989	66-69
46.	Ms. Jayalaksemi Gopal Dr. M. Srinivasan	Synthesis of polyazohydroxides	Burs. Pol. J.	24	1988	271-274
47.	Mr. T. Asok Reddy Dr. M. Srinivasan	Synthesis and Characterization of Poly (tenzlami- dazaiyl) Thiaxan- thens	J. Polly. Sci.	26	1988	1051-1061
48.	Ms. S. Padma Dr. V. Mahadevan Dr. M. Srinivasan	Synthetic study of Aromatic poly benzoxazinane	J. Polymer Science	26	1988	195-200
49.	Ms. S. Padma Dr. V. Mahadevan M. Srinivasan	Synthesis and Characterisation of some poly- quinaxolinodiene	J. Polymer Science	26	1988	1253-1257
50.	Mr. T. Ashok Reddy Dr. M. Srinivasan	Preparation and properties of polyamides from lutobutyric amides and aromatic diamines	J. Polymer Science	26	1988	1705-1720
51.	Ms. Prema Subramanyam Dr. M. Srinivasan	Synthesis and Characterisation of polymides contain- ing hetero cyclic urianthrene units	J. Polymer Science	26	1988	1553-1560
52.	Mr. T. Ashok Reddy Dr. M. Srinivasan	Synthesis and Characterisation of polyamides contain- ing hetero cyclic urianthrene units	J. Polymer Science	26	1988	1063-1076
53.	Mr. G. Prabhakara Rao Mr. O. V. K. Chetty Mr. G. Velayutham Dr. R. Narayan	Parametric Influ- ence of polarisation in ECM	13th AIMTDR conference Jadavpur		1988	

<i>S. No.</i>	<i>Author(s)</i>	<i>Title</i>	<i>Name of Journal</i>	<i>Vol &amp; Issue No.</i>	<i>Month &amp; Year</i>	<i>Pages</i>
54.	Mr. N. L. N. Kumar Mr. O. V. K. Chetty Dr. V. Radhakrishnan Dr. R. Narayan	Corrosion Resistance of some components	"		1988	
55.	Mr. E. Dayalan Dr. R. Narayan	Free Energy of Activation of the hydrogen evolution reaction in presence of Thiourea	J. Elec. Chem. Soc India	37	1988	385-387
56.	Ms. N. Vasanthy Dr. K. Lalitha	Selenium mediated biochemical changes in Japanese quails Part III. Variation in tissue uptake and distribution of 75 selenium in response to diary selenium status	Biol. Trace Elem. Res.	14	1987	
57.	Ms. N. Vasanthy Dr. K. Lalitha	Regulatory role of selenium in mitochondrial oxygen and hydroperoxide metabolism	Arch. Biochem. Biophys.	Communicated		
58.	Ms. N. Vasanthy Dr. K. Lalitha	Selenium mediated changes in thiol pool and redox linked reactions	Arch. Biochem. Biophys.	Communicated		
59.	Mr. N. Sreehari Dr. P. T. Manoharan	Triplet state EPR studies of exchange copuled Cu(II) and Ag(II) pairs in Zn(II) bis (N,N-diisopropyl dithiocarbamate)	Mol Phys	63	1968	
60.	Mr. A. P. Koley Mr. S. Purohit Mr. S. Ghosh Mr. L. Sreerama-chandra Prasad Dr. P. T. Manoharan	Studies on gold (II) complexes with hard and soft donor ligands: Part I. Complexes with o-amino-benzenethiol	J. Chem. Soc. Dalton Trans		1988	
61.	Ms. S. Lalitha Mr. G. V. R. Chandramouli Dr. P-T. Manoharan	Spectroscopic Invstigation of Intermolecular Interactions in Dithiolate Complexes of Nickel	Inorg. Chem.	27	1988	

S. No.	Author(s)	Title	Name of Journal	Vol & Issue No.	Month & Year	Pages
62.	Mr. S. Venkata Mr. K. V. C. Rao Dr. P. T. Manoharan	Electrically conductive nickelphthalocyanine polymer Synthetic Metals	Synthetic Metals	26	1988	237-246
63.	Ms. S. Lalitha Dr. P. T. Manoharan	X-Ray Photoelectron spectroscopic study of some dithiolate complexes	J. Elec. Spectroscopy		1988	
64.	Mr. A. Levy Dr. P. T. Manoharan Mr. J. M. Rifkind Mr. J. C. Walker Mr. F. C. Haberle Mr. J. D. Gicson Mr G. A. Elgavish Mossbauer	EPR and NMR Studies of the acid Induced Reduction and changes in Spin State of Ferric-Bleomycin,	Biochim. et Biophy Acta		In Press	
65.	Ms. N. Venkatalakshmi Mr. Babu Varghese Ms. S. Lalitha Mr. R. F. X. Williams Dr. P. T. Manoharan	Crystal, Molecular structure and Magnetic Properties of $(M-Bu_4N)_2 Cu(dcmdtcroc)_2$ a Dimer with Weak Ferromagnetic Coupling	JACS		In Press	
66.	Mr. M. P. Sridhar kumar Dr. B. Viswanathan Dr. C. S. Swamy Dr. V. Srinivasan	Decomposition of Isopropyl Alcohol on Oxidised inter-metallic Compound $LaNi_5$	Indian J. Chem		In Press	
67.	Mr. M. O. Alias Dr. V. Srinivasan	Molybdena dispersion in nickel promoted molybdena hydrosulphurisation catalyst	Ind. J. Chem	27A	1988	286-89
68.	Mr. M. P. Sridhar Kumar Dr. B. Viswanathan Dr. C. S. Swamy Dr. V. Srinivasan	High temperature Interaction of Hydrogen with Inter-metallic Compound $CaNi_5$	Mat. Chem. Phys.	20	1988	245-257
69.	Mr. M. P. Sridhar kumar Dr. B. Viswanathan Dr. C. S. Swamy Dr. V. Srinivasan	Surface properties of $CaNi_5$ Hydrogen Storage Alloy	J. Mater Sci.		In Press	

S. No.	Author(s)	Title	Name of Journal	Vol & Issue No.	Month & Year	Pages
70.	Mr. M. P. Sridhar kumar Dr. B. Viswanathan Dr. C. S. Swamy Dr. V. Srinivasan	Interaction of CO with the Hydrogen storage Alloy, CaNi <sub>5</sub> -Kinetic and Surface Studies			In Press	
71.	Mr. P. Selvam Dr. B. Viswanathan Dr. C. S. Swamy Dr. V. Srinivasan	Thermal Studies on Mg <sub>2</sub> NiH <sub>4</sub> -existence of additional hydride phase in Mg <sub>2</sub> Ni-H <sub>2</sub> system	Thermochemica Acta	125	1988	1-8
72.	Mr. P. Selvam Dr. B. Viswanathan Dr. C. S. Swamy Dr. V. Srinivasan	Mg <sub>2</sub> NiH-a new hydride phase in the Mg <sub>2</sub> Ni-H <sub>2</sub> system	Int. J. Hydrogen energy	13	1988	749-759
73.	Mr. P. Selvam Dr. B. Viswanathan Dr. V. Srinivasan	XPS electrical and magnetic studies on Mg <sub>2</sub> NiH <sub>4</sub> -	J. Elec. Microsc. and Relate. Phenomena		In Press	
74.	Mr. SP. Chidambaram Dr. G. Aravamudan Dr. M. Seshasayee	Structure of Benzimidazole-2 Sulphonic acid Monahydrate	Acta Cryst.	C44	1988	898 900
75.	Mr. SP. Chidambaram Dr. G. Aravamudan Dr. M. Seshasayee Mr. T. A. Shibanova Mr. V. I. Simonov	Synthesis of unusual Mixed ligand Te(IV)-Dithiocarbates with perchlorate	Polyhedron		1988	1267-1271
76.	Mr. K. Ramalingam Dr. G. Aravamudan Dr. M. Seshasayee	Synthesis, Crystal and molecular structure bis (triethanolamine) Nickle(II) Dithiodisalicylate	Z. Kristall	181	1987	215-222

#### 8. Books & Monographs brought out

Group Theory in Chemistry : Dr. V. Ramakrishnan and Dr. M. S. Gopinathan  
Vishal Publication, Delhi 1988

#### 9. National & International Conference/Symposium organised

Dr. P. T. Mahoharan, Modern Trends in Inorganic Chemistry Convener, January 1988.

#### 10. Short Term Courses/Continuing Education Programme :

1. Dr. V. Mahadevan Catalyst workshop for persons sponsored by Industries Jan. 30-Feb. 24

- |                        |                                 |                                 |
|------------------------|---------------------------------|---------------------------------|
| 2. Dr. C. N. Pillai    | Training programme in Catalysis | 30-1-89 — 24-2-89               |
| 3. Dr. P. T. Manoharan | Summer School on ESCA Convener  | April 1988<br>(one week school) |

### 11. Awards and Honors (Faculty/Students)

1. Indian Drug manufacturers Association Award Bombay For the paper "Spectrophotometric Determination of Ascorbic acid" to V. Nirmalchander, N. Balasubramanian and Elizabeth K. John.
2. Prof. P. T. Manoharan : i) Visiting Professor, University of Fribourg, May-June 1988  
ii) Visiting Scientist, NIH Bethesda Maryland, May 1988

### 12. Professional activities :

1. Dr. M. S. Gopinathan : Elected Fellow of Indian Academy of Science in 1988
2. Dr. C. Kalidas : a) On the Editorial Board of Solubility data series - a series publication by pergamon press.  
b) Member of SAEST  
c) National representative of IUPAC Commission V on solubility data.
3. Dr. J. C. Kuriacose : Member Editorial Board of Indian Journal of Chemistry
4. Dr. R. Narayan : Member Editorial Board of J. of Electrochemical Society of India. Member of executive council Electrochemical Society of India. Chairman SAEST India.
5. Dr. C. N. Pillai : Chaired a session at the 9th National Symposium in Catalysis, MRL Madras December 1988
6. Dr. S. R. Ramadas : i) Chaired International Symposium on Organic chemistry of sulphur, Dense University of Denmark, August 1988.  
ii) On Editorial Board of International Journals Sulphur compounds and Sulphur Letters
7. Dr. T. K. Varadarajan : Life member Catalysis Society of India
8. Dr. P. T. Manoharan : Member of the Editorial Boards of  
i) Proceeding of the Indian Academy of Sciences (Chemical Sciences)  
ii) Indian Journal of Chemistry
9. Dr. K. Lalitha : 1) Member Association of Food Scientists and Technologists  
2) Life member Southern Biological Chemistry of India
10. Dr. V. Ramakrishnan : Chaired sessions on the seminars listed under (13) (9)

### 13. Invited Lectures

i) (By IIT faculty in other Institutions)

1. Dr. C. Kalidas : UGC Visiting lecture - Ravishankar, University Raipur, 21-26 Jan. 1989.
2. Dr. C. N. Pillai, i) 3 Lectures on pericyclic Reactions, Tagore Arts College, Pondicherry.  
ii) 4 Lectures on Pericyclic Reactions, Govt. Victoria College and ORD, Palghat.



3. Dr. S. R. Ramadas : i) Regional Research Labs Trivandrum Spetroscopy (13C & 1H NMR of Organic molecules)
4. Dr. D. V. Ramana : i) Fast Atom Bombardment in mass spectrometry CDRI Lucknow  
ii) Metastables and their uses in structure elucidation DRDE Gwalior
5. Dr. V. R. S. Rao : i) Instrumental methods of analysis W. C. College, Madras  
ii) DAAD short term reinvitation kernforschungsanlage Julich W. Germany
6. Dr. T. Subrahmanyam : DAAD short term invitation Gottingen University, W. Germany
7. Dr. M. N. S. Rao : Two lectures (1) Inorganic Heterocycles  
(2) Inorganic macromolecules  
Gulbarga University, Feb-March 1989.
8. Dr. P. T. Manoharan : Gave lectures in ETH, Zurich, CNRS Paris University of Florence Italy, University of Geneva and in India.
9. Dr. V. Ramakrishnan : 1) UGC seminar on Physical organic methods Madurai Kamaraj University, Madurai Feb. 28 to March 2, 1989  
2) UGC seminar on Trends in Physical Organic chemistry, March 17-19, 1989. Annamalainagar  
3) UGC symposium on Heterocyclic Chemistry March 23-25, 1989 Bharathidasan University, Trichy.

ii) (By Distinguished Visitors to IIT)

1. Dr. K. K. Bhattacharya : Hydrotreating of petroleum products  
Retd. Scientist CSIR
2. Prof. H. J. C. Jacobs : University of Leiden Netherlands
3. Prof. B. A. Trofimovi : Inst. of Organic chemistry Siberian Div.  
USSR Acad. of Science 664033 IRKUTSK USSR
4. Prof. R. Yamadagni : Department of Chemistry University of Calgary, Canada
5. Prof. A. Schmidpeter : University of Munich W. Germany

**14. Staff Matters**

1. Convener of Green Canopy Environmental Group at the IIT, Madras. A symposium on Environmental organised in January 89. Arranged for planting 250 trees in the campus. (Prof. P. T. Manoharan)
2. Member BAR IIT Madras-36 & Member Library Committee (Prof. R. Narayan)

**15. Future Plans**

1. Dr. V. Mahadevan : Research and Teaching
2. Dr. M. S. Subramanian : Extractive separation and determination of metal ions using radiotracers.
3. Dr. S. Vancheesan : Fabrication of a 'metal atom syntheses' for research in organometallics.

4. Dr. P. T. Manoharan : A project to the DST as well as US Indian Fund are on the anvil. An S-band ESR spectrometer is under construction. On behalf of Green canopy a plan for planting 1200 trees inside IIT has been planned for June-July 1989
5. Dr. K. Lalitha :  
1) To develop enzymology & Enzyme technology  
2) Selenium biochemistry. Bioenergetion &  
3) Trace element Biochemistry
6. Dr. C. S. Venkatachalam : To investigate various eletro-organic reductions and oxidations of compounds for a possible large scale synthesis.

## CIVIL ENGINEERING

### Introduction :

#### 1. New Courses Introduced

<i>Course No.</i>	<i>Title</i>	<i>Offered to</i>	<i>Faculty offering the course</i>
CE 761	Transportation system Analysis	Postgraduate	Dr. S. B. Pattnaik
CE 481	Computer Methods in Civil Engineering	Undergraduate	Mr. S. Rajiv

#### 2. Research and Development Activities

The following are the details of the research and development activities of the Department :

1. Hollow block wall systems-analysis, Testing and Design.
2. Computer applications in building technology in the field of building planning, casting, construction management, Resource Scheduling and Analysis of hollow block wall panels.
3. Development of Expert System for building repair and maintenance problem.
4. Functional design of buildings and study of built environment.
5. Building components in Ferrocement
6. Durability of Concrete and corrosion of reinforcing steel in RCC in adverse environments.
7. Stresses in end zones in pretensioned building components.
8. Energy Conservation in building.
9. Analytical and experimental studies in Noise pollution.
10. Bending analysis of three forms of axisymmetric shell foundations, viz. i) Cone ii) Double cone and iii) Inverted Spherical Sector, subjected to axial loads and moments, by the finite element method, including extensive parametric studies in each case.
11. Bending analysis of hyperbolic paraboloid individual shell footing by the finite element method, including detailed parametric studies.
12. Bending analysis of conical annular shell raft foundation by the finite element method, with parametric studies.
13. Soil-structure interaction analysis of cantilever type combined footings, modelling the soil by the Winkler and elastic half space approaches.
14. Soil-structure interaction analysis of grid foundations—modelling the soil by the Winkler and elastic half space approaches.
15. Development of suitable techniques to adopt Geosynthetic fabrics as soil reinforcements and methods to evaluate the Geosynthetic—soil behaviour using different types of Indian made Geosynthetics and soils.
16. Expert systems in drought management
17. Simulation of unsteady flow
18. Analytical and Experimental Investigations on the Inelastic behaviour of R. C. frames

19. Finite Elements for Geometric Nonlinear analysis
20. Optimal Design of Structural Systems
21. Knowledge-Based Expert Systems for structural design
22. An expert system for Finite Element Analysis Modelling
23. Nonlinear Finite Element Analysis of Concrete Structures
24. Modelling for Intercity Travel Demand
25. Studies on Bus Depot Fleet size
26. Capacity studies on single line Railway—A Simulation Model.

### 3. New Facilities Added and Major Items of Equipment Procured/Fabricated

A 400 tonne capacity wall testing frame is under fabrication.

1. Measuring equipment for acoustics, vibration and lighting.
2. Universal triaxial shear equipment provided with a load cell, LVDT and a transducer, data logger—3 channel.
3. Residual shear strength measurement with a direct shear apparatus with a provision of using a load cell. LVDT's with a redout facility includes a pressuremeter and a strain meter.
4. 3-gang Bench model consolidation apparatus (20 kg/cm<sup>2</sup>) with a provision of using LVDT's and a redout facility includes a three channel strain meter.
5. Motorised large direct shear apparatus, 72 strains ranging from 10.16 mm/min. to a minimum of 0.0014 mm/min. Shear parameters are possible to measure on 30 cm<sup>2</sup> specimens of granular type used in rolled fill embankments.
6. Wave form Analyser - C - MOS Based measuring system
7. Dynamic Data Logging Equipment
8. Impulse Hammer
9. Radial Drilling Machine
10. Milling Machine
11. Sound Level Meter for Traffic Noise Studies
12. Graphic plotters
13. Digitizers
14. PC-XTs with Printers - 10 Nos.

### 4. Sponsored Projects

(i) Taken up during the year

Sl. No.	Title	Funding agency & value	Period	Co-ordinator
1.	A study on Admixtures in Burnt-Clay Products for Economy and Energy Savings	Centre for Industrial Consultancy & Sponsored Research IIT Madras	one year	Dr. P. Kalyanasundaram
2.	Physico-chemical investigations on highly plastic organic and swelling clays	Centre for Industrial Consultancy & Sponsored Research IIT Madras	Initially one year	Dr. T. S. Ramanatha Ayyar Dr. Nainan P. Kurian Dr. N. R. Krishnaswamy Dr. S. Narasimha Rao N. Dr. Balasubramanian

<i>Sl. No.</i>	<i>Title</i>	<i>Funding agency &amp; value</i>	<i>Period</i>	<i>Co-ordinator</i>
3.	Modules on Irrigation planning Development / Command Area Development	Continuing Education Centre	six months	Dr. N. Indrasenan
4.	Stress Analysis of Branch connection in pipes	Dept. of Atomic Energy Rs. 2.34 lakhs	three years	Dr. V. Paramasivam and Dr. H. Achyutha
5.	CAD/CAM Programme	Min. of Human Resources Development	Seventh Five Year Plan	Dr. V. Radhakrishnan and Dr. C. S. Krishnamoorthy
6.	Buckling and Postbuckling behaviour of Layered Carbon Fibre Composite Elements and Stiffened Panels	ADA Rs. 0.81 lakhs	1989-90	Dr. V. Kalyanaraman
7.	Analysis of layered fibre composite stiffened panels	ARDB Rs. 3,448 lakhs	1989-92	Dr. V. Kalyanaraman
8.	Mathematical Modelling of the Flow in Transport Network System	Centre for Industrial Consultancy & Sponsored Research IIT Madras Rs. 30,000	one year	Dr. S. N. Majhi Dr. S. B. Pattnaik Dr. T. Panda

(ii) Sponsored Projects completed during the year

<i>Sl. No.</i>	<i>Title</i>	<i>Sponsoring agency and value</i>	<i>Co-ordinator(s)</i>
1.	Diffraction studies	Rs 1.2 lakhs CBI & P	Dr. H. Raman
2.	Prescriptive regional ground water models	Rs. 1.16 lakhs CBI & P	Dr. K. Elango
3.	Strength and Computer Aided Optimum Design of Stiffened Plates	Rs 3. 614 lakhs ARDB	Dr. V. Kalyanaraman
4.	Preparation of Handbook on Chimneys.	Rs. 56,000 Bureau of Indian	Dr. N. Rajagopalan and Dr. V. Kalyanaraman

**5 Assistance to Students and Major Consultancy Assignments**

<i>Sl No.</i>	<i>Name of faculty</i>	<i>Name of client</i>	<i>Title of Consultancy work</i>
1.	Dr. T. P. Ganesan Dr. P. Kalyanasundaram Mr. R. Ambalavanan	Private and Public Sector Organisation	Inspection of building defects and damages such as fire damage and advice on remedial measures. Non-destructive tests of building components at site, quality assurance in construction projects.

<i>S.No.</i>	<i>Name of faculty</i>	<i>Name of client</i>	<i>Title of consultancy work</i>
2.	Dr. Nainan P. Kurian Dr. N. R. Krishnaswamy	Singareni Collieries Co. Ltd., Andhra Pradesh	Specialised tests on coal rock specimen, interpretation and advice on mine prospecting
3.	Dr. Nainan P. Kurian and Dr. N. R. Krishnaswamy	Abhay Marine Projects Pvt. Ltd., Bombay	Soil investigation and advice on platform foundations
4.	Dr. Nainan P. Kurian and Dr. T. S. Ramanatha Ayyar	Gemini Film Processing Industries Pvt. Ltd., Madras 600 006	Geotechnical investigation and advice on foundation for multistoreyed building
5.	Dr. Nainan P. Kurian and Dr. T. S. Ramanatha Ayyar	Motor Industries Co. Ltd., Madras-600 105	Soil investigation for Multi-storeyed Building and advice on foundation design
6.	Dr. Nainan P. Kurian	Tarapore and Co., Madras-600 002	Soil investigation and evaluation of results for fill construction
7.	Dr. Nainan P. Kurian	Ceetex Petrochemicals, Madras-600 004	Testing of soil samples and advice on foundation concrete
8.	Dr. Nainan P. Kurian	Dept. of Electronics Sameer- Centre for Electromagnetics, Madras-600 113	Testing of ground water and advice
9.	Dr. Nainan P. Kurian and Dr. N. R. Krishnaswamy	Dept. of Telecommuni- cations, Erode	Special soil investigation for extension of Telephone Exchange Building at Erode
10.	Dr. Nainan P. Kurian and Dr. N. R. Krishnaswamy	Military Engg. Service Madras	Soil investigation and re-commendations regarding foundation for multistoreyed building
11.	Dr. N. R. Krishnaswamy	M/s. Hirakud Industrial Works, The I. D. C. of Orissa Hirakud, Orissa	Checking the foundation Design and Drawings for Transmission Line Towers
12.	Dr. T. S. Ramanatha Ayyar	Retainer Consultancy for Kerala State Electricity Board	For problem of earth dam constructions of Padinjarethera Dam, Kuttiadiadi Augmentation Scheme
13.	Dr. H. Raman Mr. R. Bakthavatsalu	Southern Asbestos Ltd.	AC Pressure Pipe characteristics
14.	Dr. H. Suresh Rao Dr. B. S. Thandaveswara	Neyveli Lignite Corporation	Model studies for Cooling water systems

<i>Sl.No.</i>	<i>Name of faculty</i>	<i>Name of client</i>	<i>Title of consultancy work</i>
15.	Dr. B. S. Thandaveswara Dr. H. Suresh Rao	M/s. CARTEL Industries, Madras	Evaluating the Landing value performance
16.	Dr. H. Achyutha	DGS and D and Pioneer Rubber Industries, Madras	Evaluation of Elastometric Bearings
17.	Dr. H. Achyutha	Structural Water Proofing Company, New Delhi	Evaluation of Shrinkage Compensating Grout
18.	Dr. P. K. Aravindan Dr. H. Achyutha	L and T	Assessment of Strength of Concrete in Chimneys at Neyveli
19.	Dr. P. S. Rao Dr. P. K. Aravindan Dr. H. Achyutha	FACT Udyogamandal	To assess structural soundness of an existing supporting struc- ture of a sulphuric acid plant
20.	Dr. L. N. Ramamurthy Dr. C. S. Krishnamoorthy Dr. V. Kalyanaraman	M/s. Telecom Factory Jabalpur	Analysis and Design of Microwave antenna Towers
21.	Dr. C. S. Krishnamoorthy Mr. R. Krishnakumar	CAD/CAM Programme M/s. Sundaram Industries Madurai	Analysis of Bus Body
22.	Dr. N. Rajagopalan	TWAD Board	Optimum Design of elevated service reservoir
23.	Dr. N. Rajagopalan	RITES New Delhi	Design of Major Bridges (PSC) in Himachal Pradesh
24.	Dr. V. Kalyanaraman	Greaves Chitram	Design of EOT crane members
25.	Dr. V. Kalyanaraman	Prabhakar Products	Design for 14 M Parabolic Antenna
26.	Dr. V. R. Rengaraju Mr. V. Thamizh Arasan	M/s. S. R. Selvaraj Bros. Madras-600 006	Evaluation of subgrade and pavement design for road
27.	Mr. V. Thamizh Arasan	M. E. S. Naval Air Station Arakkonam-631 002	Material Selection and mix design for base and wearing courses of Airport Runway Pavement

#### **6. Assistance to Sister Institutions**

i) Assisted Calicut Regional Engineering College and Karnataka Regional Engineering College, Surathkal, in developing modern soil/Structural Dynamics Laboratories under the Institutional Network Scheme of the Government of India.

ii) Setting up of Structures Laboratory, Department of Civil Engineering, Regional Engineering College, Warangal.

iii) One Ph.D. research scholar under QIP has been guided,

## 7. Papers Presented in Conferences

### (i) Presented in Conferences held in India

<i>Sl. No.</i>	<i>Name</i>	<i>Title of paper</i>	<i>Name, Date and Venue of Conference</i>
1.	Dr. Nainan P. Kurian Mr. L. Vivekanandan	Banding analysis of a conical shell foundation by finite element	IASS - International Symposium on innovative Applications of Shells and Spatial Forms, Bangalore, Nov. 1988
2.	Dr. Nainan P. Kurian Mr. L. Vivekanandan	Ultimate Strength of Rectangular Hypar Shell Footings subjected to Vertical Loads and Moments	IASS - International Symposium on Innovative Applications of Shells and Spatial Forms, Bangalore, Nov. 1988
3.	Dr. N. R. Krishnaswamy Mr. N. Srinivasulu Reddy	Behaviour of Reinforced Earth under Triaxial Compression	First Indian Geo-textile Conference, I. I. T. Powai, Bombay, 8th to 9th Dec. 1988
4.	Dr. N. R. Krishnaswamy Mr. H. B. Raghavendra	Behaviour of Reinforced Earth under Direct Shear Test	First Indian Geotextile Conference, I. I. T., Powai, Bombay, 8th to 9th Dec. 1988.
5.	Dr. T. S. Ramanatha Ayyar	Bearing capacity of Sand Reinforced with Coir rope	First Indian Geotextile Conference on Reinforced Soil and Geotextiles, I. I. T., Bombay, Dec. 1988
6.	Dr. N. Indrasenan	Computer modeling of ground water pressure control in the mine area - A resume	3rd National Convention of Mining engineers, Neyveli 4-5, June 1988
7.	Dr. B. S. Thandaveswara	Flood Damage computation in Urban Area-A case study	International Seminar on Hydrology of Extremes Roorkee, Dec. 1-3, 1988
8.	Dr. H. Achyutha Dr. P. S. Rao Dr. M. S. Mathews	Assessment of impact resistance of ferrocement slabs	3rd International Symposium on Ferrocement, New Delhi Dec. 8-10, 1988,
9.	Dr. R. Radhakrishnan	Design of R.C. T.V. Towers	International Conference on multipurpose High Rise Towers, Bangalore, Oct. 1988.
10.	Dr. N. Rajagopalan	Parametric Study and comparison of cable stayed bridges	International Seminar on Cable Stayed bridges Bangalore 3-5, Oct. 1988
11.	Dr. V. Kalyanaraman Mr. V. Baburaj	Optimum Design of FRP Stiffened Plates	Seminar on Aero-space Structures, Advanced and Future Trends, NASAS-88, V. S. S. C. Trivandrum Nov. 15-16. 1988
12.	Dr. V. Kalyanaraman Mr. V. Baburaj	Structural Efficiency of Composite stiffened plates	Annual Symposium of the Aeronautical Soc. of India I.I.T., Madras. Dec. 19-21, 1988,



<i>Sl. No</i>	<i>Name</i>	<i>Title of paper</i>	<i>Name, Date and Venue of Conference</i>
13.	Dr. V. Kalyanaraman Mr. N. Vijayakumar Mr. B. V. Vijay Mr. P. Jayabalan	Local and Postbuckling Behaviour of Fibre Composite Plates	NASAS 89, ADE Bangalore, March 9, 1989.
14.	Dr. V. Kalyanaraman	Expert Systems in Civil Engineering	Technology Appreciation Programme on Expert system in Indian Industries, Feb. 7, 1989, I.I.T., Madras.
15.	Dr. V. Kalyanaraman	Expert Systems for Engineering of structures	ISRO Seminar on Expert Systems, Feb. 9-11, 1989.
16.	Dr. C. S. Krishnamoorthy	Expert Systems for Engineering Analysis and Design	ISRO Seminar on Expert Systems Feb, 9-11, 1989.
17.	Dr. V. Kalyanaraman	Application of Expert Systems in Structural Engineering	R and D Seminar Tata Consulting Engineers. Bangalore, March 8, 1989.
18.	Dr. D. Johnson Victor	Planning of Rail-Based Urban Transportation	Seminar on Role of Railways in the Development Process-Retrospect and Prospect, 29th Sep. 1988, Madras.
19.	Dr. S. B. Patnaik	Programming for an Optimal Urban Bus Transit Network Design	International Conference on Mathematical Modelling in Science and Technology, Aug. 1988, I.I.T. Madras.
20.	Dr. P. K. Aravindan Dr. P. Srinivasa Rao Mr. C. Natarajan	Behaviour of Cylindrical shells at Ultimate Stage	Symposium of the International Association for shell and special structures on "Innovative Applications of Shell and Special Forms," Bangalore, 21-25, November, 1988.
21.	Dr. P. Srinivasa Rao, Dr. P. K. Aravindan Mr. N. Surya Srinivas	Effect of Mullion stiffends on the Behaviour of Northlight Cylindrical Shells	Symposium of the International Association for shell and special structures on "Innovative Application of shell and Special Forms", Bangalore, 21-25, Nov. 1988.
22.	Dr. P. Srinivasa Rao Dr. P. K. Aravindan	300 m tall T. V. tower in concrete-tallest free standing structures in India	Seminar on "Recent Advances in Structural Engineering" JNTU Engg. College, Kakinada, 18-19, March, 1989.
23.	Dr. P. Srinivasa Rao Dr. P. K. Aravindan	Behaviour of Concrete under extreme temperature	National Seminar on "Advances in Concrete Technology", JNTU College of Engg., Anantapur, 27-28, March, 1989.

<i>Sl. No.</i>	<i>Name</i>	<i>Title of paper</i>	<i>Name, Date and Venue of Conference</i>
24.	Dr. C. S Krishnamoorthy	Three Dimensional Finite Element Models	Advanced Study Institute on Finite Element Analysis for Engineering Design, Proc. Lecture Notes in Engineering Vol. 37, (Ed.) J. N. Reddy, C. S. Krishnamoorthy and K. N. Seetharamu, Springer Verlag, Heidelberg, 1988 pp. 190-214
25.	Dr. C. S. Krishnamoorthy Mr. G. Narayanan	Geometric Non-linear Analysis of Framed Structures	Advanced Study Institute on Finite Element Analysis for Engg. Design, Proc. Lecture Notes in Engg., Vol. 37, (Ed.) J. N. Reddy, C. S. Krishnamoorthy and K. N. Seetharamu, Springer-Verlag, Heidelberg, 1988, pp. 215-248.
26.	Dr. C. S. Krishnamoorthy Mr. R. Krishnakumar	Knowledge Based Expert Systems for Finite Element Analysis	Advanced Study Institute on Finite Element Analysis for Engg. Design, Proc. Lecture Notes in Engg., Vol. 37 (Ed.) J. N. Reddy, C. S. Krishnamoorthy and K. N. Seetharamu, Springer-Verlag, Heidelberg, 1988, pp. 842-859
<b>(ii) Presented in Conferences Held Overseas</b>			
1.	Dr. N. Indrasenan	Analysis of Modernisation options for a tank irrigated system through digital simulation model	Asian Regional Symposium on Rehabilitation and modernisation of Irrigation and Drainage Projects, Manila 12-15 Feb. 1989
2.	Dr. P. Srinivasa Rao Dr. C. S. Krishnamoorthy	Reduction in Imposed Loads for the design of Beam and Column members in multi-storied buildings	ASCE-STD/EMD speciality conference and Structural Safety and Reliability, Virginia Polytechnic, USA, May 1988
<b>8. Research Publications</b>			
1.	Dr. Dierks K. Dr. N. P. Kurian	Zum Verhalten van Kugel-and Doppel-kegels chalenfundamenten unter zentrischer and exzentrischer Belastung	Bauingnier (Berlin), Volume No. 63, Issue No. 7, July 1988, p. 325-333
2.	Dr. H. Raman Mr. G. Ramkumar	Simulation model for analysis of waiting time of ships and berth occupancy in ports.	Journal of Institution of Engineers (India), Volume 68, MA 2, May 1988.
3.	Dr. H. Raman Mr Jobi V. Paul	Multi-objective multi-reservoir optimisation using goal programming	Indian Journal of Power and River Valley Development January 1989.

<i>S. No.</i>	<i>Name</i>	<i>Title of paper</i>	<i>Name, Date and Venue of Conference</i>
4.	Dr. N. Rajagopalan	Problems of Prestressing in a bridge deck.	Bridge and Structural Engg. Vol. 18, No. 3, Sept 1988.
5.	Dr. C. S. Krishnamoorthy	Optimal Design of Reinforced Concrete frames using Mathematical Programming, Chapter 4.3 in Engineering Design - Better Results through Operation Research Methods, Ed. Levary, R. R.	Elsevier Science Publishing Co., Inc. N.Y , 1988, pp. 226-250
6.	Mr. G. Narayanan Dr. C. S. Krishnamoorthy	A Simplified Formulation of a Plate/Shell Element for Geometrically Non-linear Analysis of Moderately Large Deflections with small rotations.	Finite Elements in Analysis and Design 4, Elsevier Science Publishing Co , North Holland, 1988, pp. 333-350.
7.	Mr. K. V. Balasubramanyam Dr. V. Kalyanaraman	Yield Line Analysis by Linear Programming	Jl. of Structural Engineering, ASCE, Tech. Note, Vol. 114 No. 6, June 1988, pp. 1431-1437.
8.	Mr. V. Baburaj Dr. V. Kalyanaraman	Structural Efficiency of Composite Stiffened Plates	Journal of Aeronautical Society of India, Vol. 41, No. 1. Feb. 1989, pp. 39-45
9.	Dr. V. Kalyanaraman Mr. N. B. Vijayakumar Mr. B. V. Vijay and Mr. P. Jayabalan	Local and Post-buckling Behaviour of Fibre Composite Plates	Jl. of Aeronautical Society of India, Vol. 41, No. 2, Mar-May 1989, pp. 131-144
10.	Dr. D. J. Victor	Road Accidents in India	IATSS Research Tokyo, Japan, Vol. 13 No. 1, Feb. 1989, 82-83.
11.	Dr. P. Srinivasa Rao Mr. A. Prasada Rao	Behaviour of Single Span Cylindrical Shells subjected to support.	Jl. of STR. DIVN, ASCE April 1988.
12.	Mr. S. C. Maiti, Mr. M. Rastogi Dr. P. Srinivasa Rao	Performance of Super-Plasticisers with Commercial blended cement in hot weather concreting	NCB-QUEST, May 1988. pp. 21-35-

#### 9. Books and Monographs brought out

1. Design of Foundation Systems : Principles and Practices (under preparation by Dr Nainan P. Kurian under a U.G.C. grant).
2. Microconcrete : The modelling material for concrete (under preparation by Dr. Nainan P. Kurian).

3. Continuing Education Module : Reinforced Soil Structures by Dr. T. S. Ramanatha Ayyar.
4. J. N. Reddy, C. S. Krishnamoorthy and K.N. Seetharamu (Edts.) Lecture Notes in Engineering-Vol. 37, 'Finite Element Analysis for Engineering Design, Springer-Verlag, Heidelberg, 1988.
5. Structures with Steel kneebraced trusses (without cranes)', Handbook on Typification of Industrial Structures, B.I.S. Project report.

#### 10. National and International Conferences/Symposium Organised :

As Organising Secretary, organised an international event, Advanced Study Institute on "Finite Element Analysis for Engineering Design" with support of National Science Foundation, U.S.A. and participation of eight leading Professors from U.S.A. and 130 Indian engineers. Held at I.I.T. Madras from 1st to 10th August 1988 (Dr. C. S. Krishnamoorthy)

#### 11. Short Term Courses/Continuing Education Programmes :

- a. Design and Construction of Tall Concrete Structures (4th to 8th April 1988) - Organised by NCB-IITM Joint Unit.
- b. Form work and scaffolding - Design and Practical Applications (29th - 31st August 1988) - Organised by NCB-IITM Joint Unit.

#### 12. Professional Activities :

Dr. Nainan P. Kurian

1. Life Member, Indian Geotechnical Society
2. Member, Research Review Committee, Public Works Department, Government of Tamil Nadu
3. Member, Foundation Engg. Sectional Committee, Bureau of Indian Standards, New Delhi

Dr. N. R. Krishnaswamy

1. Member, Indian Geotechnical Society
2. Member, Indian Society of Earthquake Technology
3. Member, Indian Society for Theoretical and Applied Mechanics

Dr. H. Raman was nominated as Co-ordinator for the preparation of Approach paper on Water Resources for Planning Commission.

Dr. H. Suresh Rao Member, American Geophysical Union

Dr. B. S. Thandaveswara Co-chaired one of the sessions, International Seminar on Hydrology of Extremes Dec. 1-3, 1988 Roorkee.

Dr. H. Achyutha Reporter of session on Housing Applications—3rd International Symposium on Ferrocement

Dr. V. Kalyanaraman Associate Member—American Society of Civil Engineers

Member—Institution of Engineers (India)

Dr. N. Rajagopalan Elected as a member of I.R.C. Sub Committee on Standardisation of Bridge Loading

Dr. D. Johnson Victor

1. Served as Co-Chairman for technical session at International Conference on Roads and Road Transport Problems, New Delhi, Dec. 12-15, 1988.

2. Elected as Vice Chairman, Indian Institute of Road Transport, (Tamil Nadu Branch).  
Dr. V. R. Rengaraju Member of Indian Roads Congress  
Dr. S. B. Pattnaik
1. Chaired a technical session at the National Conference on Transportation System Studies, I.I.T. Bombay, Dec. 1988.
2. Member, Institution of Engineers (India)
3. Associate, Institute of Town Planners, India
4. Life member, ISTE, India  
Mr. V. Thamizharasan Member of Indian Roads Congress  
Mr. M. Subbi Reddy Member of Indian Roads Congress

### 13. Invited Lectures

#### (i) By IIT Faculty in Other Institutions

- (i) Dr. T. S. Ramanatha Ayyar Two lectures at M. I. T. Manipal on Geotechnical Engg. During Sept. 1988 One Lecture : Geotechnical Solution to constructions problems on soft soils I. G. S. Madras Chapter Aug. 1988.
- (ii) Dr. V. Kalyanaraman Local and Postbuckling Behaviour of Plates NASAD-89, ADE Bangalore, March 1989.
- (iii) Dr. V. Kalyanaraman Expert Systems in Structural Engineering-Seminar Tata Consultancy Engineers, Bangalore, March 1989
- (iv) Dr. C. S. Krishnamoorthy Lectures on Finite Element Analysis to Engineers of BHEL units at Trichy, Hyderabad and Bhopal.
- (v) Dr. D. Johnson Victor Lecture on 'Transportation in Japan' to Indian Institute of Road Transport (Tamil Nadu Branch), Madras on 10-8-1988.  
  
Keynote Address on Road Safety, Highways Research Station, Madras on 10-6-1988.  
  
Lecture on Road Safety at 'Road Safety Seminar' arranged by Govt. of Tamil Nadu at Rajaji Hall, Madras on 10-6-1988
- (vi) Mr. S. Rajeev Lecture on 'Computer Aided Design in Civil Engineering, at National Institute of Port Management, Madras, January 1989.

#### (ii) By Distinguished Visitors to IIT

1. Mr. Paul Nicholson of U. K. gave a special talk on 'Architectural Management in the Indian Continent'
2. Dr. K. Shanmuganathan, Chief of Overseas Development Unit, Wallingford Station presented a seminar on 'Irrigation Management in Developing countries' on 25-3-89

### 14. Visitors to Department

1. Dr. S. Sarkar, Head of the Dept. of Civil Engineering, Dundee University, U. K.

2. Mr. Mario Picho of UNCHS, Nairobi, Venga
3. Dr. Shanmuganathan, Chief of Overseas Unit, Wallingford, U. K.

#### 15. Staff Matters

1. Prof. Harihar Raman was nominated to the Expert Committee on Water Resources to finalise the 8th Five year plan document by the Planning Commission.
2. Prof. Harihar Raman served in the Review Committee appointed by Kerala Government to review the working of the Centre for Water Resources in Kerala.
3. Prof. Harihar Raman co-ordinated and prepared the 'Approach paper on Water Resources' which was presented to the Planning Commission in April 1988
4. Dr. N. Rajagopalan Chairman GATE 1989.
5. Dr. V. Paramasivam is in West Germany on sabbatical leave.
6. Dr. D. Johnson Victor was nominated as Member, Expert Group on 'Water Transport in India', constituted by Science Advisory Council to the Prime Minister.
7. Dr. D. Johnson Victor has served as one person Review Committee to evaluate M. E. Course in Urban Engineering at Anna University.
8. Prof. P. Srinivasa Rao has served as Senior Humboldt Fellow at the University of Karlsruhe, West Germany (Oct. 87-Sept. 88)
9. Prof. P. Srinivasa Rao has served as Visiting Professor at the Washington Univ, St. Louis, USA. (Oct-Nov. 88).

#### 16. Future Plans

Development of expertise in the following areas are planned.

1. Hollow block wall systems-analysis, Testing and design.
2. Development of Expert system for building repair and maintenance problem.
3. Analytical and experimental studies in Noise pollution.
4. Finite Element Analysis of the elastic behaviour of hyperbolic paraboloid individual rectangular shell footings, combined shell footings and shell rafts.
5. Geosynthetics and their effective use in solving difficult Geotechnical problems.
6. Soil-Structure interaction studies using F.E.M. and Experimental techniques.
7. Analytical and Experimental investigations on problems involving Soil Dynamics and Machine Foundations.
8. Expert Systems in Water Resources Management and Multi-objective Multi-reservoir optimisation.
9. Develop expertise on Bridge structures of various types.
10. Develop expertise on the study of behaviour of RC and PSC elements under various loadings
11. Software Development in the area of Transport planning and Traffic Engineering.
12. Travel Demand Modelling

## COMPUTER SCIENCE & ENGINEERING

### 1. Sponsored Projects :

<i>Title</i>	<i>Agency</i>	<i>Coordinator</i>
1. Information Technology	MHRD	C. R. Muthukrishnan
2. Speech Oriented Learning System for a Handicapped - An aid for communication with hearing impaired persons	DCE	B. Yegnanarayana R. Sundar
3. Algorithms for Signal Reconstruction in Acoustic Imaging	DOE	B. Yegnanarayana Hema Murthy A.
4. Teaching graphics	MHRD	H. N. Mahabala

### 2. Consultancy Projects :

1. Computer Science - AI facilities for Institute of Mathematical Sciences (Dr. C. R. Muthukrishnan).
2. Development of Bilingual LCD Display Module for Facit Asia Ltd, Madras (Dr. S. Raman).
3. Retainer Consultancy for TCS, TCE, TELCO, SRA, Peacock, CMC (Dr. H. N. Mahabala).

### 3. Research Publications

1. Dr. C. R. Muthukrishnan, "Extension to PLITS and Applications", IFIP Proceedings WG 10.3 on Distributed Processing, North Holland, 1988.
2. Dr. C. R. Muthukrishnan, "Congestion Control in Multitop, Multiaccess Computer Networks", pp. 883-887, ICCS - 88, IEEE.
3. Dr. R. Kalyanakrishnan, "Real-time Applications and Process Control", Western Regional Conference, Computer Society of India, Goa, September 9, 10, 1988. (Invited Paper).
4. B. Yegnanarayana, K. V. Madhu Murthy and Hema A. Murthy, "Applications of Group Delay Functions in Speech Processing" JIETE, Special Issue on Speech Processing Vol. 34, Jan-Feb 1988.
5. Kamala Krithivasan and V. Srinivasan, "Time Varying Pushdown Automata", International Journal of Computer Mathematics, 24, pp 223-236, 1988.
6. S. V. Raghavan, B. Prabhakaran and R. C. Paramar, "DIMS an Implementation Experience", Proceedings of DEFCAP '88 (Bangalore).
7. Maj. G. S. Lamba, "Dynamic encryption scheme", Proceedings of DEFCAP '88.

### 4. Books / Monograph brought out :

"FORTRAN MADE EASY" written by Mr. Dheenadayalu and published by M/s. Tata McGraw Hill Publishing Company.

### 5. Awards and Honours :

Dr. (Mrs) Vijayalaxmi Sirohi was awarded Hari Om Ashram Prerit Baikala Inter University Smarak Trust Prize.

### 6. Professional Activities :

1. Dr. C. R. Muthukrishnan was a member of Managing Committee, IIT Madras Campus Educational Society, Faculty Adviser, SAC, Chairman, Committee for Telematics Project.

2. Prof. B. Yegnanarayana chaired a session at ICCS-88 conference in Singapore and Indo-US workshop in Bangalore and was Honorary Editor for JIETE.
3. Dr. Mrs. Kamala Krithivasan was a member of Board of Studies in Computer Science for Sriparasakthi College for Women, Cuttralam.
4. Dr. S. Raman elevated as Senior member of IEEE.
5. Dr. S. V. Raghavan was Chairman, Programme Committee, CSI '88 Annual Convention.
6. Mr. R. Dheenadayalu was appointed as Reviewer for Books on Computer Science for Schools by Tamilnadu Text book society.
7. Dr. H. N. Mahabala attended Fifth Generation Conference in Tokyo in November 1988.
8. T. K. Suresh and S. V. Raghavan, "Waiting Time Calculation Token Ring Network with New Strategy", Proceedings of ICCS '88, Singapore (31st Oct 1988 - 3rd Nov 1988).
9. S. Jayaprakash and S. V. Raghavan, "FIAM—An Implementation Point of View", Proceedings of ICCS '88, Singapore (31st Oct 1988 - 3rd Nov 1988).
10. S. V. Raghavan, R. S. Kripanandan and B. Prabhakaran, "Interfacing Time Sharing Host with Local Area Networks", Proceedings of COMNET '88 held at Hyderabad during 30th September 1988 and 1st October 1988.
11. C. Siva Ram Murthy and V. Rajaraman, "Multiprocessor Architectures for solving PDEs", Journal of the IETE, Vol. 34, No. 3, pp. 172-184, 1988.
12. C. Siva Ram Murthy and V. Rajaraman, "A Multiprocessor Architecture for Solving Nonlinear Partial Differential Equations", Mathematics and Computers in Simulation, Vol. 30, No. 5, pp. 453-464, 1988.
13. C. Siva Ram Murthy and V. Rajaraman, "On the Assignment of Precedence and Communication-costrained Tasks in a Multiprocessor System", Presented at the SEARCC '88, New Delhi, November 28 - December 1, 1988.
14. H. N. Mahabala and G. Raviprakash, "Auxillary Tools for Rule Based Systems", Journal of the IETE, Vol. 34, No. 3, 1988.



## ELECTRICAL ENGINEERING

### 1. New courses introduced during the year :

1. EE742, Optical Communication Network, UG by Dr. A. Jhunjunwala
2. EE421, Introduction to Digital Signal Processing, UG by Dr. V. Venkata Rao
3. EE477, Applications of Graph Theory to Network, UG by Dr. V. G. K. Murti
4. EE744, Advance in Fibre Optics and Photonics, UG/PG, Dr. J. P. Raina

### 2. Research and Development Activities :

#### Power Systems :

- i) Electronic Instrumentation of Power Systems
- ii) Multivariable design, Power Systems operation and Control High Voltage

#### High Voltage :

- i) Pollution Performance under HVDC stress
- ii) HVDC Transmission Systems
- iii) High voltage breakdown in synthetic solid insulating materials.

#### Fibre Optics, Telematics :

- i) Rural Radio Communication Systems
- ii) Speech coding, ultrasound Imaging, Digital Communications and ECG Compression
- iii) Wireless Communications and ECG Compression Telephone sharing systems, Fibre Optic Communication Systems.

#### Control and Guidance :

- i) Speech Synthesis for Robots
- ii) Identification of Discrete-data Systems
- iii) Robotics and Robot vision

#### Semiconductors :

- i) GaMOS studies, High voltage Field Plate Structure devices, High Voltage BJT Fabrication
- ii) BC MOSFET modelling
- iii) Thin film MOSFET analysis

#### Machines & Drives :

- i) Over voltage studies in NLC 400 KV Systems
- ii) Study of Homopolar Generators for Pulsed Power Applications
- iii) Studies on switching transients of large 3 phase induction motors
- iv) Field calculations for special purpose electric machines
- v) Smart Induction motor controller
- vi) Simulation of Power Electronic Circuits and Systems
- vii) Stability analysis of solid-state Power converters.
- viii) Digital Simulation of Power Electronic Circuits and Systems.

#### Microwaves and High Frequency Techniques :

- i) Direct reception of satellite signals using Fin-line technology
- ii) Line of sight propagation on control routes near Madras.

#### T. V. and Image Processing :

- i) Development of compatible digital F. O. C. system
- ii) Optical couplers

- iii) Fibre Optics Systems Application in Service Sector
- iv) Low Bit Rate Colour TV
- v) Development of CCD B & W and Colour cameras.

### 3. New facilities and Equipment :

#### High Voltage :

Additional components to HV Bankasten Units were procured from M/s. MWB India Ltd., Bangalore.

#### Robotics :

- i) Computer Vision System
- ii) Vision assisted Robots

#### Semiconductors :

- i) Plasma Deposition Equipment

#### Electrical Machines :

- i) Yokogawa 4 channel Analysing Recorder
- ii) TERCO A/C motor Control Unit with Vector visualizer
- iii) 'SCAMPT' software from Univ. of California
- iv) Power Scope, Digital Storage Oscilloscope, Smart Induction Motor controllers Power Transistor Inverter

#### High Frequency Technology :

- i) A down converted in-fin-line technology fabricated.
- ii) A Gunn Oscillator in Microstrip Configuration, in x-band. 10 GHz

#### Measurements :

- i) LOGIC Analyser (32 BIT) DAS work station
- ii) Precision Hi-tester

#### T. V. & Image Processing :

- i) Uninterrupted Power Supply 2.5 KVA
- ii) Large screen projection system (sony)

### 4. a) Sponsored projects :

- i) REF : LEE 31 DST 87-88 AK and KR power system simulator for training and testing at Energy Management Center, funded by Dept. of Science and Technology, 2 years - Prof. A. Kuppurajulu and Dr. K. Ramar.
- ii) REF : EE/34/TRC/88-89/BR & AJW  
Development of TDMA for Rural Communication Radio system, funded by Telecommunication Research Center, (25 lakhs) (2 years), - Dr. Bhaskar Ramamurthi and Dr. Ashok Jhunjunwala.
- iii) REF : NPS Project, Robotics,  
Ministry of Education, 15 lakhs, (2 years) - Dr. V. Seshadri.
- iv) EE 32/DOE/88-89/KNB  
Process Simulator Studies on LPCVD polycrystalline Silicon for multilayer structures, funded by DOE (3.93 lakhs), (2 years), Coordinators : Dr. K. N. Bhat, Dr. M. K. Achuthan, Dr. G. Sridhara Rao and others.
- v) EE/36/DCE/88-89/KNB  
LPCVD Polycrystalline Silicon MOSFET Technology for 3-D Integration funded by DOE, (36.77 lakhs), (3 years), Coordinators: Dr. K. N. Bhat, Dr. M. K. Achuthan and others.

- vi) EE/33/CBIP/87-88/SSY  
Reswitching Transients and their effect on the Design application of large induction motors for thermal power plant Auxiliary Drives (6 lakhs) (2 years) funded by Central Board of Irrigation and Power —  
Coordinators: Prof. S. S. Yegnanarayanan, Prof. G. Sridhara Rao, Dr. C. Venkateshaiah and Dr. S. Narayanan
  - vii) EE/29/DAE/86-87/SSY & BSP  
Homopolar Generator for Pulsed Power Applications, funded by Dept. of Atomic Energy, BARC Bombay (1 lakh) (3 years)  
Coordinators: Prof. S. S. Yegnanarayanan and Prof. B. S. Prabhu
  - viii) 07/18/TRC/81/DKB & VS  
VHF, GHF Propagation studies, funded by Telecommunication Research Center, (23.55 lakhs) (5 years).  
Coordinators: Prof. D. K. Banerjee and Mr. V. Subramanian
  - ix) EE/30/DOE/87-88/VVS  
Simulation of Power Electronic Circuits & Systems. Funded by DOE (19.5 lakhs) (3 years)  
Coordinator: Prof. V. V. Sastry
  - x) TV/JPR/CCD/32/88-89  
Black and White Colour TV Cameras, funded by IRDE Dehradun (1.1 lakhs) (1 year), Dr. J. P. Raina
- b) Completed Sponsored projects :
- i) 07/19/ARDB/VS/82  
Signal processing Techniques for Missile Guidance, ARDB, (19 lakhs) (5 years), Prof. V. Seshadri
  - ii) 13/05/ARDB/VS/78  
Signal Processing Technique for 3G platform, ARDB (3 lakhs) (3 years)—Prof. V. Seshadri
  - iii) a) ARDB Project  
Fibre Optic Communication System for Vijayanta Tank, (14.7 lakhs), (3 years)
  - b) IRDE Project, Low Noise Amplifiers (1 lakh)
  - c) Study of Dispersion of impulse response characteristics of fibres and Development of Automatic measurement unit (4 lakhs) — Prof. J. P. Raina

## 5. Major Consultancy :

### Power Systems :

- i) Development work for M/s. English Electric Co. Ltd. (India) — by Dr. A. Kuppurajulu & Dr. K. Ramar.
- ii) Over voltage studies for NLC 400 KV Systems for Neyveli Lignite Copn. — Prof. A. Kuppurajulu, Prof. G. Sridhara Rao, Dr. C. Venkateshaiah and Dr. K. Ramar

### High Voltage :

- i) Design of 300 KV Impulse Generator for M/s. PS Industrials, Madras — by Prof. Y. Narayana Rao
- ii) Lightning Performance studies for ASLV Launching Facilities for ISRO Sriharikota — by Prof. Narayana Rao & Dr. C. Venkateshaiah

### Semiconductors :

- i) Polycrystalline silicon solar cells, for Corporate R & D division of BHEL Hyderabad by Prof. K. N. Bhat

#### **Machines & Drives :**

- i) **Homopolar Generator for Electromagnetic Guns, for Armament Research and Development Establishment, Pune, by Dr. S. S. Yegnanarayanan.**
- ii) **Noise Sources and some abatement measures for induction motors by Dr. V. V. Sastry for M/s. Jyoti Ltd., Baroda.**

#### **Measurements :**

**Power Loss Measurements in 3 Phase Bus Ducts for BEST & CROMPTON by Dr. P. Sankaran, Dr. VGK Murti and Dr. V. Jagadish Kumar.**

#### **Telematics :**

**Wireless Multi-access Messaging system for M/s. Intelligent Communications Equipment Dr. A. Jhunjhunwala and Dr. B. Ramamurthi**

#### **TV & Image Processing :**

- i) **Development of Fibre optic cable systems for power line applications for W. S. Insulators Ltd., Madras**
- ii) **Retainer consultant to Dinesh Mills Ltd., Baroda — Dr. J. P. Raina**

#### **6. Assistances to sister institutions :**

**Dr. Y. Narayana Rao**

**Assisted Anna University in Curriculum revision**

**Dr. K. N. Bhat**

**Network National Program on Process Simulation Development :**

**MIT and Institute of Human Resource Development for Electronics, are working as networking Institutions with IIT Madras as the node**

**Dr. G. Sridhara Rao**

**Co-ordinator, Network Program with REC Warangal**

#### **7. Patents :**

1. **Dr. V. Seshadri**  
**Microprocessor based Land Navigator, P. No. 157226**
2. **Dr. V. V. Sastry**  
**Microprocessor based Smars Induction Motor Controller.**

#### **8. Conferences Attended :**

1. **V. Alamelu, R. Sethuraman and M. Mukundarao**  
**Equatorial Electrojet reversals and their Relation to Polar cusp movemets during Geographic Storms, July 1988, XXVII COSTAR Symposium held at ESPOO, Finland.**
2. **B. Ramamurthi and S. Grandhi**  
**A spread spectrum wireless LAN for Indoor Wireless Communication, Jan. 1988, Bangalore.**
3. **S. David & B. Ramamurthi**  
**Two sided filters for frame - based prediction, Nov. 1988, TIFR, Bombay.**
4. **V. Seshadri and T. V. Ramamurthi**  
**Automated aid for Microcomputer implimentation of Flight Control System, 1988, Coimbatore.**
5. **K. N. Bhat, PPS. Rao and Nandita Basu**  
**MOS studies on Gallium Arsenide using high pressure thermal oxidation, Dec. 1988. International Conference on Semiconductor Materials, Delhi.**

6. R. Prabhakar, S. Sundarasekharan and S. S. Yagnanarayanan, Design, Construction and Testing of 20 m<sup>3</sup>/h Flat Linear Induction Liquid Sodium Pump - 1988, 4th Intl. Conf. on Liquid Metal Engg, PARIS, FRANCE.
7. D. K Banerjee, V. Subramanyan, R. Ramasubramanian, VHF, UHF Propagation in Coastal Routes, Dec. 1988, National Seminar on Microwave Propagation & Antennas Cochin Univ. of Science and Technology.
8. P. Sankaran & V. Jagadesh Kumar, 'Balancing of low power factor three phase three wire load, using feed back amplifiers, OCT. 1988 IEEE Conference on Electricity distribution and Energy Management, Singapore.
9. V. V, Sastry,  
PC's help design of Electrical Machines, 1988 National Symposium on Personal Computers BARC Bombay.

#### 9. Research Publications :

1. K. Ramar, M. Krishnamurthi & M. S. T. Manipaul  
A New Generalized Approach to Fault Analysis of High Phase order Transition Systems 1988, Electric Machines and Power Systems, pp 49-62, Vol. 15.
2. K. Ramar and A Srinivas  
An efficient power system stabilizer design for multimachine systems, 1988, Electric machines and Power Systems pp 411-423 Vol. 15.
3. K. Ramar and S. Velusami  
Design of Decentralized load frequency controllers using pole-placement techniques, 1989, Electric Machines and Power Systems, No. 3, Vol 16.
4. G. Umamaheswari, RC Sekar, A. Jhunjunwala and C. Eswaran  
A signal Processing workstation on the VME Bus, Vol. 3, No. 7, IETE Journal.
5. A. Jhunjunwala, Umamaheswari G and C. Eswaran  
Signal Processing Implementation with Dual-bank Memory 1988 Microprocessors and Microsystems, pp. 206-210, Vol. 12, No. 4.
6. A. Jhunjunwala and Elizabeth Elias  
Analysis of Planar Bulk Acoustic wave Devices 1988 Electronic Letters, pp. 240-242, Vol. 24, No. 4.
7. MVC Rao and P. Subba Raj  
New and efficient unidirectional search, for optimization, 1988 Engineering Optimization, pp 293-305 Vol. 13.
8. S. Karmalkar and K. N. Bhat  
A process-parameter based circuit simulation model for iron-implanted MOSFETs and MESFETs, 1989, IEEE Journal of Solid State Circuits.
9. S. Karmalkar and K. N. Bhat  
A single C-V method to extract the correct equivalent box and the Gaussian representation of Channel doping profile and the flat band voltage of BC MOSFETs 1988, Solid State Electronics (UK), pp 1567-1572, Vol. 31.
10. Nandita Basu and K. N. Bhat  
High Pressure Oxidation of Si ( 00) for production of Ultrathin Oxide Metal Insulator Semiconductor Diodes, 1988, Thin Solid Films (UK) pp 243-257, Vol. 156.
11. Nandita Basu and K. N. Bhat  
High Pressure Thermal Oxidation of - GaAs in an Atmosphere of Oxygen and Water Vapour, 1988 Journal of Applied Physics pp 5500-5506, Vol. 63, No. 5.
12. Saibaba Reddi, M. Lakshmi Prakash and Vedam Subramanyam State Space Approach for the Analysis of Multiple inverter fed 3-phase induction-motor, 1989, Journal of IE.

13. P. Sasidhara Rao and V. Ramachandran  
Evaluation of Performance criteria of the CSI, IM Drive System, 1988 IEEE Trans. on Industrial Electronics.

14. P. A. Janakiraman and K. V. Ranga Rao  
Identification of Linear Modulated FM Signal via a new Recursive Modified Error-Response Method, Oct 1988, IEEE Transactions on Acoustics, Speech and Signal Processing Vol. 36, No. 10.

**10. Books, Monographs, Reports :**

1. Fibre Optic Communication Educator kit, (FOCE - 01) 1988 Dr. A. Jhunjhunwala and Dr. Bhaskar Ramamurthi
2. Thyristor Control of Electric Drives 1988, Dr. Vedam Subrahmanyam
3. Analysis of the propagation data in the VHF/UHF bands on a Coastal Route 1988, Tech. Reports Vol. 5,6,7,8,9,10 Dr. D. K. Banerjee, V. Subrahmanyam, N. Ramasubrahmanian.

**11. International Conferences Organized :**

Dr. M. Mukunda Rao was one of the Coordinators for the workshop on 'Fibre Optic Communications' held in Italy in March 1988.

**12. Short Term Courses :**

1. Fibre optic Application in Service Sector, April 1988.
2. Principles of Telematics Intensive Course on Digital Tech. Dec. 1988
3. Cellular Radio Mobile Communications Jan. 1989.
4. Power Electronics for CFL Engineers, Inhouse program, Sept. 1988.
5. Intensive Short term course on Fibre Optics and applications in Service Sector, April 1988.
6. Present and Future Developments on T. V. Technology in India, May 1988.

**13. Awards and Honours :**

VASVIK Award 1987, received by Dr. V. V. Sastry in Electrical Sciences and Technology.

**14. Professional activities :**

1. Dr. B. Ramaswamy, Member of Advisory Committee of the Ministry of Energy for the research scheme on 'Reswitching Transients and their effects on Design and Operation of Large Induction Motor Drives for Power Station Auxiliaries.
2. Dr. V. G. K. Murthi, Honorary Editor, IETE Journal, Circuits and Systems.
3. Dr. K. Ramar
  - i) Member, Board of Studies in Electronics, Electrical and Communications in PSG College of Technology, Coimbatore.
  - ii) Member, Board of Studies in Electrical and Electronics Engg. REC Trichy.
4. Dr. V. V. Sastry
  - i) Retainer Consultant  
Kaybee Powelec, Madras and  
Karuganti Computers Pvt. Ltd. Madras.
  - ii) Project consultant  
Alkali Metals Pvt. Ltd., Hyderabad and  
India Cements Ltd., Madras.
5. Dr. J. P. Raina
  - i) Chairman of TDC Working Group of DOE, Digital T. V.
  - ii) Adviser, Ministry of HRD, Anna University.

#### **15. Invited Lectures by the Faculty :**

1. Dr. S. S. Yegnaranayanan  
Basic Principles of Calculation of Electromagnetic fields, forces, inductances, short-term course on superconductivity - Fundamentals and Applications, BHEL, Trichy.
2. Dr. Vedam Subrahmanyam,
  - i) Microprocessor based protection systems  
College of Engg., Anantapur
  - ii) Non Conventional Energy Systems  
College of Engg. Anantapur
3. Dr. K. N. Bhat  
Recent Advances in LPCVD IVS,  
National Conference on Vacuum Science  
Dec. 1988, IIT Bombay
4. Dr. P. A. Janakiraman  
Robotics and Applications  
M. I. T., Madras.
5. Mr. M. Krishnamurthi  
Switchgear and Control gear  
Ministry of Commerce, Govt. of India
6. Dr. V. V. Sastry  
Smart Induction Motor Controllers  
Institution of Engineers at Kalpakkam

#### **16. Distinguished Visitors :**

1. Prof. P. Buchner, Dresden Univ. W. Germany
2. Dr. N. B. Singh, Washington Corporation, Pittsburgh USA
3. Dr. K. Shivanandan, Naval Research Lab., USA
4. Dr. J. Otto, University of Karlsruhe, West Germany
5. Dr. V. Balaramurthy, R & D, General Motors Ltd., USA
6. Dr. K. Tulasiraman, Concordia Univ., Canada
7. Prof. M. Mitsumoto, Shinshee Univ, Japan
8. Dr. S. Seinecke, Siemens, FRG
9. Dr. V. Rajagopalan, Univ. of Quebec, Canada
10. Prof. K. R. Rao, Univ. of Texas, USA
11. Dr. Balaji Swaminathan, Advanced Micro Devices, USA
12. Prof. Gerhard Grau, Institute of High Frequency Techniques, West Germany
13. Prof. Messerle, Univ. of Sydney, Australia
14. Dr. Krishna V. Prasad, 3C Systems, Madras.

#### **17. LECTURES BY DISTINGUISHED VISITORS :**

1. Electromagnetic Interferences due to Power Electronic Converters by Prof. P. Buchner
2. Characterization of In house Hybrid Arrays by Dr. K. Shivanadan
3. Optoelectronic methods by Dr. N. B. Singh
4. Power Electronics in Automobile Industry by Dr. V. Balaramurthy
5.
  - i) Reachability problem on Marked Graphs
  - ii) Distributed Algorithm Design for shortest path problem in Networks with negative weights by Dr. K. Tulasiraman

6.
  - i) Magnetic Recording Media
  - ii) Soft Magnetic Materials for recording heads
  - iii) Magnetic Measurements and Test Instruments
  - iv) Technical Education in Japan by Dr. M. Matsumoto
7. Error Reduction in Nuclear weighers by Dr. J. Otto, Karlsruhe
8.
  - i) High speed Fibre Optic Data Transmission
  - ii) Technology of large computer frames by Dr. S. Seinecke
9. Computer aided Analysis of Power Electronic Systems by Dr. V. Rajagopalan
10. HVS Weighted Progressive Image Transmission by Prof. K. R. Rao
11. Semiconductor memory by Dr. Balaji Swaminathan
12. A General Approach to treatment of Energy Conversion Theory and Processes by Dr. H. K. Messerle
13. Energy Management System by Dr. Krishna V. Prasad
14.
  - i) Principles of Coherent Communications
  - ii) Analysis of coherent digital receivers by Prof. Gerhard Grau

**18. Staff Matters:**

- i) Dr. M. Mukunda Rao was a visiting professor for one year at the Institute for Advanced Studies, University of Malaysia.
- ii) Dr. B. S. Bhanumurthi retired from Service.

**19. Future Plans:**

**Semi Conductors :**

- i) LPCVD Process development for MOSFET Technology on polysilicon for 3-D integration
- ii) GaAs and InP MOS studies for FET applications.

**Machines & Drives :**

- i) Field Calculations for 6 tesla Super-conducting Magnet for MHD research
- ii) It is proposed to hold an IEEE Sponsored Workshop on 'Large HT Motor Failures and their analysis
- iii) Computer applications for Motor drives.

**High Voltage, Fibre Optics :**

Development of Ground wires with Fibre Optic cables embedded inside

**Laser & Aeronomy :**

- i) To set up a satellite beacon signal receiving equipment for ionosphere studies
- ii) Laser cancer Therapy

**T. V. Engg. Lab :**

- i) Fibre Optics Communication activities are to be expanded
- ii) Development of CCD Cameras



## HUMANITIES & SOCIAL SCIENCES

### 1. New Courses introduced during the year :

<i>Sl. No.</i>	<i>Course No.</i>	<i>Title</i>	<i>Offered to</i>	<i>faculty offering the course</i>
1.	HS 735	Forecasting Methods and Applications	M. Tech Students	Dr. L. S. Ganesh Dr. R. Malathy
2.	HS 819	Advanced Topics in Production Management	Ph.D. Scholars	Dr. T. T. Narendran
3.	HS 340	Computers and Society	B. Tech Students	Dr. R. Rajagopalan
4.	HS 133 H	Outlines of Indian Society & culture in its Historical perspective	B. Tech Students	Dr. C. Ramachandran & Dr. Veeraraghavan
5.	HS 134 H	Indian National Movement and the Constitutional Development of India 1858-1950	B. Tech Students	Dr. C. Ramachandran & Dr. Veeraraghavan
6.		German Studies-I		Dr. B. Subramaniam

### 2. Research & Development Activities :

1. Dr. Dipak Chaudhuri — Coordinator (Reliability Engineering) under New Plan Scheme for Developing of Infra Structure in the areas of Emerging Technology.
2. Dr. Elizebeth N. Kurian — Research - "Dialectic of the Active and the contemplative in the Religion's Vision of T. D. Salinger"
3. Dr. Evageline Manickam — Two Ph.D. Synopsis submitted :  
M. Saxena (September 1988)  
R. Kokila (January 1989)

### 3. Sponsored Projects : (Taken up during the year)

<i>Sl. No.</i>	<i>Title</i>	<i>Funding agency &amp; value</i>	<i>Period</i>	<i>Co-ordinator(s)</i>
1.	"Evaluation of Technical Education in Tamil	Tamil Nadu Council for Science and Technology, 18 lakhs	1987-1989	Dr. R. N. Anantharaman
2.	"Developing of Infra structure in the areas of Emerging Technology"	Ministry of Education 10 lakhs	From 14-12-88	Dr. Dipak Chaudhuri
3.	"Strategies to arrest the phenomenon of dropouts in primary schools"	TNSCST. 3.6 lakhs	1987-1990	1) Prof. K. Ramakrishnan Bharathiar School of Management., Coimbatore, & 2) Dr. L.S. Ganesh

#### 4. Assistance to Sister Institutions

Dr. S. Ambirajan : Member of

- 1) Academic Council, Madras Institute of Development Studies, Madras
- 2) Academic Council, Stella Maris College, Madras
- 3) Board of Studies, Tamil Nadu Institute of Labour Studies, Madras
- 4) Board of Studies in Economics, Jawahar Bharati, Kavali, Andhra Pradesh
- 5) Executive Committee, Sri Aurobindo Institute of Social Sciences, Pondicherry

#### 5. Papers presented at Conference attended :

<i>Sl. No.</i>	<i>Name of faculty member attending the Conference</i>	<i>Title of paper presented and authors</i>	<i>Name, Dates and Venue of Conference</i>
1.	Dr. S. Ambirajan	a) 'The content of Technical Education in South India' paper presented to the Indo-Australian Seminar on Science & Empire organised by NISTADS (a division of CSIR, New Delhi)	9 - 11 May 1988
		b) 'Indigenous Technologies in India in Historical Perspectives' VIII Science Research Seminar in Tamil Gandhigram Rural University, Gandhigram	27 - 28 August 1988
		c) 'Issues in the Economic History of India in the Nineteenth Century' in Seminar on 'New Frontiers in Economics' Kerala University	27 - 28 October 1988
		d) 'The Economist and Future' National Level Winter School in Futurology, Bharatidasan University, Tiruchirapalli.	7 - Jan. 1989.
		e) 'Food, Famine and Hunger in Tamil Nadu 1850-1900' Seminar on 'Aspects of Structural Changes in the colonial Indian Economy'	Jamia Millia Islamia and Nehru Memorial Museum, New Delhi 3-6 March 1989
		f) 'The changing Attitudes towards Business in India 'A Long View' Seminar on 'Business and Politics in India' : A Historical perspective	Indian Institute of Management, 29-31 March '89 Ahmedabad

<i>Sl. No.</i>	<i>Name of faculty member attending the Conference</i>	<i>Title of paper presented and authors</i>	<i>Name, Dates and Venue of Conference</i>
2.	Dr. R. N. Anantharaman	a) 'Certain Correlates of Physical health in Old Age' at VGC Seminar on "Gerontology" b) Seminar on Statistical Analysis - Dr. John Hunter Michigan Univ. USA	June 1988 S. V. University, Tirupathi  8th June 1988
3.	Dr. Dipak Chaudhuri	1) "Computer-aided heuristic scheduling of jobs in a Flowshop" accepted for publication and presentation" 2) "Flowshop scheduling problem with two performance measures" 3) Two papers presented in the Annual Convention of Indian Institution of Plant Engineering a) "Replacement Policies for a system with Assured Reliability" b) "Probabilistic approaches to Design and Maintenance of Equipments"	Third International Conference on 'Computer-aided Production Engineering' at Ann Arbor, Michigan, USA in June 1988.  International Conference on 'Mathematical Modelling in Science and Technology at Madras, August' 88  Jamshedpur Nov. 26 - 27, 1988
4.	Dr. Elizabeth N. Kurian	"Religion and Conservation in the fiction of J. D. Salinger"	XXIII Annual Conference of the Indian Association for American Studies., ARC., Hyderabad Feb. 22-24, 1989
5.	Dr. Evangeline Manickam	"Religion and Conservation in America: J. F. Powers Use of the Roman Catholic Church as a Strategy for Fiction"	Indian Association for American Studies 23rd Annual Conference Feb. 18-22, 1989
6.	Dr. L. S. Ganesh	"Stochastic models of school enrollments"	National Systems Conference Dec. 1988, Coimbatore
7.	Dr. A. V. Krishna Rao	"Ethnic Encounters in a) E. M. Forster's <b>A Passage to India</b> and K. Markandaya's <b>Nowhereman</b> "	A. I. E. T. Conference, Nov. 26 to 28, 1988 Shivaji University, Kothapur

<i>Sl. No.</i>	<i>Name of faculty member attending the Conference</i>	<i>Title of paper presented and authors</i>	<i>Name, Dates and Venue of Conference</i>
7 (Contd.)		b) "Structure & symbolism in Paul Scott's Raj Quarter" in Collaboration	— do —
		c) "Subjugation of women: A Historical Perspective."	Mother Teresa Women's University, Kodaikanal March 8, 1989.
8.	Dr. V. R. Muraleedharan	a) "Nutrition and Health in Madras Presidency during the interwar years"	National level seminar on 'Structural Changes in the Colonial Indian Economy' New Delhi, 3-6 March 1989
		b) "Some observations on the Colonial Governments Responses to Changing Medical Views in Colonial India."	Indo-Australian Seminar on Science and the Raj. India and Imperial Expectations 1800-1950, New Delhi 9-11 May 1988
		c) "Pharmaceutical Industry in Colonial South India"	International Conference on the "History of Pharmacy Athens (Greece) April 1989
		d) "Development of preventive Health care in Colonial South-India. The case of Malaria in the Madras Presidency during Inter-war years."	National Seminar on "Economic History of South India, Trivandrum April 1988
9.	Dr. R. Rajagopalan	"Stochastic models of school enrolments"	National Systems Conference, Dec. 1988, Coimbatore.
10.	Dr. C. Ramachandran	1) Problems of a "Cleancity" History of Private Conservancy in the City of Madras, 1885-1925.	49th session of the Indian History Congress held at Karnataka University, Dharwar Nov. 2-4, 1988
		2) Trends in Inter war History 1919-1939. "Industrial Labour in the Madras Presidency during the years 1919-1939."	Seminar on foundings on Indian & contemporary History held at Madras Christian College, Tambaram, February 24-26 1988 in connection with the Centenary Celebration of the History Dept. of MCC., Tambaram.

<i>Sl. No.</i>	<i>Name of faculty member attending the Conference</i>	<i>Title of paper presented and authors</i>	<i>Name, Dates and Venue of Conference</i>
11.	Mr. C. Rajendran	1) "Computer-aided heuristic scheduling of jobs in a Flowshop" accepted for publication and presentation 2) "Flowshop scheduling problem with two performance measures."	Third International Conference on a 'Computer-aided Production Engineering at Ann Arbor, Michigan USA in June 1988. International Conference on 'Mathematical Modelling in Science and Technology, at Madras, August 1988.

#### 6. Research Publications :

<i>Sl. No.</i>	<i>Title</i>	<i>Name of Journal</i>	<i>Year &amp; Month</i>	<i>Vol. &amp; Issue No. &amp; Pages</i>
1. a)	'The Changing Pattern of Health Delivery System in South India' in the Supplement <i>The Changing Face of South India</i>	The Economic Times	1st Oct. '88	
b)	'Democracy and Elections' <i>The Heritage</i>		Dec. '88	Vol. IV No. 12
2.	Stress - Strain Relationships : some moderating variables.	Journal of Psychological Researches	1988	
3.	Multiple Objective Decision Making Approach Towards the Improvement of Productivity in Industry.	Journal of Mechanical Working Technology	1988	17 (Vol ) pp. 433-440
4.	"A Survey of Systems Analysis in Educational Planning and Management"	Journal of Educational Planning & Administration	1989	Vol. 2 Nos. 1 & 2 pp. 28-68
5.	"A Survey of Systems Analysis in Educational Planning and Management"	Journal of Educational Planning & Admn.	1989	Vol. 2 Nos. 1 & 2 pp. 28-68
6. a)	"Colonialism, Nationalism and Labour - A study of Nationalist Politics and Labour Movement in Madras Presidency 1918-1922"	Indo-British Review- A Journal of History Theme South India in Modern Indian History		Vol. XIII No. 1
b)	"Nationalist Politics & working class Movement in Madura 1918-1920	Omdp Indo British Review		Vol. XV No. 2

#### 7. Books & Monographs brought out

Dr. S. Ambirajan : *Strategy and Structure in the Development of Indian Business* (Dr P S Lokanathan Endowment Lecture) Published by Vivekananda College, Madras-4 1988

## 8. National & International Conferences/Symposium organised

- Mr. M. Durga Prasada Rao : Attended the Annual Conference of Madras Management Association.
- Title : Competitiveness of India in Global Markets.
- Date : Dec. 16 - 17, 1988

## 9. Short term Courses/Continuing Education Programmes conducted

- Dr. L. V. L. N. Sarma : Visited the U. S. at the invitation of the U. S. Government during March-April 1988.

## 10. Awards and Honors (Faculty / Students)

1. Dr. Evangeline Manickam : Awarded Mulder Endowment Fund middle Award by American Studies for Project "Humanities for a Technological Age" (88-89)
2. Dr. R. Rajagopalan : First Prize (Non-fiction category) by Children's Book Trust, New Delhi for the book "The Secrets of Indus Valley"

## 11. Professional activities

1. Dr. S. Ambirajan : Chaired two sessions in Seminar on 'South Indian Economy' (1914-1945) held at Centre for Development Studies Trivandrum 25-27 April 1988.
2. Dr. Dipak Chaudhuri : Member of IAQR, IPE, IIMM, IIE
3. Dr. A. V. Krishna Rao : Chaired the Session on the Indian Fiction in English at the AIETC., Kothapur.

## 12. Invited lectures

1. Dr. S. Ambirajan :
  - i) 'Higher Education in a Free Society : Ideals and Realities' Sri T. R. Venkatarama Sastri Memorial Lecture, South India National Association, Madras, 4th July 1988.
  - ii) 'Official Statistics and the Academic Economist' given to the Officers Association Tamil Nadu, Department of Statistics, Madras 14-Oct. 1988.
  - iii) 'The Political Economy of Indian Economic Development' Extra-Mural Lecture, Regional Engineering College, Calicut 12-Dec.-1988
2. Dr. R. N. Anantharaman : Delivered guest lectures in the following Institutions :
  - a) Regional Labour Institute, Madras.
  - b) Tamil Nadu Institute of Labour Studies.
  - c) Indian Airlines Training Division, Madras.
  - d) National Productivity Council, Madras.
  - e) Life Insurance Corporation, Madras.
  - f) Maruthi Udyog Limited, Madras.
3. Dr. L. S. Ganesh : Delivered Lectures and Seminars on "Technological Forecasting" in the following institutions.
  - a) Engineering Staff College of India, Hyderabad.
  - b) Thiagarajar College of Engineering, Madurai.
  - c) Bharatidasan University, Trichy.
  - d) Avinashilingam Institute for Higher Learning, Coimbatore.
  - e) Central Food Technological Research Institute, Mysore.
  - f) Birla Institute of Technology and Science, Pilani.
  - g) Stella Maris College, Madras.

4. Dr. A. V. Krishna Rao : Invited to give a lecture on the subjugation of women :  
"A Historical Perspective", Mother Teresa Women's  
University, Kodaikanal
5. Mr. V. S. Kumar : "Written Communication" to Indian-Airlines Staff in May  
and December 1988.
6. Dr. L. V. L. N. Sarma : Chaired Seminar on 'Project Financing' at IPE, Hyderabad  
and invited speaker at Madurai-Kamaraj University,  
Nagarjuna University etc.

## MATHEMATICS

### 1. New Courses introduced during the year :

Course No.	Title	Offering faculty	
MA 101	Mathematics - I	B. Tech	All
MA 102	Mathematics - II	B. Tech	All
MA 737	Statistical methods and Time series Analysis	}	M.Sc. Dr. S. Kalpakam
MA 738	Stochastic Methods in Industry		M.Sc. Dr. A. Rangan
MA 827	Time discretisation methods for the numerical solution of time dependent problems		Ph.D. Dr. V. Subbarao

2. Research and Development Activities : Faculty and Scholars are engaged in Research in their respective areas of interest.

3. New facilities added and major items of equipment procured / fabricated.

1. Modi Xerox
2. P.C.
3. Telescope.
4. Epidiascope.

### 4. (i) Sponsored Projects : (Taken up during the year)

Sl. No.	Title	Funding agency and value	Period	Coordinators
(i)	'Mathematical Modelling of the Flow in Transportation Net Work System'.	I.C. and S.R. I.I.T., Madras Rs. 30,000/-	One year	1. Prof. S N. Majhi (Principal investigator) 2. Dr. S. B. Patnaik (Civil Engg.) (Co-investigator) 3. Dr. T. Panda, Chem. Engg. (Co-investigator)

### (ii) Sponsored Project completed during the year

1.	'Slow viscous Motion Past a cylinder in simple shear A Numerical study' (No. 26-3-1985-G. I.I.T., Ref. No. DAE/04/85-86	D.A.E. Rs. 25,780/-	1986-87	Dr. C. V. Raghavarao (Principal investigator) Dr. D.S. Subrahmanyam (Co-Coordinator)
		Rs. 65,000/-	1987-88 1988-89	Dr. G. Subramanian, (Aero Space Engg.) (Principal investigator)

5. Assistance to students and major consultancy assignments : Dept. is doing its best to render assistance to the students in whatever way required.

6. Assistance to sister Institutions (Net work Programmes, Q. I. P. Scholars etc.): A few faculty members have been assisting the sister institutions in various ways like being members of Academic Bodies, being experts for preparing Course materials for Indira Gandhi Open University etc.



7. Papers presented at Conferences/attended in India.

<i>Sl. No.</i>	<i>Name of faculty member attending conference</i>	<i>Title of the paper presented and authors</i>	<i>Name, dates and venue of conference</i>
1.	Dr. S. K. Srinivasan	'Multiplicity distribution, Quark-Gluon Cascade and Natural scaling'	IX Symposium on High Energy Physics at Madras, December 1988 (invited talk)
2.	Dr. H. S. Paul and K. Renganathan	'Pyroelectric surface waves'	International Conference on Mathematical Modelling in Science and Technology, Aug. 11-14, 1988 at Madras.
3.	Dr. V. B. Johri and R. Sudarshan	'FRW models with bulk viscosity'	ICMMST, Aug. 88, Madras.
4.	Dr. V. B. Johri and R. Sudarshan	'Cosmic fluid dynamics'	ISTAM, Decem. 88, B.H.U. Varanasi
5.	Dr. P. Achuthan and S. Sundar	'Ramanujan's Partition function, CFS and Pade' Approximants.	3rd RMS, Conference, May 1988, Manipal
6.	Dr. P. Achuthan and S. Sundar	'Pade Approximants and some problems in HEP'	IX HEP Symposium Decem. '88, Madras
7.	Dr. P. Achuthan and Dr. S. Ponnuswamy	'Certain applications of Generalized CFS to problems in HEP'	"
8.	Dr. S. N. Majhi and S. Krishnambal	'Matched solutions of slow viscous flow past a deformed fluid sphere'	ICMMST Aug. '88, Madras.
9.	Dr. S. N. Majhi, Dr. K. Swaminathan, K. E. Elango	'An analytical model for draw down in a dual Aquifer system'	ICMMST Aug. '88, Madras.
10.	Dr. S. Kalpakam and G. Arivarignan	The (S-1, S) inventory System with lost sales'	ICMMST Aug. '88, Madras.
11.	Dr. P. Achuthan	On Modern Mathematical Models in High Energy Fundamental Particle Physics	Invited talk in ICMMST Aug. '88.
12.	S. Sundar and Dr. P. Achuthan	Computational Models and Matrix Pade' Approximants	ICMMST Aug. '88
13.	Dr. S. Ponnuswamy and Dr. P. Achuthan	Canur continued fractions and Transfer Function Models	ICMMST '88
14.	S. Sundar R Rangaraj and Dr. P. Achuthan	Algorithms for Pade' Approximants for Lacunary Power Series	} Varahamihir Memorial National Seminar on Theory of Approximations Vikram University, Ujjain
15.	Dr. P. Achuthan, R. Rangaraj	Special Function and Optional Approximants	
16.	Dr. P. Achuthan	Computer Algorithms and Models in High Energy Physics	IX HEP Symp Dec. '88.

(ii) Papers presented at Conferences attended Abroad :

1. Dr. C. V. Raghavarao and Dr. Munther Al Druby 'Numerical studies of slow viscous flow past a circular cylinder' Accepted for Presentation in BAIL-V, Int. Conference Shanghai, China, June 1988, but could not present the paper due to lack of financial assistance.
2. Dr. A. Rangan 'On the replacement of systems subject to schocle and wear dependent failure' Accepted for Presentation in the First Conference of the Association of Asian-Pacific Research Societies at Seoul, Korea but could not present due to personal problems.
3. Dr. S. K. Srinivasan and Dr. N. Ravichandran An (S,S) Model of Deteriorating ITAS International Society for Inventory System Budapest Aug. '88.

8. Research publications :

1. S. K. Srinivasan 'Age Dep. model of cavity radiation II: Antibunched and thermal characteristics' Pramana 30, 59-70, 1988.
2. S. K. Srinivasan 'Analysis of (S, S) inventory systems' -Optimization, 19, 557-576, 1988.
3. S. K. Srinivasan 'Analysis of (S, S) inventory systems with deteriorating items' Proc. Int. Soc. Ims. Res. 4, 1988.
4. W. J. Beckmann and S. K. Srinivasan 'An (S, S) inventory systems with POISSON DEMANDS - OR SPECTRUM 9, 213-217, (1988)
5. S. H. Kulkarni and N. Srinivasan 'An analogue of Hoffman - Wermer theorem for a real function algebra Ind. J. Pune. Appl Maths. Vol. 19, 154-166, 1988.
6. S. H. Kulkarni and N. Srinivasan 'Restrictions of real function algebra' J. Math. Phy. Sci. Vol. 22, 209-223, 1988.
7. S. H. Kulkarni and N. Srinivasan 'A note on a theorem of Gorin' Math. Japonica Vol. 33, 887-893, 1988.
8. S. Arundhati and S. H. Kulkarni 'Choquet boundary for real function algebras' Canadian J. Math.
9. W. B. Vasantha 'Zero Square Group Rings' Bull. Cal. Math. Soc. 80, 105-106, 1988.
10. M. Paul Deva Sahayam and V. Subbarao 'A monotone method for the equation  $U_{xyz} = f$ .' Applied Mathematics and Computation 25, 175-186, 1988.
11. H. S. Paul and M. Venkatesan 'Wave propagation in a Piezoelectric ceramic cylinder of arbitrary cross section of (622) class' -Int. Jour. Engg. Sci. Vol. 26, pp 437-443, 1988.
12. R. Subramanian and V. Sridharan 'Age specific population Growth of Two-Sex Model by Phase Approach' Jour. Math. Phy. Sci. Vol. 22, No. 6 pp 699-709, 1988.

13. R. Subramanian and R. Natarajan 'A Two-Unit Redundant system with Different types of failures and 'Imperfect Repair'. Accepted for publication in Int. Jour. of Science and Engg.
14. R. Subramanian and V. Sridharan 'Optimum ordering policies with Random Lead Times and Salvage' Accepted for publication in Microelectronics and Reliability.
15. R. Subramanian and V. Sridharan 'An n-unit system with spares' Accepted for publication in Microelectronics and Reliability.
16. U. N. Srivastava and S. Usha 'Unsteady Boundary layer on a circular cylinder embedded to a wedge' Appl. Sci. Res. 45, 179-194 (1988).
17. S. N. Majhi and L. Usha 'Modelling the Fahraens Lindquist Effect through fluids of Differential type' Int. Jour. Engg. Sci. Vol. 26, No. 5, pp 503-508, 1988.
18. I. N. Baker and P. Bhattacharyya 'On a class of Non-Embeddable entire functions' J Ramanujam Math. Soc. 3(2) 1988, 151-159.
19. P. Bhattacharyya 'On the Four colour problem' Jour. of the Assam Academy of Mathematics, Vol. 12, July 1988.
20. S. Kalpakam and G. Arivarigan 'A continuous review perishable inventory model', J. Statistics 19, 1-10, 1988.
21. S. Kalpakam and G. Arivarigan 'A continuous review inventory system with semi - Markovian Demand, J. Math. Comput. Modelling 11, 1172-1177, 1988.
22. A. Avudainayagam and B. Jothiram 'A circle theorem for plane stockes flows' Quarterly Jour. of Mech. and Appl. Math 41, pt. 3 pp 383-393, 1988.
23. P. R. Parthasarathy and M. Sharafali 'A Complex two unit system with stochastic demand' Micro-electronic Rel. 28, 359-366, 1988.
24. P. R. Parthasarathy 'Density dependent Market branching processes' Proc. Trieste Research Conf. or Math. Ecology, World Sci. Pub. 554-564, 1988.
25. C. V. Raghavarao and K. Pramadavalli 'Numerical studies of slow viscous rotating flow past sphere-II' Accepted for publication in Int. Jour. Num. methods in Fluids on 16.12.88
26. C. V. Raghavarao and K. Pramadavalli 'Numerical studies of slow viscous rotating flow past a sphere-III' Accepted for publication in Int. Jour. Num. methods in fluids on 16.12.88.
27. R. Baskaran and P. V. Subramanian 'Common fixed points in closed balls' Atti. Sem Mat Fis Univ. Modena 36, 1-5, 1988.
28. R. Baskaran and P. V. Subramanyam 'Remarks on the non-linear eigenvalue problem  $T_x = \lambda S$ ' J. Math. Anal. Appl. 132, 146-153, 1988.
29. A. Chitra and P. V. Subramanyam 'A generalisation of a section theorem of Ky Fan and its applications to variational inequalities' Review of Research. Univ. of Novisad 17, 17-37, 1988.
30. A. Rangan 'A note on the selective interaction of two types of events resulting from a renewal point process and its applications' J. Math. and Phy. Sci 22, 371-383 1988.
31. A. Rangan 'A non-Markov model for the opt. replacement of self repairing systems subject to shocks' J. Appl. Prob. 25, 375-382, 1988.

32. A. Rangan 'On a class of Opt. Preventive replacement policies of systems subject to shocks' *Microelectronics and Rel.* 28, 563-568, 1988.
33. A. Rangan 'On the replacement of systems subject to shocks and wear dependent failure' To appear in *Advances in Appl. Probability*
34. S. G. Kamath 'The super-conformal anomaly in the 1+1 dimensional Wess - Zumino model' *Pramana* 30, 299-304 (1988)
35. S. G. Kamath 'The brachistochrone in almost flat space' *Jl. of Math. Physics* 29, 2268-2272 (1988)
36. H. S. Paul and M. Venkatesan 'Wave propagation in a piezoelectric ceramic cylinder of arbitrary cross section with circular cylindrical Cavity' *The Jour. of Acoustical Society of America*, Vol. 85, No. 1 (January) 1989.
37. H. S. Paul and M. Venkatesan 'Wave propagation in a piezoelectric solid cylinder of arbitrary cross section of class 6 (BONE)' - *Int. Jour. of Engg. Sci.* Vol. 27, 1989 (inpress)
38. P. Achuthan and S. Ponnuswamy 'A Theorem of Ramanuja and conversion of continued fraction Int. Power Series, *Journ. Math Phy. Sci.* 22, 6 663-79 (1988)
39. P. Achuthan and S. Ponnuswamy 'Caber continued fractions and Transfer Function Models, Proc. Intl. Conference on Maths Modelling in Sc. and Tech. (Ed.) NVC Swamy, P. Achuthan, S. N. Majhi, Tata Mc. Graw Hill New Delhi (1988)
40. P. Achuthan and S. Ponnuswamy 'On simultaneous Expansion and Inversion of continued Fraction of certain transfer functions, *Intl. Jl. Comp.* 48 499 - (1988)
41. P. Achuthan S. Ponnuswamy and S. Sundar 'On certain Special Function, continued fraction and Pade' Approximants, Proc. National Symp. Gorakhpur (1988)
42. P. Achuthan and S. Sundar 'A New Application of the Extended Euclidean Algorithm for Matrix Pade' Approximants, *Intl. Jl. of Computer and Maths, with Application*, 16, 4, 287 (1988)
43. P. Achuthan and S. Sundar 'On a Recursion Algorithm for Matrix. Pade' Approximants- the Divide-and-conquer Approach, *Intl. Jl. of Computer and Maths, with Application*, to appear.
44. Dr. P. Achuthan and S. Sundar 'Computational Models and Matrix Pade' Approximants, Proc. ICMMST-88 (Ed.) L. S. Srinath, P. Achuthan, S. N. Majhi, World Scientific, Singapore (1989).
45. Dr. P. Achuthan and S. Sundar 'Computation of Generalized Basic 'Hypergeometric Functions Thro' Pade' Approximants, *IMA Jl. of Num. Analysis*, U. K. Communicated.
46. Dr. P. Achuthan and S. Sundar 'Computation of Scattering Phase Shifts Thro' Pade' Approximants, *Jl. of Computl. Physics* U. K. Communicated.
47. P. Achuthan and S. Sundar 'Algorithms for Matrix Pade' Approximants, Thro Caue Forms, *Jl of Math. Modelling and Num. Analysis*, France, Communicated.

48. Dr. P. Achuthan 'On Modern Mathematical Models in High Energy Fundamental Particles Physics' in Vol. II, P. 302, Proc. of ICMMS-88 World Scientific, Singapore (1988), (Ed.) L. S. Srinath, Dr. P. Achuthan, S. N. Majhi.
49. Dr. P. Achuthan 'Computer Algorithms and Models in High Energy Physics IX HEP Symp. Dec. 1988 - Proc.
50. Dr. P. Achuthan and H. J. W. Muller-Kirsten (FRG), 'Perturbation Theory and Boundary Conditions. Analogous Treatments of Anharmonic Oscillators and Double-Wells and Similarly Related Potentials and the calculation of exponentially small contributions to Eigenvalues 146 p to appear in Fortschritte Der Physik, Berlin, Germany.
51. H. S. Paul and K. Renganathan Pyroelectric surface waves Proc. Intl. Conf. on Maths Modelling in Sc. and Tech. (Ed.) NVC. Swamy, P. Achuthan and S. N. Majhi, TATAMC Graw Hill, New Delhi (1988).
52. V. B. Johri and R. Sudarshan FRW Models with bulk viscosity Proc. Intl. Conf. on Maths Modelling in Sc. and Tech. (Ed.) L. S. Srinath, P. Achuthan and S. N. Majhi, World Scientific, Singapore (1988).
53. S. Kalpakam and G. Arivarigam The (S-1, S) inventory system with lost sales Proc. Intl. Conf. on Maths Modelling in Sc. and Tech. (Ed.) L. S. Srinath, P. Achuthan, and S. N. Majhi, World Scientific, Singapore (1988).
54. S. N. Majhi and S. Krishnambal Matched solutions of slow viscous flow past a deformed fluid sphere Prof. Intl. Conf. on Maths Modelling in Sc. and Tech. (Ed.) NVC. Swamy, P. Achuthan and S. N. Majhi, TATA Mc Graw Hill New Delhi (1988).
55. S. N. Majhi K. Swaminathan and E. Elango An Analytical Model for draw down in a dual aquifer system Prof. Intl. Conf. on Maths Modelling in Sc. and Tech. (Ed.) L. S. Srinath, P. Achuthan, S. N. Majhi World Scientific Singapore (1988).

### 9. Books and Monographs brought out :

Name(s) of Author(s)	Title of Text Book / monograph	Publishing Company	Year of Publication
1. S. K. Srinivasan	Point Process Models of Cavity Radiation	Edward Arnold, U. K.	1988.
2. S. K. Srinivasan and K. M. Mehta	Stochastic Processes (Second Edition)	Tata McGraw Hill, New Delhi.	1988.
3. K. R. Parthasarathy	A course in Graph theory.	Tata Mc Graw Hill, New Delhi.	} Expected to be completed by 1989.
4. N. V. C. Swamy, P. Achuthan, S. N. Majhi	Mathematical Modelling in Science and Technology Vol. I	Tata Mc Graw Hill, New Delhi.	
5. L. S. Srinath, P. Achuthan, S. N. Majhi	Mathematical Modelling in Science and Technology Vol. II	World Scientific, Singapore	1989
6. P. Achuthan	Pade' Approximants : Theory and Applications	UGC - Project - under publication.	

## 10. National and International Conferences/Symposium Organised

- (i) International Conferences on Mathematical Modelling in Science and Technology-ICMMST - 88, Aug. 11-14, 1988.
- (ii) One-day symposium on Srinivasa Ramanujam, December 22, 1988.
- (iii) 9th High Energy Physics Symposium, December 1988.  
(in collaboration with MatScience)

## 11. Awards and Honors (Faculty / students)

- (i) Mr. S. Sundar, Research Scholar, has been awarded DAAD Fellowship for working in "Mathematics in Industry" in KAISERSLAUTERN Univ., F.R.G.
- (ii) In mathematics - Quiz held at Anna Univ. and St. Xaviers' College, Palayamkottai the following won prizes :

Shri. D. Surya Ramana		: 1st Prize at
Shri. Ravi Sundaram		Anna University.
„ Kannan Govindarajan		
Shri. K. C. Sivakumar		II-M.Sc. IInd Prize at
„ S. Shankar		St. Xaviers College
Shri. S. Sivaramakrishnan		I - M.Sc.
- (iii) Prof. K. R. Parthasarathy was called upon by the Kyota Prize Committee of Japan to nominate two persons for the award of the Kyota Prize in Mathematical Sciences for the year 1989.
- (iv) a) Prof. V. B. Johri is a member of the National Executive of the Indian Association of General Relativity and Gravitation.  
b) Nominee for INSA - Royal Society short term visiting Fellowship for visiting U. K. in 1988-89.

## 12. Professional activities

### Journal of Maths. and Physical Sciences (JMPS)

Patron :

Prof. L. S. Srinath

Editor-in-chief

Prof. P. Achuthan

Associate Editors

1. Prof. S. N. Majhi
2. Prof. U. N. Srivastava
3. Prof. V. B. Johri
4. Dr. P. R. Parthasarathy
5. Dr. S. H. Kulkarni

Prof. P. Achuthan, Life membership in AMII  
Academic Secretary, Ramanujan Maths. Society.

## 13. Invited Lectures

- (i) By I. I. T. Faculty in other Institutions

Prof. P. Achuthan delivered invited lectures in Gill Adarsh School, Bharatiya Vidya-Bhavan, Sri Vaishnava College Madras, Sri Venkateswara University, Tirupathi, Loyola College, Madras, Central School

Professor U. N. Srivastava delivered the invited lectures at.

- (i) National productivity Council
- (ii) Lectures for the central school teachers.
- (iii) Lectures for the U.G.C. refresher course in Physics at the Bharathidasan University, Trichy.

14. (ii) Lectures by Distinguished Visitors to I.I.T.

1. Dr. Parameswaran Sankaran, 'Cobordism of Grassmannians'  
Institute of Mathematical Sciences, Madras-113. on 13-10-1988.
2. Dr. N. Nikolaj Ushakov,  
Head of Tomography Group,

Institute of problems of Microelectronics Technology and Superpure Materials, USSR Academy of Sciences, Moscow was a visiting Professor under the bilateral exchanges I NSA-USSR Academy of Sciences. Under the joint auspices of Depts. of Physics and Mathematics the following lectures were given by him :

1. 'Wavefront Reconstruction using Intensity Distributions' 17-10-88
  2. 'Inverse Problems of Sub-micron Structure Diagnostics' 18-10-88
  3. 'On Non-Parametric Estimation Problems' 19-10-88
  4. 'On a class of Implicit Non-Linear Integral Equations' 21-10-88
3. Prof. K. L. Duggal, 'Role of Geometry in Mathematical Physics - on  
University of Windsor, Canada 10-11-1988.
  4. Dr. R. P. Agarwal, 'Recent Developments in Special Functions Research  
Professor Emeritus, Univ. of Lucknow on 15-12-1988.  
(Former Vice-Chancellor, Rajasthan University)
  5. Dr. Peter G. Zograf of V. A. Steklov 'MODULI SPACES of Riemann surfaces'  
Mathematical Institute of the USSR on 26-12-1988.  
Academy of Sciences, Leningrad
  6. Dr. Fyodor A. Smirnov of 'On Certain Models of Field Theory'  
V. A. Steklov Mathematical Institute on 26-12-1988.  
of the USSR Academy of Science, Leningrad
  7. Prof. Renu Laskar, Department of 'Theory of Domination in Graphs on 27-12-1988.  
Mathematical Sciences, Clemson University, Clemson, South Carolina, USA.
  8. Prof. P. L. Kannappan, 'Functional Equations and Applications' in January and  
Department of Mathematics, February 1989. (From 5-1-1989 )  
University of Waterloo, Canada,

9. Dr. K. T. Arasu, Department of Mathematics, Wright State University Dayton, OHIO, USA Difference sets in a Group on 6-1-89.
10. Dr. Yong Yeow Chin, Ngee Ann Polytechnic, Singapore Computers in Mathematics Teaching on 11-1-89.
11. Prof. Dr. Erkkka J. Maula, Helsinki University, Finland. Fermat's Last problem - Under joint auspices of Mathematics and Humanities and Social Sciences Depts. on 17-1-1989.
12. Sir Dr. Wilfred Cockcroft, Chairman and Chief Executive, Secondary Examinations Council, U.K. 'Mathematics : Queen or Hand Maid' on 2-2-1989.
13. Prof. Megha Singh, Appl. Mech (Bio-medical Division of I.I.T. Madras'. 'Blood flow and its visualisation around stenotic geometries' on 2-3-1989.

#### 14. Visitors to the Dept./Centre

Prof. P. L. Kannappan, Dept. of Mathematics, University of Waterloo was a visiting Professor in the Dept. from Dec. '88 to March '89.

#### 15. Staff Matters

1. Dr. P. R. Parthasarathy had been a visiting Scientist during Aug.-Oct. 1988 in the Dept. of Mathematics and Statistics, MC Master University, Hamilton, Canada.
2. Dr. C. V. Raghavarao was on E.O.L. from 30-12-86 to 1-2-89 and was in the Faculty of Dept. of Mech. Engg. College of Engg., Univ. of Baghdad, Iraq.
3. Dr. S. N. Venkatarangan was on sabbatical leave at NITIE Bombay for one year and four months.
4. Dr. R. Subramanian went to Germany on the Humbolt Fellowship for four months during 1988.

#### 16. Miscellaneous

The Department has taken initiative to establish firm links with industries. A one-day Technology Appreciation Programme (TAP) on 'Mathematics in Industries' is planned.

To revamp the academic work and encourage commitment towards dedicated service a "goal-oriented project planning (ZOPP)" programme is being arranged in which the various aspects of the Department's activities are to be discussed.

Dr. P. Achuthan participated in COSERIMS held under the auspices of Indian Mathematical Society, New Delhi to discuss above the support for education and research in mathematical sciences.

An International Conference on stochastic Process, Modelling and Applications is planned for December 1990.

#### 17. Future Plans

The Dept. has plans to develop Teaching and Research activities in different directions like introducing computer-oriented courses, starting Five-Year Integrated M Sc. Course, augmenting the computational facilities, developing astronomical and astrophysical activities etc. It is proposed to start a centre for Mathematical Modelling, Simulation and Applications. Various Projects and consultancy works with close collaboration with industry are planned. Inter-departmental and Inter-Institutional activities are to be strengthened. The JMPS will receive further attention for increased circulation (number of issues year to be increased-bimonthly to monthly) and intensifying efforts to attract quality research papers.



## MECHANICAL ENGINEERING

- (i) Engineering Design Centre
- (ii) Heat Transfer & Thermal Power Laboratory
- (iii) Hydroturbomachines Laboratory
- (iv) Internal Combustion Laboratory
- (v) Precision Engineering & Instrumentation Laboratory
- (vi) Machine Elements Laboratory
- (vii) Mechanical Handling Laboratory
- (viii) Production Engineering Laboratory
- (ix) Refrigeration & Airconditioning Laboratory
- (x) Thermal Turbomachines Laboratory
- (xi) Thermodynamics Laboratory

### (i) Engineering Design Centre

#### 1. New Courses introduced during the year :

<i>Course No.</i>	<i>Title</i>	<i>Offered to</i>	<i>Faculty offering the course</i>
ME 741	Optimization Techniques in Mechanical Design	M. Tech. students in Mechanical Engineering	Dr. M. A. Veluswami

#### 2. Research and Development Activities :

##### (i) Research activities :

Work is being done in 'Gear Impacts, Machine Tool Vibrations and Vibration of Composite Plates', Publications have come out.

##### (ii) Development activities :

- a) An interactive software package for computer aided pressure vessel design has been done.
- b) An improvement in Biogas stove has been done.

#### 3. New facilities added and Major items of equipment procured / fabricated :

- (i) A real time analyser (Philips Make) with the plotter and other accessories.
- (ii) A 2 KVA stabilizer have been purchased
- (iii) To the existing Personal Computer, enhancement of memory with an additional floppy drive has been added

#### 4. Assistance to Students and Major Consultancy Assignments :

<i>Name of faculty</i>	<i>Name of client</i>	<i>Title of consultancy work</i>
Dr. M. A. Veluswami	M/s M. S. Dastur & Co., Ltd. Madras 600 035	Design of tall Pressure Vessels
Mr. T. S. Chennabasavan	M/s. Shanthi Gear Ltd. Coimbatore	Design of Gears

#### 5. Assistance to Sister Institutions :

- (i) A Q.I.P. Scholar has been taken for Ph.D. work.
- (ii) A course to the P. G. students at Anna University has been offered on 'Optimization Techniques in Mechanical Design'
- (iii) A module on 'Computer Aided Engineering is under preparation under Continuous Education Programme.

**6. Papers presented at Conference attended :**

<i>Sl. No.</i>	<i>Name of faculty member attending the Conference</i>	<i>Title of paper presented and authors</i>	<i>Name Dates and venue of Conference</i>
1	Dr. M. A. Veluswami	Strain Analysis of Filament Wound FRP Cylindrical Shells under Axisymmetric Loading <i>Authors: S.K. Malhotra J.C. Babu, N. Ganesan and M.A. Veluswami</i>	International Conference on composite Materials and Structures, Jan., 1988 IIT, Madras
2	Dr. M. A. Veluswami	Vibration Analysis of Filament Wound Reinforced Plastics Shells of Revolution. <i>Authors: S. K. Malhotra, N. Ganesan and M. A. Veluswami</i>	- do -
3	Dr. M. A. Veluswami	Studies on Vibration of Orthotropic Plates of Various Planforms <i>Authors: S. K. Malhotra, N. Ganesan and M. A. Veluswami</i>	The Annual National Conference of the Aeronautical Society of India, IIT, Madras Dec., 1988

**7. Research Publications :**

1. 'Vibration Analysis of Filament Wound Reinforced Plastics Shells of Revolution' with S. K. Malhotra and N. Ganesan, International Conference on Composite Materials and Structures at Indian Institute of Technology, Madras, India, January, 1988.
2. 'Strain Analysis of Filament Wound Fibre Reinforced Plastics Cylindrical Shells under Axisymmetric Loading' with S. K. Malhotra, J. C. Babu and N. Ganesan, International Conference on Composite Materials and Structures at Indian Institute of Technology, Madras, India, January, 1988.
3. 'An Experimental Investigation of Impact Phenomena in Spur Geared Torsional Systems' with Ch. Penchalayya, Commemorative Volume to honour Prof. K. A. V. Pandalai, the former Head (Director) of the Indian Institute of Technology, Madras, India, February, 1988.
4. 'Damped Vibrations of Orthotropic Square Plates having Variable Thickness (Linear Variation)' with S. K. Malhotra and N. Ganesan, Journal of Sound Vibration, V. 120, n-3, pp. 617-621, 1988.
5. 'Effect of fibre orientation and boundary conditions on the vibration behaviour of Orthotropic square plates', with S. K. Malhotra and N. Ganesan, Journal of Composites, V. 9, n-3, pp. 247-255, 1983.
6. 'Effect of fibre orientation and boundary conditions on the vibrations behaviour of Orthotropic rhombic plates', with S. K. Malhotra and N. Ganesan, Journal of Composites, V. 19, n-2, pp. 127-132, 1988.
7. 'Effect of fibre orientation and boundary conditions on the vibration behaviour of orthotropic square plates (FEM)', with S. K. Malhotra and N. Ganesan accepted for publication in Journal of Computers and Structures.
8. 'Vibrations of Orthotropic square plates having variable thickness (Linear Variation) with S. K. Malhotra and N. Ganesan, accepted for publication in Journal of Composites.
9. 'Vibrations of Orthotropic triangular plates', with S. K. Malhotra and N. Ganesan, accepted for publication in Journal of Composites and Structures.

10. 'Vibrations of stepped Orthotropic square plates', with S. K. Malhotra and N. Ganesan, accepted for publication in Journal of Composites and Structures.
11. 'Some studies on vibration of Orthotropic Plates of Various Planforms;', Ph.D. Thesis of S. K. Malhotra with N. Ganesan, Indian Institute of Technology, Madras, 1989.
12. 'Vibration of Composite Plates with Cut-outs', with S. K. Malhotra and N. Ganesan, the Journal of the Aeronautical Society of India, V. 41, n-1, pp. 61-64.
13. 'Impact Phenomena on Spur Gears: Instrumentation Through Telemetry', with T. N. Ranganathan, in preparation.
14. 'Impact Phenomena in Spur Gears - Some Experiments', with K. Balaveera Reddy, in preparation.
15. 'Impact Phenomena in Spur Gears-Analysis', with K. Balaveera Reddy, in preparation.
16. 'Optimum Design of Engine Mufflers', with P. Bhupal Reddy, in preparation.
17. 'Investigation of Noise in Cam-Follower System of a Single Cylinder Reciprocating Engine', with A. Singaravelu, in preparation.
18. 'Growth Parameters of Water Hyacinth, a Plant for Biogas Generation', in preparation.

#### **8. Books and Monographs brought out :**

1. A book on 'Modern Pressure Vessels and Piping Design' is in progress and a grant by UGC has been given to write this book. This is authored by M. A. Veluswami and A. N. Pandey (Engineer in Kalpakkam)
2. A monograph by M. A. Veluswami on 'Computer Aided Engineering'—An Introduction is in preparation (sponsored by CCE)

#### **9. Professional activities :**

1. One session at the 'International Conference on Composite Materials and Structures' was chaired by M. A. Veluswami in January, 1988 when the conference was held at IIT, Madras.
2. Dr. M. A. Veluswami is in the editorial board for the Indian Journal on Engineering Design
3. a) i. Dr. M. A. Veluswami is a member of the American Society of Mechanical Engineers, USA.  
 ii. He is a member of the Institution of Engineers (India)  
 iii. He is a member of the Aeronautical Society of India.  
 iv. Life member in the Indian Society for Technical Education.  
 b) Mr. T. S. Chennabasavan is a member of the Institution of Engineers (India)  
 c) Mr S. D. Kalandar Sahab is a member of the Institution of Engineers (India)

#### **10. Invited Lectures :**

Dr. M. A. Veluswami was invited to lecture on 'Optimum Design of Mechanical Elements' by Anna University, Madras for one semester in 1988.

#### **11. Future Plans :**

Research and Development activities apart from teaching and consultancy are planned in the area of Engineering Design (Experimental, analytical and numerical)

## (ii) Heat Transfer and Thermal Power Laboratory

### 1. Research and Development Activities:

- (a) Flow and Heat transfer with obstructions
- (b) Flow and heat transfer in porous media
- (c) Radiation heat transfer
- (d) Phase change heat exchanger
- (e) Heat transfer in fin arrays, fluidized beds, electrical machines
- (f) Heat Transfer augmentation

**Development :** (a) Data Acquisition system for instrumentation  
(b) Thermal conductivity apparatus for high temperatures

### 2. New facilities added and Major items of equipment procured / fabricated:

- (a) Pool boiling heat transfer apparatus
- (b) Radiation heat transfer apparatus
- (c) Thermal conductivity apparatus

### 3. Sponsored Project:

<i>Sponsored Project</i>	<i>Sponsoring Agency &amp; Value</i>	<i>Coordinator</i>
Design and Development of Data Acquisition system	DST Rs. 1 25 Lakhs	Dr. S. P. Venkateshan

### 4. Assistance to Students and Major Consultancy Assignments:

#### *On going :*

Dr. S. P. Venkateshan	ISRO, Bangalore	VHRR Cooler thermal analysis.
Dr. K. N. Seetharamu	MRF, Madras	Vulcanization of tyres.
Dr. V. M. Krishna Sastri and Dr. Ajit Kumar Kolar	NSF, U.S.A.	FBC of Low Grade Coal.

### 5. Assistance to Sister Institutions:

- 6 OIP Scholars doing work towards Ph D.
- 2 Sponsored candidates completed M. Tech.
- 1 Q.I.P. candidate doing work towards M. Tech.

6. Patents taken : One U. S. patent for Dr. S. P. Venkateshan  
"Acoustic temperature profile measuring system"

### 7 Papers Presented at Conference attended:

<i>Sl. No.</i>	<i>Name of faculty member attending the Conference</i>	<i>Title of paper Presented and authors</i>	<i>Name, Dates and Venue of Conference</i>
1.	Dr. S. P. Venkateshan	Analysis of repetitive NMR Spectra	Indian Institute of Chemical Engineers Annual Symposium Kalpakkam, November 1988.

<i>Sl. No.</i>	<i>Name of faculty member attending the conference</i>	<i>Title of paper Presented and authors</i>	<i>Name, Dates and Venue of conference</i>
2.	Dr. K. N. Seetharamu	Finite Element Analysis of Laminator Flow over obstructions.	Commonwealth Advisory Aeronautical Research Council NAL Bangalore 5-10 Decem. 1988.
3.	Dr. K. N. Seetharamu	Heat Transfer phenomenon in continuous casting	Proc. National Seminar on Problems and Prospects of continuous cast steel, Bhadravathi June, 1988.
4.	Dr. K. N. Seetharamu	Finite Element Techniques for improved performance in computing Navier-Stokes and Related Heat Transfer Problems	Proc. Int. Conference on Mathematical Modelling in Science and Technology I.I.T. Madras August 11-14 1988.

#### 8. Research Publications :

<i>Sl. No.</i>	<i>Author(s)</i>	<i>Title</i>	<i>Name of Journal</i>	<i>Vol. and Issue No.</i>	<i>Month &amp; Year</i>	<i>Pages</i>
1.	S. P. Venkateshan O. Solaiappan	Approx solution of non-linear Heat conduction.	Harme-Stoffubertragung		July 1988	239-243.
2.	K. N. Seetharamu S. G. Ravikumar P. A. Aswatha Narayana	Finite Element Analysis Shell and Tube Heat Exchanger	Int. Comm. Heat Mass Transfer	V. 15 No. 2	1988	151 to 163
3.	K. N. Seetharamu P. Dutta	Mixed Convection about a Nonisothermal Vertical surface in a Porous Medium.	Int. JI. Num. Methods in Fluids.	8, 6	1988	723-735.
4.	K. N. Seetharamu K. V. S. Varier	Performance of a Fluidized Bed Cooling Tower using Bed Materials of various configuration	Warne and stoffubertragung	22	1988	219-222
5.	K. N. Seetharamu G. Subash Babu G. Subramanain	Consistent Penalty Method in Fluid Mechanics.	Jl of Aeronautical Society of India.	40 4	Nov.- Dec. 1988	247-253
6.	K. N. Seetharamu M.A. Parameswaran C. J. G. Chandra.	Effect of Supply orifice Diameter and Minimum thickness in Air Film Conveyor used for conveying Packages	Ind. JI. Tech.	26	May 1988	237-242

**9. Books and Monographs brought out:**

Monograph on "Finite Element methods in Engineering Design" Springer - Verlag, August 1988.

**10. Short term Courses/Continuing Education Programmes:**

Advanced study Institute: "Finite Element Method in Engineering Design" August 1988.

**11. Awards and Honors (Faculty/Students):**

NASA Tech brief award for Dr. S. P. Venkateshan, for "Acoustic Temperature Profile Measuring System", 1988.

**12. Professional activities:**

Dr. Ajit Kumar Kolar chaired a session at the Fluidized Bed Combustion Seminar at BHEL, Trichy.

**13. Invited Lectures:**

- (i) Dr. Ajit Kumar Kolar delivered invited lectures on Fluidized Bed Combustion Technology at BHEL Centres at Trichy, Ranipet, and New Delhi.
- (ii) Dr. K. N. Seetharamu: "Finite Element Analysis for fluid flow and heat Transfer" at BHEL, Trichy, Bhopal and Hyderabad.
- (iii) Prof. Dr. Ing. Habil. H. Martin: "Lecture series on Heat Exchangers". University of Karlsruhe
- (iv) Prof. R. W. Lewis, University College of Swansea: "Heat Transfer with phase change".

**14. Visitors to the Department/Centre:**

Prof. R. W. Lewis, University College of Swansea, U.K.  
Prof. Dr-Ing. Habil H. Martin, University of Karlsruhe, F.R.G.

**15. Future Plans Two short term courses to be held in May and June 1989.:**

- (i) Scientific Instruments
- (ii) Recent Developments in Heat Exchangers

**(iii) Hydroturbomachines Laboratory**

**1. New Courses introduced during the year:**

<i>Course No.</i>	<i>Title</i>	<i>Offered to</i>	<i>Faculty offering the course</i>
ME 612	Computational Fluid Mechanics	M. Tech Elective	Dr. V. Balabaskaran

**2. Research and Development Activities:**

1. Return flow studies in a centrifugal pump.
2. Studies on blade profiles for wave energy air turbines.
3. Studies on the application of surface vorticity distribution method for two dimensional bodies between parallel walls.
4. Further studies on cavitation, noise and vibration on centrifugal pumps has been completed.
5. Studies on 'S' blade profiles for the application to reversible pump turbines.
6. Off design flow studies on axial flow turbomachines.
7. Studies on the effect of guide vane angles on the velocity distribution has been completed.

### 3. Sponsored Projects : (Taken up during the year)

<i>Sl. No.</i>	<i>Title</i>	<i>Funding Agency</i>	<i>Period</i>	<i>Coordinator/s</i>
1.	Experimental Study on an Axial Flow Fully reversible Turbomachine	DST	3 years	Dr. H. C. Radhakrishna & Dr. V. Balabaskaran

### 4. Assistance to Students and Major Consultancy Assignment :

<i>Name of Faculty</i>	<i>Name of client</i>	<i>Title of consultancy work</i>
1. Dr. V. Balabaskaran & Dr. H. C. Radhakrishna	Instrumentation Ltd., Palghat	Model analysis of 6" through flow and disc type butterfly valves
2. Dr. S. Kumaraswamy	M/s. Beacon Weir Ltd., Madras	Retainer Consultant

### 5. Papers presented at Conference attended :

1. 'Techniques of Measurement and Analysis of Noise due to Cavitation in Centrifugal Pumps', S. Kumaraswamy and H. C. Radhakrishna, International Symposium on Cavitation Research Facilities and Techniques, 1987, FED Vol 57.
2. 'SVD Methods Applied to Axial Flow Hydraulic Machines', V. Balabaskaran and H. C. Radhakrishna, JI. of 54th R and D Session CBIP, Technical Session - V - paper No. 6, pp 69-74, Ranchi.
3. 'Computer Aided Design of Radial Flow Pumps' S. Kumaraswamy and H. C. Radhakrishna, JI. of 54th R and D Session, CBIP, Technical Session - V - Paper No. 8, pp 81-85. Ranchi.
4. 'Effect of Blade Geometry on the Performance of S-Cambered Profiles', R. S. Madhusudan, P. A. Aswatha Narayana, V. Balabaskaran and H. C. Radhakrishna, FM and FP, Kanpur Dec 88, Sec. 4, p. 210.

### 6. Research Publication :

1. 'Cascade Characteristics of 'S' Cambered Profiles', H. C. Radhakrishna and P. A. Aswatha Narayana, JI. of the Institution of Engineers (India), Vol. 68 Part ME 1 & 2, July-Sept. 1987.
2. 'Design and Performance of a Pump - Turbine for Tidal Power', M. Ravindran and H. C. Radhakrishna, JI. of Irrigation and Power, Diamond Jubilee Special Issue, Dec. 1987, pp. 241-268.
3. 'Cavitation studies of Centrifugal Pumps', S. Kumaraswamy and H. C. Radhakrishna, JI. of Irrigation and Power, Jan. 1988, pp. 99-116.
4. 'Application of Surface Vorticity distribution theory for the analysis of flow through axial flow Hydroturbomachines', V. Balabaskaran, R. I. Lewis & H. C. Radhakrishna, Irrigation and Power JI Apr. 88.
5. 'Effect of Blade Geometry on the Performance of S-cambered profiles', R. S. Madhusudan, P. A. Aswatha Narayana, V. Balabaskaran and H. C. Radhakrishna, FM, and FP, Kanpur, Dec. 88, Sec. 4, p. 210

### 7. Awards and Honors (Faculty/students) :

1. Central Board of Irrigation and Power has awarded Merit Certificate to Prof. H. C. Radhakrishna and Prof. M. Ravindran for their paper 'Design and Performance of a Pump Turbine for Tidal Power' published in I : P JI. Spl issue during 1987.
2. Institution of Engineers (India) has awarded 'Sir Rajendra Nath Mookerjee Memorial Gold Medal' for 1987 to Prof. H. C. Radhakrishna and Prof. P. A. Aswatha Narayana for their paper 'Cascade Characteristics of 'S' Cambered Profiles'. This award was presented to them in January 1989.

### **8. Professional activities :**

Prof. H. C. Radhakrishna as a Member of the International Editorial Committee Book Series on Hydraulic Machinery is actively involved as an editor for one Volume and an author for a section.

### **9. Visitors to the Department :**

Prof. R. I. Lewis, Professor of Fluid Mechanics and Thermodynamics, (Dept. of Mech. Engg.) of University of Newcastle Upon Tyne U. K. visited Hydroturbomachines Laboratory during November 15 to 17, 1988 and delivered lectures on 'Vertex cloud theory and its applications'.

### **10. Miscellaneous :**

Dr. S. Kumaraswamy, Asst. Professor visited Institute of Ship Building, Hamburg University under DAAD short term invitation programme from July to Sept. 1988.

### **11. Future Plans :**

The following are the brief indication of the developmental programme for the future.

1. Studies on ducted propellers and pump jets
2. Studies on wave energy turbines
3. Cavitation, noise and vibration studies in Hydroturbomachines
4. Studies on Jet Pumps
5. Developmental studies on Bulb Turbines and special purpose pumps
6. Developmental studies on alternative sources of energy.

## **(iv) Internal Combustion Engines Laboratory**

### **1. Research & Development Activities :**

- 1) Computer programmes are being developed for the simulation of various processes in 4-stroke and 2-stroke I.C. engines. These programs taken into account the type of fuel used, the gas exchange process and heat exchange with the walls.
- 2) Catalytic coatings are being developed to improve the combustion and reduce pollution in I.C. Engines. These coatings are given by electroplating or by flame spraying. The piston top and the cylinder head in contact with the gas are the surface coated.
- 3) Lean Burn engine are being developed for using extremely lean air fuel mixtures in 4-stroke SI engines. Use of lean mixtures will enable the achievement of higher efficiency and lower emissions.
- 4) Alternative fuels like alcohols, vegetable oils and their methyl esters are being tried out as fuels.
- 5) Adiabatic engines are being developed. These engines have a low heat rejection rate to the coolant and enable the use of low cetane number fuels.

### **2. New Equipment procured :**

- (a) Eddy Current Dynamometer Controller & Monitor
- (b) Data Acquisition System for Eddy Current Dynamometer

### **3. (i) Sponsored Projects (Taken up during the year) :**

DST Project 'Development of Lean Burn Engine for Automotive Application' 3 years.  
Dr. B. Nagalingam

### **(ii) Sponsored Projects completed during the year :**

NSF Project 'Combustion of Alcohol & Biogas' National Science Foundation, U.S.A.  
Sept. 0, 1988.



**4. Assistant to Students and Major Consultancy Assignments:**

Prof. V. Ganesan                      ISRO Trivandrum                      Computer Simulation processes

**5. Assistance to Sister Institutions :**

<i>Name of QIP Scholars</i>	<i>Institution</i>
1. Mr. S. Dhandapani	Govt. Engg. College Coimbatore
2. Mr. S. Subramaniam	Anna University
3. Mr. K. Rajagopal	JNTU Andhra Pradesh

**6. Papers presented at Conference attended :**

Dr. V. Ganesan                      Development and Testing of a Surface Ignition                      Nov 13 - 16,  
Engine Using ceramic hot Surface                      Tokyo, Japan.  
Effect of Induction Turbulence  
on Aldehyde Emissions in Single Cylinder  
Alcohol Fuelled SI Engine

**7. Research Publications :**

1. R. Varaprasada Rao, B. Nagalingam, V. Ganesan, K.V. Gopalakrishnan, 'Effect of Induction Turbulence on Aldehyde Emissions in Single Cylinder Alcohol Fuelled SI Engine', VII Int. Symp on Alcohol Fuels, Nov. 13-16, 1988, Tokyo.
2. A. Ramesh, B. Nagalingam, K.V. Gopalakrishnan, 'Development and Testing of a Surface Ignition Engine Using Ceramic hot surface', VIII Int. on Alcohol Fuels, Nov. 13-16, 1988, Tokyo.
3. S. Dhandapani, B. Nagalingam, K. V. Gopalakrishnan, 'Theoretical Studies on the swirl air motion during the compression stroke of an I. C. Engine', 16th National Conf. on Fluid Mechanics and Fluid Power, Kanpur.
4. S. Dhandapani, B. Nagalingam, K. V. Gopalakrishnan, 'Experimental investigation of the effect of swirl due to squish height on the performance of Lean Burn SI Engine', Institution of Engineers, Calcutta.
5. Vince Joseph, U.S.P. Shet, V. Ganesan, 'Flow and Flame characteristics in a New Swirl Burner', IV National Conf. on Aerodynamics, Aero Soc. of India, IIT Dec. 19-21, '88.
6. S. Subramaniam, V. Ganesan, P. Srinivasa Rao, S. Sampath, ' Experimental Investigation on the turbulent flow inside the cylinder of a diesel engine', 16th National Conf. on Fluid Mechanics and Fluid Power.
7. K. N. Gopalan, 'Design and Matching of Turbocharging Systems for 4-cylinder in-line engine', National Conf. on I.C. Engines', Bangalore, Feb. '89.
8. K. N. Gopalan, 'Latest Development of Diesel Engines', National Conf. on I.C. Engines, Feb. '89, Bangalore.

**8. Short - Term Courses :**

Dr. B. Nagalingam - Recent Developments in I. C. Engines                      7 - 21, May 1988.

**9. Future Plans :**

The laboratory aims to acquire a few more smaller sized computers so that research scholars can do the simpler types of work on them. The latest version of the signal analyser, which can convey and analyse pressure and temperature signals from engines, is being acquired. The laboratory aims to become a significant centre for Computer Aided Design (CAD) for I. C. Engines. It is also our aim to develop excellent experimental facilities and carry out research projects which will have practical application to the Industry.

(v) Precision Engineering and Instrumentation Laboratory

1. Research and Development Activities :

Robotics : Mobile types, work space analysis, sensor development, drives, finite element analysis, bond graph techniques, flexibility in robot dynamics.

Precision articulated manipulating platforms,

Prosthetic and Robotic arm control using fluid power,

High speed hydraulic actuators,

Hydrostatic drives; dynamic studies on hydraulic system using bond graph techniques,

Form error effects in hydraulic locks,

Pneumatic servo positioner and sequential circuits,

Friction wear and noise studies in sintered bearing,

Digital Transducer developments,

Surface topography, inprocess surface roughness monitoring,

Torsional vibration, noise studies on precision gear drives; gear profiles for instruments; plastic gears,

Microprocessor based system developments,

Adaptive control of CNC, operational system for programme logic controllers

Manufacturing methods in precision engineering,

Online dynamic balancing of high speed rotors,

Stability analysis of a resonant magnetic suspension; gyroscopic system, inertial and navigational system developments.

2. New facilities added and Major items of Equipment procured/fabricated :

Rhino Robot (Educational Training Type)

Scara Robot ( -do- )

Opticam Camera for vision

FFT analyser

AT 386 Computer - 40 MB

Microprocessor Systems.

3. Assistance to Students and Major Consultancy Assignments :

<i>Name of faculty</i>	<i>Name of client</i>	<i>Title of consultancy work</i>
1. Dr. Y. G. Srinivasa	State Bank of India	Project Report evaluation
2. Dr. M. Singaperumal Dr. T. Nagarajan	Larsen and Toubro	Investigation on Hyd. Tube splicing machine.

4. Papers presented at Conference attended :

<i>Sl. No.</i>	<i>Name of Faculty Member attending the Conference</i>	<i>Title of paper presented and authors</i>	<i>Dates and Venue of Conference</i>
<b>In India</b>			
1.	S. P. Venkateshan	Real time studies on Repetitive NMR spectra S. P. Venkateshan, G. Palanisamy and Y. G. Srinivasa	National Symposium on current Trends in Process Instrumentation and Control-Kalpakkam, Oct. 1988
2.	Ramachandra N. Hedge	Modelling of Engine Noise - Ramachandra N. Hedge and Y. G. Srinivasa	-do-

<i>Sl. No.</i>	<i>Name of faculty member attending the conference</i>	<i>Title of paper presented and authors</i>	<i>Dates and Venue of Conference</i>
3.	T. Nagarajan	Design and Analysis of Novel overhead platform manipulator T. Nagarajan, Vinayak G. Hedge	XIII AIMTDR Conf. in Jadavpur, Calcutta Nov. 1988
4.	T. Nagarajan	Wire Frame modelling of work volume of Industrial Robots. T. Nagarajan, K. R. Kumar, V. Radhakrishnan	XIII AIMTDR Conf. in Jadavpur, Calcutta Nov. 1988
5.	T. Nagarajan	A generalised FEM Procedure for determining Input functions of Machining Robots. T. Nagarajan, N. Siva Prasad, S. Ramachandran	XIII AIMTDR Conf. in Jadavpur, Calcutta, Nov. 1988
6.	T. Nagarajan	Microprocessor control for positioning of pneumatic actuators. T. Nagarajan and D. Babu	XIII AIMTDR Conf. in Jadavpur, Calcutta, Nov. 1988.
7.	T. Nagarajan	Kinematic Analysis of RCPRC Spatial Mechanism T. Nagarajan, B. V. A. Rao and K. V. Sri Rama Rao	40th AGM, The Aeronautical Society of India, Dec. 10-21.

#### Overseas

1.	M. Singaperumal	Analysis of Hydrostatic Steering System of a front end loader. Sekhar, N and M. Singaperumal	12th IMACS World Congress on Scientific Computation, at Paris July 1988.
2.	..	Modelling of RCPRC Spatial mechanism for its kinematic analysis using Denavit-Hartenberg Transformation Matrix. T. Nagarajan, B. V. A. Rao, K. V. Sri Rama Rao.	Int. Conf. on Modelling and Simulation Shenzhen, China, Nov. 7-9, 1988
3.	..	A Generalised approach for finding the minimum deflection path for assembly robots using finite element method. T. Nagarajan, N. Sivaprasad, S. Ramachandran	-do-
4.	..	A Survey of finite element methods application for dynamic analysis of robot manipulators T. Nagarajan, N. Sivaprasad, S. Ramachandran	-do-

**5. Research Publications :**

<i>Sl. No.</i>	<i>Author(s)</i>	<i>Title</i>	<i>Name of Journal</i>	<i>Vol. and Issue No.</i>	<i>Month/ year</i>	<i>Pages</i>
1.	P. Venugopal Murthy NVR M. Singaperumal, T. Nagarajan	Suitable Tooling on Hydrostatic Extension- Related Feasibility studies	Fluid Power	Vol. 14 Issue No. 4	Dec. 1988	27-36
2.	T. Nagarajan, B.K. Venkataramu, etal	Evaluation and Analysis of a Fast acting sole- noid valve	Current Science	Vol 57	5-8-88	815-820

**6. Short Term Courses / Continuing Education Programme:**

- |    |           |  |   |                     |
|----|-----------|--|---|---------------------|
| 1) | Aug. 1988 | Technology Appreciation Programme on<br>"Fluid Power Technology Status"                    | } | Dr. M. Singaperumal |
| 2) | Dec. 1983 | Short Term Course on "Industrial Hydraulics"<br>jointly with Fluid Power Society of India. |   |                     |

**7. Professional activities :**

1. Dr. M. Singaperumal — Member, Institution of Engrs. (India) and Fluid Power Society of India.
2. Dr. K. Narayanasamy — Member, Institution of Engrs. (India) and Fluid Power Society of India.
3. Dr. T. Nagarajan — Life Member, AIMM, ISTE.  
Treasurer, Fluid Power Society of India (Madras Chapter)

**8. Staff matters :**

- Dr. R. Raman — NSS Coordinator since 15-4-88
- Dr. M. Singaperumal — DAAD invitation - Hamburg (W. Germany)  
— underwent Zopp moderator Training programme.
- Dr. T. Nagarajan — Warden, Tapti Hostel

**9. Future Plans :**

The laboratory desires to embark in the following activities in the future :

**a) Research and Developmental activities :**

- i) Robotics : Some of the important topics in this field are Sensor developments for Robots, Flexible arm dynamics in Robots, software development for Robotic applications etc.
- ii) Precision Manufacturing and Measurement Techniques.
- iii) Improvement of the performance of hydraulic and Pneumatic components; Servo-hydraulics etc.
- iv) Development of conventional transducers for displacement, force, torque, etc.

**b) New P. G. Courses :**

It is proposed to start new P.G. courses on interdisciplinary nature :

- i) Fluid Power Engineering
- ii) Robotics and Automation.

## (vi) Machine Elements Laboratory

### 1. Research and Development Activities :

Kinematics, Gears, Surface Treatments, Lubrication sintered materials, Friction and Wear, Computer Aided Design, Finite Element Analysis.

### 2. New facilities added and Major item of equipment procured/fabricated :

- (a) 1000 KN Hydraulic Press
- (b) Microhardness tester
- (c) Data logger
- (d) Pressure transducer
- (e) Accelerometer and torque transducer
- (f) Carrier frequency amplifier

### 3. Short-term courses/Continuing Education Programmes conducted :

Surface Coatings/treatments 20-6-88 to 1-7-88  
Powder Metallurgy 11-11-88 to 18-11-88

### 4. Professional activities :

K. Gopinath, Secretary, FPSI, Madras Chapter  
K. Gopinath, Editor Flowlines, FPSI Madras Chapter bulletin

### 5. Invited Lectures :

- (a) Dr. N. Sivaprasad — 'Finite Element Methods' CMERI, DURGAPUR.
- (b) Prof. G. Bechtloff — 'Surface Coatings' — West Germany

### 6. Future Plans :

Surface treatments, Development of new sintered materials, compound heat treatment computer aided design, Thermalspraying.

## (vii) Mechanical Handling Laboratory

### 1. New facilities added and major items of equipment procured/fabricated :

F.F.T. Analyser

### 2. (i) Sponsored Projects : (Taken up during the year)

Title : Studies on the continuous forming of Helicoidal flights by rolling  
Funding agency and value : D. S. T.  
Rs. 4,89,760/-  
Period : 2 years  
Co-ordinators : Dr. K. Ramakoteswara Rao  
Prof. M. A. Parameswaran

### (ii) Sponsored Projects completed during the year :

Title : Development of Energy saving pneumatic conveying system  
Sponsoring agency and value : National Council for Cement and Building Materials  
Rs. 1,35,000/-  
Co-ordinators : Prof. M. A. Parameswaran  
Dr. K. Ramakoteswara Rao

### 3. Assistance to students and Major Consultancy Assignments :

<u>Name of client</u>	<u>Title of consultancy work</u>
i) MHD, BHEL, Tiruchy	Design of Pneumatic Conveyer for conveying potacium chloride
ii) Prabhakar Products	Design of drive systems to 14 m MESS Antenna
iii) L & T Ltd.,	Failure analysis of 3 roll bending machine.

### 4. Assistance to Sister Institutions :

Series of lectures on Mechanical Handling equipment to M. Tech students of REC. Tiruchy.

### 5. Papers presented at Conference attending :

<i>Sl. No.</i>	<i>Name of the faculty member attending the Conference</i>	<i>Title of paper presented and authors</i>	<i>Name, Dates and venue of Conference</i>
1.	Dr. K. Ramakoteswara Rao	Dynamic loading in EOT cranes due to Hoisting Dr. K. Ramakoteswara Rao	All India Seminar on Design and selection of kinemation for handling equipment: June 3 & 4, 88. Institution of Engineers, Calcutta-30.
2.	Dr. K. Ramakoteswara Rao Prof. M. A. Parameswaran	Design and Development of nosel roll lifting Device	Industrial problems in Machines and Mechanical 11th, 12th Ja. 89 E.E.C. Nagpur.

### 6. Research Publications :

1. Influence of Fluidization in Dence Phase Pneumatic conveying  
B. Anil and Dr. M. Madhusudana Rao  
Institution of Engineers (India), Vol. 69, pp. 29 to 34, Sept. '88
2. Dence phase pneumatic conveying system for fine materials  
A. Chattopadyay Dr. M. Madhusudana Rao & Prof. M. A. Parameswaran Bulk Solids Handling, Vol. 8, No. 6, Dec 88
3. Transport of fuel to the paver plants  
Dr. M. Madhusudana Rao  
Energex '88, International Energy Conference and exposition No. 25 - 30, 1988, TRIPOLI, LIBYA

#### Conference papers : by Prof. M. A. Parameswaran :

1. M. A. Parameswaran, Mechanical Handling, State of Art, keynote address, IPROMM 88, had national problems in Machines and Mechanisms - 88, Nagpur 11/12 Jan, 1989
2. S. Ganapathy and M. A. Parameswaran., The Phenomenon of starting a vibrating conveyor and its influence on design — a case studying IPROMM-88 (as above)
3. K. Ramakoteswara Rao & M.A. Parameswaran, Development of Roll lifting and tilting device, IPROMM-88 (as above)

#### Journal Papers :

1. C. J. G. Chandra, K. N. Seetharamu and M. A. Parameswaran, Effect of Supply orifice diameter and minimum thickness in air film conveyor used for conveying packages. Indian Journal of Technology, Vol. 26 May 1988 pp. 237/242

**7. National & International Conferences/Symposium organised :**

One day Seminar on Status of Technology in Materials Handling Equipment on 17-6-88 at I.I.T. Madras-36.

**8. Invited Lectures :**

- i) By IIT faculty in : Key note address by Prof. M. A. Parameswaran to IPROM 88 at REC other Institution : Nagpur on 11-11-88
- ii) By Distinguished : Invited lecture on Safety in the use of conveyors on 16-3-89 visitors to IIT : organised by National Safety Council

**9. Visitors to the Department/Centre :**

- 1) Prof. G. Bachtloff : Technique Hochschule der Bundeswehr, Hamburg, West Germany
- 2) Prof. Wiedenroth, Paderborn University, West Germany

**(viii) Production Engineering and Machine Tools Laboratory**

- 1. Research and Development Activities :**
- |        |   |                   |
|--------|---|-------------------|
| Ph.D   | — | 12 (2 completed)  |
| M.S.   | — | 8 (2 completed)   |
| M.Tech | — | 57 (26 completed) |

**2. New facilities added and major items of equipment procured / fabricated :**

- 1. 3 Component tool dynamometer for measuring cutting forces
- 2. Data Acquisition System

**3. Sponsored Projects : (Taken up during the year)**

Development of an integrated approach for the system Adaptive control of CNC machines based on workpiece Monitoring DST 3 years Dr. V. Radhakrishnan  
Dr. R. Krishnamurthy  
Dr. Y. G. Srinivasa

**4. Assistance to Students and Major Consultancy Assignments :**

	<i>Name of faculty</i>	<i>Name of Client</i>	<i>Title of Consultancy work</i>
1.	Dr. V. Radhakrishnan Dr. R. Krishnamurthy	Aeronautical Dev. Agency, Bangalore	Investigation of Drilling Holes in CFC Plates
2.	Dr. V. Radhakrishnan Dr. R. Krishnamurthy Dr. O. V. K. Chetty	Carborundum Universal Ltd., Madras	Wheel Evaluation in Cylindrical Grinding
3.	All Faculty staff of Prodn. Engg.	Murugappa Electronics Madras.	Obtaining mirror finish and for testing the surface finish of 3 Nos Imported rollers.
4.	Dr. R. Krishnamurthy	Madras Atomic Power Station, Kalpakkam	Machining of chrome oxide coated plungers
5.	Dr. M. S. Shunmugam	Cut-fast Abrasives Madras	Calibration of gauges
6.	— do —	Audco India Ltd., Madras	Calibration of slip gauges
7.	Dr. B. Ramamurthy	Balaji Valves Ltd., Madras	Checking the dimensions on threads
8.	— do —	Ramakrishna Engg., Madras	Calibration of thread plug gauges and ring gauges
9.	Dr. R. Krishnamurthy	MTU Liaison Office India, New Delhi	Machining and subsequent welding on Al. parts

##### 5. Assitance to Sister Institutions :

1. College of Engineering, Guindy
2. REC, Warangal
3. Advanced Training Institute Guindy
4. S. V. University, Tirupati
5. Annamalai University, Chidambaram
6. University of Cochin, Cochin

##### 6. Papers presented at conference attended :

<i>Sl. No.</i>	<i>Name of faculty member attending the Conference</i>	<i>Title of paper presented and authors</i>	<i>Name; Dates and venue of Conference</i>
1.	Dr. V. Radhakrishnan	Key Note address Automation in Manufacturing - Its Philosophy and Implications	XIII AIMTDR 25-27 Nov., 1988 Jadavpur Univ.
2.	Dr. P. K. Philip	Textural characteristics of EDM surfaces	— do —
3.	Dr. M. S. Shunmugam	Computer Aided Design of Pinion Type gear shaping cutter	— do —
4.	Dr. O. V. Krishnaiah Chetty	Corrosion Resistance of Ball burnished components	— do —
5.	Dr. G. Kuppaswamy	Model Building in Machnability Data Analysis/Bank/System	— do —
6.	Dr. B. Ramamoorthy	Effect of burnishing of shafts on the performance of inter- fit assemblies	— do —
7.	Dr. L. Vijayaraghavan	Studies on the dynamics of Internal broaching	— do —
8.	Mr. N. Ramesh Babu	A study of laser dressed grinding wheel profiles	— do —
9.	Dr. M. S. Shunmugam	Friction weldability of T-1 (Type A) steels	Int. Conf. on Joining of Materials 19-22 March 89 Hellsingor, Denmark.

##### 7. Research Publications :

1. RADHAKRISHNAN, V.  
Automation in Manufacturing-Its Philosophy and Implications, Key Note Paper, 13th AIMTDR  
Conf., Jadavpur (1988) Calcutta.
2. RAMESHBABU, N. RADHAKRISHNAN, V.  
A Study of Laser Dressed Grinding Wheel Profiles. Proc. 13th AIMTDR Conf. Jadavpur (1988)  
Calcutta, pp. C01-06.
3. KUMAR, N. L. N. N. CHETTY, O. V. K. RADHAKRISHNAN, V.  
Corrosion Resistance of Ball Burnished Components, Proc. 13th AIMTDR Conf. Jadavpur  
(1988) Calcutta, pp. D06-10.



4. KUMAR, K. R. NAGARAJAN, T. RADHAKRISHNAN, V.  
Wireframe Modelling of Work Volume of Industrial Robots, Proc. 13th AIMTDR Conf. Jadavpur (1988) Calcutta, pp. H06-10.
  5. NAKKEERAN, P. R. RADHAKRISHNAN, V.  
Effect of Regulating Wheel Errors in Centreless Grinding, Proc. 13th AIMTDR Conf. Jadavpur (1988) Calcutta, pp. J07-12.
  6. RAMAMOORTHY, B. RADHAKRISHNAN, V.  
Effect of Burnishing of Shafts on the performance of Interference fit assemblies, Proc. 13th AIMTDR Conf. Jadavpur (1988) Calcutta, pp. J13-16.
  7. BABU, N. R. RADHAKRISHNAN, V.  
Surface Topography of a Laser Dressed Grinding Wheel, Symposium on Recent Developments in Nontraditional Machining, ASME, Winter Annual Meeting, Nov. (1988) pp. 199-212.
  8. NAKKEERAN, P. R. RADHAKRISHNAN, V.  
A Strategy for inprocess control of workpiece quality in Centreless Grinding, Symposium on Manufacturing Metrology, ASME Winter Annual Meeting, Nov. (1988) pp. 65-73.
  9. SATHYANARAYANAN, G. RADHAKRISHNAN, V.  
Roughness Measurement with Non-contacting Inductive pick-up, Symposium on Manufacturing Metrology, ASME Winter Annual Meeting, Nov. (1988) pp. 75-100.
  10. CHETTY, O. V. K. RAJASEKHAR, C. RADHAKRISHNAN, V.  
Selection of Unconventional Machining Processes Using Expert Systems. Third Int. Conf. on Computer-Aided Production Engineering, The University of Michigan, Ann Arbor, Michigan, USA, 1988.
  11. SUBRAMANYA UDUPA, N. G. SHUNMUGAM, M. S. RADHAKRISHNAN, V.  
Workpiece movement in centreless grinding and its influence on quality of the ground part. Trans ASME J. of Engg. for Industry 110 (1988) pp. 179-186.
  12. BHAT, B. D. RADHAKRISHNAN, V.  
Effect of Surface roughness of adherends on the tensile strength of 2014-Aluminium bonded with a room temperature curing epoxy adhesive. J. of the Instn. of Engrs. ME division 69 (1988) pp. 59-63.
- II. 1. P. K. PHILIP and G. KUPPUSWAMY  
"Emerging trends in machine tool Technology", Proc. 3rd National Convention of Prod. Engineers, Bombay, Nov. 25-26, 1988.
2. V. S. R. MURTI and P. K. PHILIP  
"Textural characteristics of EDM surfaces", Proc. 13th AIMTDR Conference, Jadavpur, Nov. 1988, pp. F1-F06.
3. JOSE K. JOHN, P. K. PHILIP and PAUL THOMAS  
"Optimising machining conditions for finish turning hardened steel using black ceramics", Proc. 13th AIMTDR Conference, Jadavpur, Nov. 1988, pp. B45-B50.
4. C. S. VIJAY ANAND, A SARAVANAN, P. K. PHILIP and G. KUPPUSWAMY  
'Software development for the microprocessor based control of a NC vertical milling machine', Presented at XIII AIMTDR Conference (Calcutta, India), Nov., 1988.
5. Y. BASHEER KUTTY and P. K. PHILIP  
"Technology Development of P/M Brass Components from Metal cutting chips" Int. J. of Powder Metallurgy, (Princeton, USA.) Jan. 1988.
- III. 1. 'Text Books and Technical Education', National Seminar on Need and Availability of Text Books for Higher Education Sector in India, Feb. 12-14, 1988.

2. 'Microprocessor Applications in Manufacturing', National Seminar on Automation in Industry, Oct. 28-29, 1988, Kurukshetra.
  3. 'Automated Factory of the Future'. National Seminar on Automation in Industry, Oct. 28-29, 1988, Kurukshetra.
  4. 'Model Building in Machinability Data Analysis/Bank/System', Proc. 13th AIMTDR Conf., Nov 25-27, 1988, pp. B-51-54. (Co-author: P. S. Subramanya, and P. Sivasankaran).
  5. 'Software Development for Microprocessor Based Control of an NC Vertical Milling Machine', Proc. 13th AIMTDR Conf., Nov. 25-27, 1988, p. G-67, (Co-authors: P. K. Philip, C. S. Vijay Anand, A. Saravanan).
- IV.
1. **G. Santhanakrishnan, R. Krishnamurthy and S. K. Malhotra**  
"Machining of composites", 12th Conference on Composites-Materials and Structures, Advanced composites working group, NASA, USA, Jan., 1988.
  2. **G. Santhanakrishnan and R. Krishnamurthy**  
"Friction characteristics of machined FRP surface" Int. Conf. on Composite Materials and Structure, IIT, Madras, Jan., 1988.
  3. **G. Santhanakrishnan and R. Krishnamurthy**  
"Machinability of Fibre reinforced plastics composites", Int. J. Mechanical Working Technology, 17, 1988, pp. 195-204.
  4. **R. Krishnamurthy**  
"Surface durability of hollow rolling elements", 7th European Conf. on Fracture, Budapest, 19-24 Sept., 1988.
  5. **R. Krishnamurthy**  
"Performance characteristics of Ion implanted sliding surface Engg. Int. Conference, COTEC Corpn, Tokyo, Japan, Nov., 1988, pp. 369-378.
  6. **M. M. Mayuram and R. Krishnamurthy**  
"Modified axial shear test for bond strength evaluation of thermal sprayed coatings", Proc. of Surface Engineering International Conference, Japan Thermal Spraying Society Tokyo, Japan, Oct., 1988, pp. 29-34.
  7. **R. Krishnamurthy**  
Ion implantation for performance enhancement of structured steel", National Convention IPE, Jamshedpur, Nov. 1988.
  8. **G. Santhanakrishnan and R. Krishnamurthy**  
Machining of carbon fibre reinforced plastics", Proc. of 13th AIMTDR Conference, Jadavpur University, Calcutta, Nov., 1988, pp. 51-55.
  9. **R. Krishnamurthy**  
Comb cracking in cemented carbides", Proc. of 13th AIMTDR Conference, Jadavpur University, Calcutta, Nov., 1988, pp. 99-104.
  10. **B. L. Anantharamu and R. Krishnamurthy**  
"Machinability study on toughened  $ZrO_2$  and  $Al_2O_3$  ceramics", Proc. of 13th AIMTDR Conference, Jadavpur University, Calcutta, Nov., 1988, pp. C22-24.
  11. **G. Santhanakrishnan and R. Krishnamurthy**  
"Preliminary investigation on machining of fibrous composites", 40th Annual Genl. Meeting of Aeronautical Society of India, Dec., 1988.
- V.
1. **B. Ramamoorthy and V. Radhakrishnan**  
'Effect of burnishing of shafts on the performance of interference fit assemblies', Proc. 13th AIMTDR Conf., Jadavpur Univ., Calcutta, 1988, pp. J13-J16

- VI. 1. **N. G. Subramanya Udupa, M. S. Shunmugam and V. Radhakrishnan**  
'Influence of setup geometry on the harmonic content of the transverse profiles of ground parts in centreless grinding', Recent developments in production research, Elsevier Science Publishers, Netherlands, 1988.
2. **K. Sankaranarayananaswamy and M. S. Shunmugam**  
'Minimum achievable quality of involute gears in generation processes', Int. J. Mach. Tools Manufact, 1988, V. 28, n 1, pp 1-10
3. **N. G. Subramanya Udupa, M. S. Shunmugam and V. Radhakrishnan**  
'Workpiece movement in centreless grinding and its influence on quality of the ground part', Trans. ASME, Journal of Engineering for Industry, 1988, V. 110, pp. 179-186
4. **P. K. Ramakrishna Rao and M. S. Shunmugam**  
'Wear studies in B.T.A. drilling', Wear, 1988, V. 124, pp. 33-43.
5. **M. S. Shunmugam and S. Janardhanan**  
'Minimum-Inspection and Minimum-Cost designs of x-control chart', Indl. Engg. Journal (India) ', 1988, V. 17., n.3, pp. 1-9.
6. **K. Sankaranarayananaswamy and M.S. Shunmugam**  
'Computer-aided evaluation of gear parameters from coordinate measurements', 3rd Int. Conf. on Computer-aided Prod. Engg., Michigan, U.S.A. June 1988.
7. **G. P. Rajamani and M. S. Shunmugam**  
'Role of surface finish in friction welding', Int. conf. on Welding Technology in Developing Countries - Present status and Future needs, Roorkee, India, Sep. 1988, pp. 141-148.
8. **K. Sankaranarayananaswamy and M. S. Shunmugam**  
'Synthesis of profiles obtained in Gear Shaping', Int. Nat. Conf. on Gears, China, Nov. 1988, pp. 289-294.
9. **K. Sankaranarayananaswamy and M. S. Shunmugam**  
'Minimisation of error on the effective profile of pinion-type gear shaping cutter', Int. J. Mach. Tools manufacture. 1988, V. 28, n. 4, pp. 591-601.
10. **M. S. Shunmugam**  
'Assessment of errors in geometrical relationship', Wear, 1988, V. 128, pp. 179-188.
11. **M. S. Shunmugam and G. Somasundaram**  
'Accuracy and surface finish in reaming', XIII AIMTDR conf. Jadavpur Univ., India, Nov. 1988, B41-44.
12. **M. S. Shunmugam and Capt. K. N. Achappa**  
'Back-spot facing tool for CNC machining centre', XIII AIMTDR conf., Jadavpur Univ., India, Nov. 1988, pp. B13-16.
13. **K. Sankaranarayananaswamy and M. S. Shunmugam**  
'Computer-aided Design of Gear shaping cutter', XIII AIMTDR conf., Jadavpur Univ., India, Nov. 1988, pp. B17-22.
14. **G. P. Rajamani and M. S. Shunmugam**  
'Design, development and testing of a friction welding machine for research purposes', National welding Seminar, Nov. 1988, pp PE4 1-5.
15. **M. S. Shunmugam**  
'Measurement of half-bore and large-bore features', Precision Engg., 1989, V. 11, No 1, pp. 15-18.
16. **G. P. Rajamani, M. S. Shunmugam, K. Prasad Rao and M. V. Rao**  
'Friction-weldability of T-1 (Type A) steel', 4th Int. conf. Joining of Materials, Hellsingor, Denmark, March 1989.

- vii. 1. **N. L. N. N. Kumar, O. V. Krishnaiah Chetty, and V. Radhakrishnan**  
 'Corrosion resistance of ball burnished components', Proc. 13th AIMTDR Conf., Calcutta, Dec. (1988), D 6-10.
2. **O. V. Krishnaiah Chetty, G. Prabhakara Rao and R. Narayan**  
 'Parametric influence on polarisation in ECM', Proc. 13th AIMTDR Conf., Calcutta, Dec. (1988), F 17-20.
3. **O. V. Krishnaiah Chetty, C. Rajasekhar and V. Radhakrishnan**  
 'Selection of unconventional machining process using expert systems', Accepted for presentation and publication at 3rd Int. Conf. on Computer Aided Production Engg., Michigan, USA, June (1988).
4. **M. Lakshmanan, O. V. Krishnaiah Chetty, E. Unnikrishnan,**  
 'Influence of heat stress in Ferrous Foundry environment, Indian Foundry Journal, V XXXIV, 2 (1988), pp. 33-38.
5. **G. Prabhakara Rao, O.V. Krishnaiah Chetty and R. Narayan**  
 'Application of FEM to anodic smoothing in ECM', J. Mech. Working Technology, 17 (1988), pp. 289-296.
6. **G. Velayutham, G. Prabhakara Rao, O. V. Krishnaiah Chetty and R. Narayan**  
 'The Electrochemical Machining of Nickel - A statistical Design of Experiments and Analysis', Proc. Int. Symposium on IMF, Karaikudi, Jan., (1989).
- viii. **V. Sajeew and L. Vijayaraghavan**  
 'Studies on the Dynamics of Internal Broaching', 13th AIMTDR Conf., Jadavpur, Univ., 1988, pp. B-86-B. 90.
- ix. 1. **N. Ramesh Babu and V. Radhakrishnan**  
 'A study of Laser dressed grinding wheel profiles, Proc. 13th AIMTDR Conf., Jadavpur University, (1988), Calcutta, pp. CO1-06.
2. **N. Ramesh Babu and V. Radhakrishnan**  
 'Surface topography of a laser dressed grinding wheel', Symposium on Recent Developments in Nontraditional Machining; ASME, Winter Annual Meeting, Nov. (1988), pp. 199-212.
8. **Short term courses continuing education programmes :**
1. ISTE Short term course on 'Emerging Trends in Precision Machining - June, 1988.
  2. Short Term course on 'CAD-CAM - An Introduction'.
  3. Short Term course on 'CAD-CAM for Executives'.
9. **Professional activities :**
- Dr. M. S. Shunmugam - Session Chairman, Int. Conference on Joining of Materials, 19-22 Mar, 1989 held at Hellsingor, Denmark.
- Membership in Professional Societies by Faculty Members**
- Fellow - Institute of Engineers, India.  
 Corp. Member - Instn. of Prodn. Engineers, UK.  
 Sr. Member - SME, USA. (Soc. of Manf. Engrs. USA)  
 \*\*\* Member - ASME (American Soc. of Mech. Engrs.)  
 Member - National Institute of Quality Assurance  
 Member - Indian Soc. of Manuf. Engineers  
 Member - Fluid Power Soc. of India.

## 10. Invited Lecturers :

### i) By IIT Faculty in other Institutions

1. College of Engineering, Guindy
2. S. V. University, Tirupati
3. A. T. I., Guindy

### ii) By Distinguished visitors at IIT :

1. Prof. Dr. Ing.—**Massberg**—Under Indo-German Programme
2. Prof. Stephen Malkin, Univ. of Massachusetts, USA
3. Mr. Schneider and Mrs Addey from the Federal Ministry for Economic Co-operation (BMZ) of West Germany
4. Dr. M. Mohrle, Ruhr-Universitat Bochum - under Indo-German Programme

## 11. Visitors to the Department :

Various Industries people visited during Open house programme

## 12. Future plans :

Research and development work will be carried out on the following areas :

Metal cutting, Surface characterisation, Surface Integrity, Gear Tribology, Unconventional Machining, EDM, ECM, CAD/CAM, Group Technology, etc.

## (ix) Refrigeration & Airconditioning Laboratory

### 1. Research & Development Activities :

- a) Development of a R21-DMF vapour absorption heat transformer
- b) Testing of a-R22-DMETEG vapour absorption refrigeration system suitable for low potential heat sources utilisation
- c) Fabrication and testing of a rotary silica-gel regenerator
- d) Use of heat pumps for energy conservation in airconditioned buildings
- e) Bulk cooling of food products.

### 2. Sponsored Projects :

<i>Sl. No.</i>	<i>Title</i>	<i>Funding agency &amp; value</i>	<i>Period</i>	<i>Coordinator</i>
<b>i) Sponsored projects sanctioned during the year :</b>				
1.	Design and Development and Testing of Heat Exchangers for Helium Liquefier	DST 8.5 lakhs	3 Years	Dr. S. Srinivasa Murthy
<b>ii) Sponsored Projects completed during the year :</b>				
1.	Heat Pumps and Energy Conservation	TERI 2 lakhs	1½ Years	Dr. S. Srinivasa Murthy
2.	Solar Thermal Power Plant	DNES 1 lakh	1 Year	Dr. S. Srinivasa Murthy

### 3. Assistance to Students and Major Consultancy Assignments :

<i>Name of the faculty</i>	<i>Name of the client</i>	<i>Title of consultancy work</i>
1. Dr. S. Srinivasa Murthy	Elgi Equipments Coimbatore	Testing of A/C Compressors on Railway Coaches
2. Dr. S. Srinivasa Murthy	Alfa Laval Ltd. Poona	Performance of compressors

### 4. Assistance to Sister Institutions :

- |   |   |
|---|---|
| a) Network Programme<br>(Coordinated by<br>Dr. S. Srinivasa Murthy) | i) REC, Trichy for Establishing a Refrigeration and Airconditioning Laboratory        |
|   | ii) REC, Surathkal for establishing Energy Technology Laboratory                      |
| b) OIP Scholars<br>(All guided by<br>Dr. S. Srinivasa Murthy)       | i) Mr. John M. George (Ph D)<br>TKM College of Engineering<br>QUILON                  |
|   | ii) Mr. A. M. K. Poduval<br>Govt. College of Engineering<br>FARMAGUDI, PONDA, GOA     |
|   | iii) Mr. S. Shanmugha Sundaram<br>Govt. College of Technology<br>COIMBATORE - 641 013 |
|   | iv) Mr. P. K. Shah<br>L. D. College of Engineering<br>AHMEDABAD - 380 015             |

### 5. Papers presented at Conference attended:

1. S. Srinivasa Murthy, M. V. Krishna Murthy & M. V. C. Sastri  
Two Stage Metal Hydride Heat Transformers : A Thermodynamic Study.  
7th World Hydrogen Energy Conference, Moscow (USSR), 25-29 Sept. 1988.  
(Presented by M. V. C. Sastri, Consultant)

### 6. Research Publications :

1. P. S. Asha Iyer, S. Srinivasa Murthy & M. V. Krishna Murthy.  
Correlations for evaluation of the performance characteristics of vapour absorption refrigeration cycles  
Solar and Wind Technology. Vol. 5, 1988, pp 191-197.
2. Phuong Dung Dan & S. Srinivasa Murthy  
Comparative thermodynamic study of fluoracarbon refrigerant based vapour absorption heat pumps  
Int. J. of Energy Research, Vol. 13, 1989, pp 1-14.
3. Phuong Dung Dan & S. Srinivasa Murthy  
Thermodynamic analysis data on vapour absorption heat pump working on R22-DMETEG pair Heat Recovery Systems & CHP, Vol. 8, 1988, pp 87-93.

## 7. Future Plans :

### Energy Conservation :

Development of high temperature heat pumps and heat transformers for industrial applications. Improvement in operating efficiencies of airconditioning plants.

### Cryogenic Engineering :

Development of compact heat exchangers for cryogenic applications.

### Food Processing :

Techniques for bulk cooling of food products.

## (X) Thermal Turbomachines Laboratory

### 1. Sponsored Projects :

The laboratory has successfully completed a joint Indo-German research project on 'Energy-Centrifugal Compressors' in collaboration with Aachen Technical University, West Germany, during the year 1988-89.

### 2. Research and Development :

The laboratory collaborated with Regional Engineering College, Trichy, under the Institute network scheme of the Ministry of Human Resources Development, New Delhi to establish a Turbomachinery Lab. at REC, Trichy.

Ph. D.	—	5 (external) in progress
	—	1 (Q I P) in progress
	—	1 (Regular) in progress
M.S.	—	1 (Part time-internal)-in progress
M. Tech.	—	8 Completed

### 3. New Facilities added :

The laboratory has acquired a dual channel Hot wire anemometer with signal analysis modules and an IBM compatible At-386 personal computer with peripherals such as printer, plotter etc.

### 4. Assistance to Industries :

1. 'Design fabrication and calibration of two dimensional and three dimensional probes' for BHEL, R & D, Hyderabad.
2. 'Performance testing of fan rotor cascade' for BHEL, Bhopal.
3. 'Calibration of cup counter anemometer' for PRICOL, Coimbatore.
4. 'Calibration of Pitot Static Probe', for PRICOL, Coimbatore.
5. 'Modification of a radial inflow turbine for rotor static and total pressure measurements in the rotor blade passage, for BHEL, R & D, Hyderabad.
6. 'Design of a centrifugal fan', Digvijay Cements, Digvijaygram.
7. 'Testing of centrifugal fan' for NADI, Airtechnics, Madras.
8. 'A report on cold storage plant' for the Marine Products Export Development Authority, Cochin.
9. 'Calibration of total pressure probe and inclined manometer' for M/s. Batliboi & Co., Madras.

10. 'Performance testing of radiator cooling fans' for M/s. Ampson Plastics Pvt. Ltd., Bombay.
11. 'Performance testing of induced draft centrifugal fan' for M/s. Swathy Chemicals Pvt. Ltd. Madras.
12. 'Testing of automobile car fan assemble for its airflow characteristic'—M/s. Lucas TVS Ltd. Madras.
13. 'Design of axial fans for application to hydrogenerators - BHEL. Bhopal, in progress.

#### 5. Research Publications :

1. *Sitaram, N.*, 'Effect of Stage Loading on Endwall Flows in an Axial Flow Compressor Rotor', ASME Paper No. 88-GT-111 June 1988, 7 pages.
2. *Govardhan, M., Sitaram, N., Prasad, R.S.N., and Venkatrayulu, N.*, 'Effect of Aspect Ratio on Secondary Flows and Losses in a High Deflection Linear Turbine Rotor Cascade', Indian Journal of Technology, Feb., 1989.
3. *Sitaram, N., Govardhan, M., Venkatrayulu, N.*, 'Wake Behaviour of a Large Deflection Turbine Rotor Linear Cascade', 4th National Conference on Aerodynamics, Dec., 19-21, 1988, I. I. T., MADRAS, India, J. of Aero. Soc. of India (in print)
4. *Govardhan, M., Sitaram, N., and Vidyasagar, D.*, 'Effect of the Entry Boundary Layer Thickness on the performance of an Axial Flow Fan Impeller', 16th National Conference of Fluid Mechanics and Fluid Power, Dec., 15-19, 1988, KANPUR, India.
5. *Sitaram, N., Govardhan, M., Giridharan, M.G., and Venkatrayulu, N.*, 'Effect of Incidence Angle on Secondary Flows and Losses in a High Deflection Linear Turbine Rotor Cascade', 16th National Conference of Fluid Mechanics and Fluid Power, Dec. 15-19, 1988, KANPUR, India.
6. *Govardhan, M., Venkatrayulu, N., and Nayak, A.K.*, 'Quasi-Three Dimensional Computational Flow Analysis Through an Annular Turbine Cascade', 40 Years of Turbo Institute, Sept., 13-15, 1988, YUGOSLAVIA.
7. *Govardhan, M., and Venkatrayulu, N.*, 'Effect of Space Chord Ratio on Secondary Losses in a Large Deflection Linear Turbine Cascade', Seminar on 'Gas Turbine Technology for Power Generation', Institution of Engineers (India), 2nd April 1988, MADRAS, India.
8. *Govardhan, M., and Venkatrayulu, N.*, 'Loss Estimation Through an Annular Turbine Cascade', Seminar on Gas Turbine for Power Generation, Institution of Engineers (India), 2nd April 1988 MADRAS, India.

### (xi) Thermodynamics Laboratory

#### 1. Research and Development activities :

- i) Carried out research on supersonic combustion.
- ii) Laser doppler anemometer set-up is ready for use.

#### 2. New facilities added and major items of equipment procured/fabricated :

- i) Fabricated a thermal solar water pump.
- ii) Burner set-up for investigation of the effects of interference and confinement in multiple diffusion flame systems.



### 3. Sponsored Projects :

Sl. No.	Title	Funding	Value	Period	Coordinators
1.	Studies on supersonic combustion	ISRO	7 lakhs	4 Years from March '89	Dr. K A. Damodaran Dr. V. Sriramulu Dr. U. S. P. Shet
2.	Studies on combustion phenomena in rocket ramjet engines.	ARDB	6.2 lakhs	86-89	Dr. R. Natarajan K. S. Padiyar Dr. BHL Gowda
3.	Interference effects in spray combustion	ISRO	4.96 lakhs	1988-90	Dr. R. Natarajan Dr. BHL Gowda
4.	Data base for Brain Drain institution based study IIT-Madras	DST	0.16 lakhs	1987-88	Dr. R. Natarajan Dr. M. S. Ananth Dr. K. Ganesh Babu

### 4. Assistance to students and major consultancy assignments :

Consultancy to EdCil, New Delhi on IIT, Assam, through Project Director, Prof. R.C. Malhotra, Deputy Director, IIT-D.

Guided 2 M. Tech. and one Ph.D Student.

### 5. Assistance to Sister Institutions :

Having one QIP scholar for Ph. D. from Trivandrum Engineering College.

Assisting, Dept. of Mechanical Engineering, Malnad College of Engineering, Hassan through network scheme.

### 6. Papers presented at Conference attended :

National Conference : 9

International Conference : 3

#### Dr. R. NATARAJAN

1. "Velocity Histories of a Burning Droplet including Liquid-Phase Unsteady Effects", with A. K. Ghosh, 40th Annual Technical Meeting of the Aeronautical Society of India, Dec. 19-21, 1988, IIT, Madras.
2. "An Investigation of the Stability and Lift-off Characteristics of Jet Diffusion Flames", with S. K. A. Somaraj and K. S. Padiyar, Ibid.

#### Dr. A. VENKATESH

3. A. Venkatesh, "Solar Cooling," Workshop on Thermal Applications of Solar Energy, Institute of Engineers Karnataka Circle, Bangalore, September 1988.
4. A. Mani and A. Venkatesh, "Experimental Investigations of a Two Stage Intermittent Solar Refrigeration System", National Solar Energy Convention 1988, Hyderabad, 1988.
5. A. K. Chaturvedi and A. Venkatesh, "Problems in Portable Solar Still", National Solar Energy Convention 1988, Hyderabad, 1988.
6. R. Hariprakash Rao and A. Venkatesh, "Solar Thermal Water Pump", National Solar Energy Convention 1988, Hyderabad, 1988.
7. V. B. Gandhe, A. Venkatesh and V. Sriramulu, "Analysis of an FMDF Solar Collector", National Solar Energy Convention 1988, Hyderabad, 1988.

**Prof. V. SRIRAMULU**

8. "Analysis of an FMDF Solar concentrator" - V.B. Gandhe A. Venkatesh, V. Sriramulu - Solar Energy Conference, BHEL-Hyderabad, 1988.

**Dr. U. S. P. SHET**

9. Vince Joseph, Shet U. S. P. and Ganesan, V. "Flow and Flame characteristics of a New Swirl Burner" - 4th National Conference on Aerodynamics, Dec. 19-21, 1988, IIT-Madras-36.
10. Balachandran P. and Shet U.S.P: "Turbulence characteristics of a heated Air Jet" Proc. 16th National Conference on Fluid Mechanics and Fluid Power, H.B.T.J., Kanpur - December 15-17, 1988, pp. 474-479.

**Dr. R. NATARAJAN**

11. "Flow Visualization Studies in the Wakes. of Single and Binary Sphere Systems", with K. Nandakumar and B. H. L. Gowda First World Conference on Experimental Heat Transfer, Fluid Mechanics and Thermodynamics, Dubrovnik, Yugoslavia, Sept. 4-9, 1988.
12. "Flow Visualization Studies in the Wakes of Single and Binary Simulated Vaporizing Drops", with K. Nandakumar and B.H.L. Gowda, 5th Miami International Symposium on Multi-Phase Transport and Particulate. Phenomena, U. of Miami, USA, Dec. 12-14, 1988.

**Dr. U.S.P. SHET**

13. Rao P.R.R., and Shet U.S.P.: "Thermosyphon Flow Measurement in Solar Water Heaters", Asian Congress of Fluid Mechanics, August 21-25, 1989, Hong Kong.

**7. Research Publications :**

National Journal : 12  
International : 5  
Journals

**Dr. R. Natarajan**

1. "Contributions of the Porous-Sphere Technique for the Modelling of Droplet Diffusion Flames", in "Advances in Aerospace structures and Allied Fields", Ed. T. K. Varadan, I. I. T., Madras, 1988, pp. 245-256.
2. "Numerical Investigation of Combustion of Fuel Sprays with Systematic Consideration of Variable Properties", with T. C. Arun Murthy and K. S. Padiyar, Journal of the Aeronautical Society of India, 40, 35-39 (1988).
3. "Description of Liquid Diffusion Flames in Terms of the Conserved Scalar Approach", with V. Ramanujachari, Fuel Science and Technology, 7, 47-50 (1988).
4. "Velocity Histories of a Burning droplet including Liquid-Phase Unsteady Effects", with A. K. Ghosh, J. Aero. Soc. of India.
5. "Interference Effects in Multiple Gaseous Diffusion Flames", with S. K. A. Somaraj and K. S. Padiyar, Defence Science Journal, Vol. 38, No. 3, 245-259 (1988).
6. "Dynamics of Burning Drops Injected Vertically into Stagnant Gas", with R. Venkatram and U. S. P. Shet, Indian J. Technology, Vol. 26, 320-323 (1988)
7. "Some Essential considerations of Faculty Accountability and work ethics", Ind. J. Tech. Education, 11 (1), 1-12 (1988).
8. "Composition Profiles for a Simple Chemically Reacting System undergoing a two-stream steady-flow mixing and reaction process", Fuel Science and Technology, 7(3), 53-62 (1988).

**Dr. A. Venkatesh**

9. A. Venkatesh and A. Mani, "Comparison of Performance of Single stage and two stage intermittent solar refrigeration systems," Journal of Solar and Wind Technology, 1989.
10. A. Venkatesh and A. Mani, "Experimental Investigations on a Two Stage Intermittent Solar Refrigeration System," Journal of the Solar Energy Society of India, Issue 1, 1989.
11. V. B. Gandhe, A. Venkatesh and V. Sriramulu, "Thermal Analysis of an FMDF Solar Concentrator", Journal of Solar and Wind Technology.

**Dr. K. A. Bhaskaran**

12. "Detonation wave parameters for aromatic hydrocarbons - Sanjay Deodhar, K. A. Bhaskaran and K. Thyagarajan, Indian Journal of Technology - (under print)

**Dr. R. Natarajan**

1. "Thermodynamic Analysis of Binary - Fluid Rankine Cycles for Geothermal Power Plants", with S. Subbiah, Energy Conversion and Management, 28, 47-52 (1988)
2. "Process Analysis of Becoming Committed to Energy Conservation - a Path Analytic Approach", with K. P. Srinivasa Setty, Energy Conversion and Management, 28, 5-9, (1988).
3. "First and Second-Law Analysis of the Rankine Steam Power Cycle", with T. C. Arun Murthy, International Journal of Mech. Engg. Education, 16 (4), 5-12, (1988).
4. "Experimental Investigations of Interference Effects in Binary Droplet Systems of Unequal size", with K. Nandakumar and B. H. L. Gowda, in particulate Phenomena and Multiphase Transport, Eds : T. Nejat Veziroglu, Hemisphere Pub. Corporation, USA, Vol. 4, pp. 401-412 (1988).

**Dr. A. Venkatesh**

5. A. Venkatesh and V. Sriramulu, "Analysis of the Flat Plate Collector Serving as Generator in an Intermittent Solar Refrigeration System", ENERGY - The International Journal 1989.

**8. National & International Conferences / Symposium organised :**

One day workshop on thermal applications of solar energy under the auspices of institution of engineers, Karnataka circle, Bangalore on September 10, 1988 (Convenor - Dr. A. Venkatesh)

**9. Short term courses / continuing education programmes :**

- i) Workshop on liquid atomisation and combustion systems at IIT Madras December 7-10, 1988 (Convenor : R. Natarajan)
- ii) Workshop on liquid atomisation and combustion systems at Univ. of Technology, Malaysia : Dec. 13-16, 1988.

**10. Awards and Honors :**

Prof. K. A. Bhaskaran has been nominated to "Reference Asia" published by Rifacimento International, New Delhi.

**11. Professional activities :**

**Dr. U. S. P. Shet**

Serving as Jt. Secretary & Treasurer of Combustion Institute (Indian Section) which is affiliated to its parent body Combustion Institute Pittsburgh 'USA.

## **Dr. R. Natarajan**

1. Continues to be Member (since 1976), International Editorial Board, FUEL Butterworths, U.K.
2. Continues to be Member, Editorial Board (Since 1983) FUEL SCIENCE AND TECHNOLOGY, CFRI, Dhanbad.
3. Continues to be Member, Editorial Board (Since 1986), INDIAN JOURNAL OF TECHNICAL EDUCATION.
4. Continues to be Secretary, Institute for Liquid Atomisation and Spraying systems - South Asian Section (since 1986).
5. Invited to be a Member of the Board of the Governing Council of the Urja Research Foundation, IBPL, Bombay.
6. Continues to be a Member of the Propulsion Panel of the Aeronautics R and D Board of the Ministry of Defence (since 1980)
7. Continues to be a Member of the Special Recruitment Board of C. S. I. R. (since 1982)
8. Member, Expert Panel of ISTE for selection of Summer/Winter School programs (since 1985)
9. Nominated Member of the State Board of Technical Education Kerala, 1988-90.
10. Was a Member of the Selection Committee of the TANASAWA AWARD for selecting the Best Paper of three I CLASS (International Conference on Liquid Atomization and Spray Systems) Conferences : I ICLASS 1978, Tokyo, II ICLASS 1982, Wisconsin III ICLASS 1985, London.
11. Re-nominated to the Editorial Board of FUEL SCIENCE AND TECHNOLOGY, CFRI, India.
12. CHAIRMAN of the working Group of the National Productivity Council on "Academic Programmes at PG Level and in R & D Areas" for their Project on "Education and Training in Energy Sector".
13. Member of the working group on "Energy Conservation" on DNES.
14. Member of the Working Group on "Policy, Economics and Resource Mobilisation", of DNES.
15. Member, National Organising Committee, "10th International Conference on MHD Electrical Power Generation", BHEL Trichy, December 5-9, 1989.

## **12. Invited Lectures :**

### **i) By IIT faculty in other Institutions :**

Laser Doppler Anemometry at the Wednesday Seminar on 1-2-89 held under the auspices of the Association of Technologies, Chemical Engineering group by the Dept. of Chemical Engg., A. C. College of Technology, Anna University, Madras-600 025 By Dr. U.S.P. Shet.

Delivered a seminar talk on "LDA application in Flames" on 20-2-1989 at Mechanical Engg. Dept. REC, Warangal, A. P. by Dr. U.S.P. Shet.

### **ii) By Distinguished Visitors to IIT :**

Prof. Dr. Th. Just delivered 10 lectures in the area of combustion Kinetics.

## **13. Visitors to the Department/Centre :**

Prof. Dr. Th. Just, DFVLR, Stuttgart visited Thermodynamics and Combustion Engineering Lab. as DAAD guest professor during February 27 to March 25, 1988.

## METALLURGICAL ENGINEERING

### 1. Research & Development Activities :

The major areas of research of the department would fall under the following heads :

- 1) Metal Joining
- 2) Metal Casting
- 3) Metal Forming
- 4) Materials Technology
- 5) Extractive Metallurgy and Corrosion

### 2. New facilities added :

Major items of equipment procured/fabricated :

- 1) Scanning Transmission Electron Microscope Philips CM12/STEM
- 2) 'Schenk' Servohydraulic Fatigue Testing Machine
- 3) Image analyser from 'Cambridge Instruments'
- 4) Spectrovac ARL 3460
- 5) Thermo gravimetric analyser (STANTON)
- 6) Electro-mechanical screw driven Schenck-Treble machine
- 7) Instrumented charpy machine

### 3. Sponsored Projects :

(Taken up during the year)

<i>Sl. No.</i>	<i>Title</i>	<i>Agency</i>	<i>Period</i>	<i>Coordinators</i>
1.	Fatigue characteristics of Aluminium and Magnesium Alloys	ARDB		Dr. V. M. Radhakrishnan Dr. S. D. Pathak
2.	Creep studies on stainless steel & Welds	DAE		Dr. V. M. Radhakrishnan Dr. K. J. L. Iyer Dr. K. Prasad Rao
3.	Solidification Modelling in Metallic Moulds with thermal resistance at the interface.	DST	1986-89	Dr. O. Prabhakar Dr. D. G. R. Sharma
4.	Computer Aided Design of Gravity die castings	DST	1986-89	Dr. O. Prabhakar
5.	Superplastic forming of Aluminium and Titanium Alloys.	ARDB		Dr. K. A. Padmanabhan
6.	Studies of the effect of ultrasonic vibration in the heat treatment of some age hardenable alloys of Al & Mg.	ISRO	1988-91	Dr. R. Vasudevan Dr. K. J. L. Iyer
7.	Assessment of Evaluation of some Cobalt-based ternary systems	ARDB	1989-91	Dr. K. S. Raghavan
8.	Materials Research in Ocean Environment	DNES		Dr. H. Md. Roshan

**Project Under R & D Scheme :**

1.	Transmission Electron Microscope & Accessories	MHRD	1988-1991 25 lakhs	Dr. K. S. Raghavan
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**Sponsored projects completed during the year :**

<i>Sl. No.</i>	<i>Title</i>	<i>Sponsoring Agency</i>	<i>Coordinators</i>
1.	Hot corrosion of high temperature alloys	DST	Dr. V. M. Radhakrishnan Dr. K. J. L. Iyer Dr. S. Ramakrishna Iyer
2.	Superplastic forming of Al V Ti alloys	ARDB	Dr. K. A. Padmanabhan
3.	Reliability study of ultrasonic testing procedure	VSSC Trivandrum	Dr. O. Prabhakar
4.	Development of Aluminium Alloy AFNOR 7020 specification and inducing plasticity in the material	VSSC	Dr. K. A. Padmanabhan
5.	Evolution of Forming limit diagrams for extra deep drawing SS40" grade steel manufactured at Bokaro and Rourkela Steel Plants	SAIL	Dr. K. A. Padmanabhan
6.	Development of superplastically formed hemisphere of Ti6Al4V alloy for potential applications in formation of Air for flight vehicle applications	DRDL	Dr. K. A. Padmanabhan

**4. Major Consultancy Assignments :**

	<i>Name of Faculty</i>	<i>Name of Client</i>	<i>Title of consultancy work</i>
1.	Dr. O. Prabhakar	VSSC, Trivandrum	Reliability study of ultrasonic testing procedure
2.	Dr. K. J. L. Iyer	Tamilnadu Petroproducts Ltd ,	Failure Analysis
	— do —	Indo National Ltd	— do —
	— do —	Neyveli Lignite	— do —
	— do —	Southern Railway	— do —
	— do —	Mettur Thermal Station	— do —
3.	Dr. R. Vasudevan	Indo National Ltd	X. R. D. studies
	— do —	CECRI Karaikudi	Phase identification
	— do —	NML Madras Unit	— do —
	— do —	Sundaram Clayton	— do —
4.	Dr. H. Md. Roshan	Secals Limited, Ranipet.	Retainer Consultancy on Steel foundry practice

**5. Assistance to Sister Institutions :**

**Q. I. P. SCHOLARS :**

- |                      |   |
|----------------------|---|
| 1) Mr. K. R. Kotaiah | Govt. College of Engg. Anantapur (JNTU) |
| 2) Mr. M. B. Lele    | College of Engg, Morvi (Gujarat)        |
| 3) Mr. K. Srinivasan | K. R. E. C., Surathkal                  |

**6. Patents taken if any :**

- 1) Dr. R. Vasudevan:—  
Use of electrolytic heating for boring holes through thin sheets of hard/brittle metallic materials.
- 2) Dr. K. A. Padmanabhan :  
A process of preparing a superplastic alloy of Al-Cu-Zr.

**7. Paper presented at International Conference :**

<i>Sl. No.</i>	<i>Name of the faculty member attending Conference</i>	<i>Title of the paper presented</i>	<i>Name, Dates and Venue of Conference</i>
1.	Dr. D. R. G. Achar	Studies on Improving Al-Zn-Mg alloy weld metal properties	International Conference on Welding Technology Roorkee, Sept. 1988.
2.	Dr. D. R. G. Achar	Role of Matrix structure in lammeller tearing in HSLA steel weldments.	—do—
3.	Dr. C. V. Gokularathnam	Study of transformation in yttria stabilised zirconia	Indo-US workshop on Advanced techniques for material characterisation, 1988.
4.	Dr. K. Prasad Rao	Preparation & Propertion of yttria stabilised tetragonal zirconia.	Int. Powder Met. Conf, Florida, 1988.
		Comparative evaluation of T-1 type A steel (MIG 102) weld metals deposited using C-Mn and low alloy filler wires.	Int. Conf. on Welding Technology, Sept. 1988, Roorkee.
		SCC behaviour of austenitic clads	Int. Conf. on STAINLESS STEELS, Feb 1989 Bombay
		Effect of Chem. Comp. and ferrite on electrochemical behaviour of aust. welds.	—do—
5.	Dr. V.M. Radhakrishnan	Effect of Chem. Comp. and ferrite on mechanical properties of aust. welds.	—do—
		Characterisation of creep properties of type 304 stainless steel by parametric approach.	Proc. Int. Conf. on alloy design, Roorkee, March, 89
6.	Dr. H.Md. Roshan	Knowledge based expert system for analysis of casting defects	92nd AFS Castings Conf. Hartford, Connecticut April 1988.
		Studies on dimensional Acuracy and consistency in high pressure moulded castings.	—do—

**Papers Presented at National Conferences :**

<i>Sl.No.</i>	<i>Author</i>	<i>Title</i>	<i>Date/Venue</i>
1.	Dr. D. R. G. Achar	An investigation to determine the depth of penetration of GTAW weld bead during circumferential welding method. Welding of Aluminium-Lithium Alloys-A Review	Annual National Welding Seminar of IIW, Cochin, Nov. 1988.  Science & Technology Seminar, on 'Aluminium-Lithium Alloys' March, 4-5th, 1989, Bangalore, IIMB, AAI, HAL.
2.	Dr. C. V. Gokularatnam	Grinding study on Advanced ceramics	42nd Annual Tech. meeting of IIM, New Delhi, Nov. 1988.
3.	Dr. K. Prasad Rao	Effect of ferrite content & PWHT on mech properties of metroplasma arc welded austenitic stainless steel.	National Conference on welding, Cochin, Nov. 1988.
4.	—do—	Studies on phase transformations in Nb stabilised austenitic clad metals	—do—
5.	—do—	A study on mechanical properties of austenitic stainless steel weld metals.	—do—
6.	—do—	Effect of ferrite content & PWHT on High temperature behaviour of austenitic weld metals.	—do—
7.	—do—	Pitting resistance of austenitic weld metals.	Annual Technical meeting of IIM, Nov. 88, New Delhi.
8.	Dr. O. Prabhakar	Computer simulation of Turbine blade Solidification.	ATM of IIM, November 1988, New Delhi.
9.	—do—	Influence of acoustic emission generated in a nimonic alloy PE16 during tensile deformation.	—do—
10.	—do—	Finite element Viscoplastic Analysis of Dynamic Fracture.	—do—
11.	—do—	Influence of presence of hard Secondary Phase and Fracture in Nimonic alloy PE16.	C. V. Raman Centenary symposium on acoustics I.I.Sc Bangalore October 1988.
12.	Dr. V. M. Radhakrishnan	Use of fracture mechanics in creep damage.	National Seminar on Application of advanced Technology in field of Testing, Evaluation of Materials



<i>Sl. No.</i>	<i>Author</i>	<i>Title</i>	<i>Date/Venue</i>
13.	Dr. H. Md. Roshan	Sand reclamation-A waste management concept.	Annual Convention of IIF 17 - 19, Feb. 1989.
		Computerised methoding of steel castings.	—do—
		Knowledge based computer system for casting defect analysis.	—do—
		Computer simulation of foundry related activities.	—do—
14.	Dr. S. K. Seshadri	Electrodeposition of lead graphite composite.	Symposium on Plating and finishing Calcutta, Aug. 1988
15.	Dr. R. Vasudevan	Compatibility studies of AISI 316 Stainless steel with Pb-Bi eutectic alloy.	Silver Jubilee Conference Lead Zinc & Cadmium into the 90s. organised by Lead zinc information centre, New Delhi Nov. 1988.
		'Ultrasonics-its potential in electro-deposition'	National seminar on energy and economy in Electro chemical Industry Madras Jan. 1988. -organised by SAEST & CECRI.
		'Influence of ultrasonic vibrations on the age hardening behaviour of 17-4PH stainless steel'.	Seminar on Material for advanced Technology, Trivandrum. Jan. 1989. - organised by IIM.
		'X-ray line broadening studies during aging of 17-4PH & 18 Ni Maraging Steels'.	47th Annual Convention of Metallurgists & Materials Scientists on "Alloy Design and Development, Roorkee, March 1989 - organised by Institution of Engineers, India.
		'Effect of Forging Temp. on the microstructure, Mechanical properties & weldability of Ti-6Al-4V alloy'.	Seminar on Materials for Advanced Technology- - organised by IIM.

#### 8. Research Publications :

1.	D. R. G. Achar	Welding Research Trends & Development in the Indian Scene	Indian Welding Journal	4	October 1980	401-406
2.	K. J. L. Iyer	Pitting Corrosion of Al-Li-Cu-Mg-Zn alloy in 3.5% NaCl Solution	Bulletin of Electro Chemistry	4 (1)	January 1988	7

		Influence of ultrasonic vibration in the transformation in 304 L stainless steel	Materials Science Letters	6		P 413
		Some experiments and comments on the effect of Hydrogen on Austenite martensite transformation in 1% carbon low alloy steel	Materials Science Engg.	100	1988	L 7
3.	Dr. S. D. Pathak	Analysis of Fatigue life of welded joints	Trans IIM	41,(4)	Aug. 1988	315-318
		Bending fatigue of Butt-welded joints	Joining & materials	1(6)	Oct. 1988	184-186
		Fatigue crack growth in cruciform welded joints	-do-	1(6)	Dec. 1988	284-289
4.	Dr. O. Prabhakar	Fatigue damage assessment acoustic emission	IINDIE Journal	6(6)	Jan. 1988	15
5.	Dr. V. Jagasivamani	Electromagnetic emission during fracture of heat treated spring steel	Materials letters	6	1988	p 11
6.	Dr. K. Prasad Rao	Submerged Arc strip cladding-A study on the effects of fluxes and process parameters	Schweissen and Schneiden (German)	40	July	339-345
		Prediction of depth of penetration of Electron beam welds	Trans, IIM		Aug. 1988	343-348
		Ferrite transformation in Austenitic stainless steel weld metal	J. of Met: Science letters	7	1988	616-620
		Effect of microstructures on mechanical properties of weld metals	Practical Metallography	25	1988	219-224
		Influence of ferrite content on corrosion behaviour of austenitic clad metals of type 316	Werkstoffe und Kerrosion	39	1988	135-142
7.	Dr. V. M. Radhakrishnan	Analysis of fatigue life of welded joints	Trans, IIM	41 (4)	Aug. 1988	315-318
		High temperature crack growth in austenite weld metal	Engg Fracture mechanics			

7. (Contd)	Bending fatigue of butt welded joints	Joining of materials	1 (6)	Oct. 1988	184-186
	Fatigue crack growth in Cruciform welded joints	-do-	1 (6)	Dec. 1988	284-289
	High temperature crack growth in austenitic weldmetal	Engg. Fracture mechanics		1989	
	Creep and fracture of cast Ni-base super alloy	Trans IIM		1989	
	Cumulative fatigue in a Nimonic alloy	—do—		1989	
	Creep cracking in type 308 CB Austenitic SS and Weldmetal at 600 C	Trans IIM		1989	
	Interaction of low temperature hot corrosion and creep	Mat. Sci & Engg.		1988	
8. Dr. H.Md. Roshan	Model of creep rupture life under hot corrosion	High Tem. Tech.		1989	
	Significance of friability as an important property of high pressure moulding sand	Trans IIM	41(4)	Aug. 1988	357-358
	Studies on tensile strength of phenolic urethane no-bake sand compacts as influenced by material variables	Trans AFS	—	1988	—
	Wear behaviour of LM6 aluminium alloy	Proc. of the National Conf. on Industrial tribology	—	Jan. 1989	1.6 1-1.6 8
	Simulation of metal casting processes	Proc. of the adv. Study Inst. on energy optimisation in Manufacturing & Materials processing		Jan. 1989	314-317
9. Dr. K.S. Raghavan	Characteristics of serrated flow in commercial Cu-Be-Co alloy	Material Sci & Tech.	4	1988	578-585
	Laser alloying in Al-Ni system	IIM Tech. meeting		Nov. 1988	

10.	Dr. R. Vasudevan	Ring compression tests on sintered iron preforms.	J. of Mech Working Tech.	16	1988	51-64
		Some failure studies in the hooker extrusion of sintered iron-powder metal preforms.	- do -	-do-	-do-	165-174
		On the properties and economics of sintered iron powder metallurgy.	- do -	-do-	-do-	231-242
		Force & energy during the cold hooker extrusion of sintered iron preforms.	- do -	-do-	-do-	357-374

**9. Books / Monographs brought out :**

Proceedings of the Advanced Study Institute on Energy Optimisation in Manufacturing and Materials Processing, Jan. 1989.

Edited by R. K. Shah, H. Md. Roshan, V.M.K. Sastri and K. A. Padmanabhan.

**10. Short term courses conducted :**

- |    |  |                 |
|----|--|-----------------|
| 1) | Inspection Technology and NDT for ONGC   | Feb. 1988       |
| 2) | Damage mechanisms and life assessment technique for high temperature plant components        | 20-21 Aug. 1988 |
| 3) | Workshop on modern Metallography in Industry   | 2-3 Nov. 1988   |
| 4) | Workshop on Stainless steel  | 17, Dec. 1988   |
| 5) | An Advanced study Institute on Energy optimisation in manufacturing and materials processing | Jan. 1989       |
| 6) | Workshop on Superplasticity  | Jan. 1989       |

**11. Awards and Honours :**

- |    |   |   |
|----|---|---|
| 1. | Dr. K. Prasad Rao                         | I. T. Mirchandani Award at National Welding seminar, 1988   |
| 2. | Dr. D. R. G. Achar                        | Received German Academic Exchange Fellowship  |
| 3. | Dr. S. D. Pathak                          | Deputed to F. R. G. under Indo-German project on Materials Testing  |
| 4. | Dr. R. Vasudevan & Mr. Papa Rao,          | Awarded first prize for Portable Thermocouple Welding unit based on the principle of electrolytic heating in Annual Engineering Design Competition of ISTE held at Mysore, Dec. 1987. |
| 5. | Mr. Suraj, Mr. Shankar & Dr. R. Vasudevan | A portable Boring / cutting unit based on the principle of electrolytic heating - awarded third prize in Annual Engg Design competition of ISTE held at Poona, Dec. 1988.             |
| 6. | Prof H. Md. Roshan                        | Awarded the Prof. Banerjee Memorial Award for the best paper published in the Indian Foundry Journal on Ferrous Castings 1988.  |

**12. Professional Activities :**

The I. I. T. Madras Chapter of the Indian Institute of Metals is run by the Department with one of its faculty as Chairman. The Chapter, along with the Department, takes part in organizing seminars and workshops.

**13. I. Invited Lectures; by IIT Faculty in other Institutions :**

	<i>Date</i>	<i>Organization</i>	<i>Topic</i>
a) Prof. D.R.G. Achar	8.4.1988	Rotary Club of Madras	Welding Metallurgy and Welding of Dissimilar Metals
	12.7.1988	Institute of Welding & Materials Technology, Tech. Univ. Bramschweig, Fed. Rep. of Germany	Use of Accoustic emission Techniques in the Lamellar Tearing Studies
	4.8.1988	Inst. of Welding Production Tech. Univ. of Aachen Fed. Rep. of Germany	1. Welding of Dissimilar Materials 2. Metal Transfer in Submerged Arc Welding
	7.9.1988	Joining Technology Division Tech. Univ. Berlin Fed. of Germany	Welding of Dissimilar Metals
	15.9.1988	Inst. of Materials Research GKSS Research Centre, Geesthacht, Fed. Rep. of Germany	Overview of Welding Research and Development in India - Dissimilar Metal Welding
	19.9.1988	Inst. Ocean Technology GKSS-Research Centre, Geesthacht, Fed. Rep. of Germany	Welding Research in India
	7.10.1988	Indian Institute of Metals IIT Madras Chapter, Madras	Current Trends in Welding Research in West Germany
	29.10.1988	Indian Institute of Welding Madras Branch	Weldability of Ferrous Alloys
	14.11.1988	Indian Institute of Welding Madras Branch	Current Trends in Welding Technology in West Germany
	18.11.1988	Indian Institute of Welding Jamshedpur Branch Jamshedpur	Keynote Address on Current Developments in Welding Weiding Technology
	17.3.1989	Madras Metallurgical Society Madras	Metal Joining Technology
b) Prof. R. Vasudevan	Different talks in 1988	B.H.E.L. Trichy, Hyderabad Haridwar.	Metallurgy to the Non-Metallurgists
	Nov. 30 1988	R.R.L. Trivandrum	On the effect of ultrasonic vibrations in some engineering applications
	2-3, Nov. 1988	Workshop on Modern Metallography in Industry, conducted by IIM Madras Chapter, ICR & IIT Madras	Indusrial Applications of X-ray Diffraction

b) (Contd)	Jan. 1989	IIT Madras & IIM	Physical Metallurgy of stainless steels and Properties of PH stainless steel
	12-15, Nov. 1988	Workshop on Modern Manufacturing & Inspection systems Engg. Staff College of India	Advances in new materials and their quality assurance
	16th Nov. 1988	Short term course on Powder metallurgy Organised by Mechanical Engg. Dept. IIT M	Heat treatment of PM parts
	25th March 1988	Society for Advancement of electrochemical Science and Technology, Madras Chapter.	On Electrolytic Heating

## II. Lectures by distinguished visitors to the Dept :

1. Prof Hobacher, Technical University of Aachen, F.R.G. Workshop on Fatigue Design of Welded Joints, Aug. 1988.
2. Dr. A. K. Roy, IIT Kharagpur, Application of Johnson Mehl's Equation.
3. Dr. R. Viswanathan, Tech. Advisor, EPRI, Palo Alto, California, USA., Damage Mechanisms and Life assessment Technique for high temperature plant components, 20.8.88 - 21.8.88
4. Dr. T. S. Srivatsan, Univ. of Alton, Ohio. Development, applications and properties of improved aluminium alloys for Aerospace applications.
5. Prof. Doris Wilsdorf, Univ. of Virginia, USA, Friction and Wear.
6. Prof. Heinz Wilsdorf, Univ. of Virginia, USA, High temperature Aluminium Alloys.
7. Dr. T. Ramachandran, Karnataka Regional Engg College, Surathkal, Metallurgical Education in India.

## 14. Staff Matters :

- Prof. D. R. G. Achar      Chairman, Indian Institute of Welding, Madras Branch.
- Prof. K. S. Raghavan      Chairman of the IIT Madras Chapter of the IIM. Contributing Editor, International Commission on Alloy Diagram.

## PHYSICS

### 1. New Courses Introduced during the Year :

<i>Course No.</i>	<i>Title</i>	<i>Offered to</i>	<i>Faculty offering the course</i>
PH 753	Optical Physics	M.Sc.	Dr. R. S. Sirohi
		M.Tech.	Dr. M. P. Kothiyal
PH 754	Applied Optics	M.Sc.	Dr. R. S. Sirohi
		M.Tech	Dr. M. P. Kothiyal

### 2. Research and Development Activities:

The department is actively involved in the study of the properties in crystals such as crystal growth, Transport studies in ionic crystals, Luminescence and Thermoluminescence, Defect Solid State, Semiconductors, Fast ion conductors, Electromigration and Thermal and Elastic studies in crystals.

Transport properties were extensively studied in many ionic crystals using radioactive tracer diffusion, electrical conductivity dielectric loss, thermal expansion techniques to evaluate the point defect parameters. Dielectric loss studies at A. F., R. F. and microwave frequencies are being carried out.

Self diffusion and electromigration in several metallic thin films are being studied to understand the mass transport and to estimate the reliability of these films for various applications.

Several I-III-VI compound semiconductors are being prepared and characterised by studying the electrical conductivity, photo conductivity, Hall effect both in the form of single crystals and in thin film form. Schottky junctions formed by evaporating several metallic films on compound semiconductor crystals are also being investigated. Indium tin oxide silicon heterojunctions are formed and studied for applications in solar cells.

Studies on transport properties of silver and copper ion conducting solid electrolyte materials in pellet and thin film form are on hand. Solid state batteries with super ionic compound  $Ag_7I_4PO_4$  as the electrolyte have been developed and their discharge and polarisation characteristics are being studied. Electronic properties of semiconductor interfaces using the A. C. field effect setup and a wide band capacitance voltage bridge are being studied. Effect of surface passivation on the Si-SiO<sub>2</sub> interface properties are under way. Space charge effects in semiconductors and insulators are also being carried out to understand the electronic processes in the junction region particularly in relation to photovoltaic and photocapacitive effects.

Thermoluminescence, optical and electrical properties of aliovalent cation doped rubidium and other alkali halides are being studied with a view to understand the involvement of impurity, vacancy complexes and other point defects in the thermoluminescence processes. Laser Raman studies are made on decayed rubidium halide crystals under different experimental conditions to understand defect kinetics and venture aggregate formation in these crystals. Colour centers in mixed crystals of KCl KBr have been utilised to record optical images in crystals holographically. The techniques of photochromic storage have been developed by following F center clustering and M center reorientation processes. Theories of lattice energies and energies of lattice defects in ionic crystals have been developed. A modified point ion model and a shell model ionic potential for alkali halides that synthesizes the short range and long range interactions in a unified way have been worked out. Experimental investigations cover ionic and protonic charge transport, dielectric loss due to defect dipoles, colloidal type colour centers and thermostimulated luminescence in alkali halides.

Second Order Elastic Constant (SOEC) of sodium nitrate has been studied experimentally upto liquid nitrogen temperature using the pulse echo interferometer. Thermal expansion coefficients have been determined at low temperatures using the interferometer set up developed. Theoretical analysis of the thermal expansion of sodium nitrate and a set of antiferroite compounds has been carried out.

Three dimensional structural studies of organic and inorganic crystals have been carried out. Some of the classes of compounds whose structural studies have been done in the laboratory are: Organic compounds of interest to biochemists and industrial chemists. Inorganic compounds: Se and Te complexes, Thiourea complexes, Coordination complexes.

The recent discovery of high  $T_c$  superconducting oxides triggered a spate of research activity as part of the continuing active collaboration with the Materials Science Research Centre. Compounds of the type  $(La, Sr) Cu_2O_4$  and  $YBa_2Cu_3O_7$  in which several rare earth ions could also be substituted in the place of  $Y^{3+}$  are synthesized and  $T_c$  in the range of 40 K to 90 K are measured using both ac magnetic susceptibility and electrical resistivity measurements. The thermopower of these materials have been studied and the electron phonon enhancement has been observed. A new approach for vacuum adiabatic calorimetry has been fabricated and the specific heat of  $YBa_2Cu_3O_7$  has been measured down to 5K. A project on microprocessor based instrumentation for stirling nitrogen liquefier is nearing successful completion and a similar programme for a helium liquefier is about to be taken up.

The dielectric parameters as a function of frequency, temperature and concentration (in the case of dilute solutions) are measured so that the entire dispersion can be studied. These studies have been carried out on samples such as Acrylates, Mannich basis Allyl ethers, Acetylenic compounds, Heterocyclic compounds and Ferrites, Polymers and some ionic crystals. Presently, the dielectric studies are being extended to FIR and IR regions.

Ferromagnetic and spin wave resonance studies have been carried out in several Mn-Sb alloys systems. The out come of these results is the novel method of identification of spin reorientation phenomenon. Detailed experiments have been carried out in  $Mn_2Sb$ , MnAs and MnZn to understand the magnetic properties of these systems by the zero field NMR technique. Hydrogen absorption studies in metals and alloys are being carried out.

Electro-optic effect in doped alkali-halide crystals is being investigated. Studies on the Kerr optic constants in these crystals in the ultraviolet region are being carried out. The strain variation of the static dielectric constant in alkali halides is being experimentally studied. Optical and magneto-optical studies are being carried out in thin ferromagnetic films and their magnetic parameters like Curie temperature, hysteresis, magnetisation are being determined.

Experimental and theoretical research work have been carried out on solid, liquid and gas lasers and on laser applications in optics, in holography, in speckle interferometry, in metrology and in biomedical engineering. A number of gas and liquid lasers have been developed. Dye lasers of the Xanthene, Coumarin and Oxazone series have been studied to determine and develop efficient lasers. Investigations on stimulated Raman scattering (SRS) and amplification of (SRS) using Cyanine dye have been carried out. Energy level mechanisms in metal atoms under lasing conditions are being investigated.

Currently work is on to test the collimation of laser beams. Techniques to apply holography for deformation measurement and HNDT are developed. Rainbow holography for display purposes is carried out. Speckle methods to measure in plane displacement components, out of plane component, slope, curvature etc have been developed. The methods of fringe sharpening, and multiplexing are studied. The speckle interferometry using electronic detection and digital processing is also carried out.

A detailed study of diffusion (random walk) with and without a superposed drift (bias) on finite and infinite one-dimensional continua (lattices) has been carried out. The drift or bias may be induced by an external field, or, in the case of spectral diffusion, by finite temperatures.



Theoretical and experimental study of the variation of elastic constants in metals, alloys and superconducting compounds as a function of strength of magnetic field and temperature has been made. Elastic constants exhibit a pronounced variation near the superconducting transition temperature. Elastic constants of  $UAl_2$  have been studied.

Applicability of Lennard Jones potential to metals, shear wave propagation and its relation to dislocations, applicability of Morse potential for calculating Debye temperature, the relation of elastic constants to certain physical parameters of binary alloys have been studied. A series of detailed studies in the field of atomic photoionization has been taken up. Photoionization cross-sections, photoelectron angular distributions and spin-polarization parameters of photoelectrons are being calculated and analyzed using a relativistic many body theory. Investigations in inner-shell threshold behaviour of the photoionization cross-section has been undertaken.

To conclude, the years's research work of the faculty and research scholars has resulted in publishing more than 80 papers in reputed national and international Scientific Journals and presentation of an equal No. of papers at national and international conferences held in India and abroad.

### 3. New facilities added and major items of equipment procured/fabricated :

1. Helium Liquefier
2. Arc furnace
3. Induction furnace
4. Image processing systems based on IBM — PC/AT
5. DSP I interferometer
6. Foco meter
7. Microwave net work analyser
8. Philips x-ray Diffractometer
9. Gama Ray Spectro meter
10. C. D. Rom Workstation  
(Pieco Electronics and Electricals Ltd)
11. Hitachi Spectro Photo meter
12. High Power Solid State Laser Sources (Ruby Laser / Nd : YAG and Nd ; Glass Lasers)
13. Stress apparatus to investigate the change in dielectric properties in solids
14. Facilities to estimate hydrogen absorption
15. Automatic scanning arrangement for electromigration studies
16. Solid State Klystron power supply system
17. X. Q. E. and B band Microwave benches
18. Leybold Heraeus Helium leak detector

<i>Sl. No.</i>	<i>Title</i>	<i>Sponsoring Agency and value</i>	<i>Period</i>	<i>Co ordinators</i>
<b>4. (i) Sponsored Projects Taken up Duriug the Year :</b>				
1.	'Physical studies on high Tc super-conductors'	PMB DST Rs. 33.50 lakhs	June '88 onwards	Dr. R. Srinivasan Dr. V. Sankaranarayanan
2.	'Development of cold box for Hellum Liquifier'	DST Rs. 1.50 lakhs	June '88 onwards	Dr. R. Srinivasan

<i>Sl. No.</i>	<i>Title</i>	<i>Sponsoring Agency and value</i>	<i>Period</i>	<i>Co-ordinators</i>
3.	'Magnetization and AC magnetic susceptibility studies on high Tc superconductors'	PMB DST Rs. 11.70 lakhs	June '88 onwards	Dr. G. Rangarajan Dr. V. Balakrishnan Dr. G. V. Subba Rao
4.	'Microwave conductivity studies on the high Tc superconductors'	PMB DST Rs. 5.90 lakhs	June '88 onwards	Dr. V. R. K. Murthy Dr. B. Viswanathan
5.	'Synthesis and characterization of Lithium intercalation compounds for solid state batteries'	DAE Rs. 3.0 lakhs	June '88 onwards	Dr. V. R. K. Murthy
6.	'Development and characterization of Microwave and Dielectric Materials (ceramics and copper clad materials)	Ministry of Defence Rs. 30.00 lakhs	Sept. '88 onwards	Dr. V. R. K. Murthy
7.	'Study of sound velocity and attenuation of high Tc superconductors'	CSIR Rs. 1.29 lakhs	June '88 onwards	Dr. V. Ramachandran
8.	'Fabrication of contact potential Difference set up for Surface / Interface analysis of Semiconductor Materials and Devices'	DST Rs. 5.42 lakhs	Sept. '88 onwards	Dr. J. Majhi Dr. A. Subrahmanyam
9.	'Microwave Photoconductivity Zn <sub>3</sub> , P2 and Cd <sub>2</sub> Semiconductors'	CSIR Rs. 1.7 lakhs	May '88 onwards	Dr. J. Sobhanadri
10.	'Investigation of magnetic properties in magnetostructural alloys by Mossbauer spectroscopy'	CSIR Rs. 1.14 lakhs	June '88 onwards	Dr. K. V. S. Rama Rao Dr. K. V. Reddy
11.	'Development of materials for Hydrogen Storage Applications'	DNES Rs. 6.6 lakhs	March '88 onwards	Dr. K. V. S. Rama Rao Dr. Y. V. G. S. Murti
12.	'Single chip Microcomputer controlled Instrumentation for Stirling Cycle Nitrogen Liquefier	DST Rs. 1.13 lakhs	Feb. '89 onwards	Dr. G. Rangarajan
13.	'Study of Implementation of Hologram Interferometry and speckle methods to problems of ISRO interests'	ISRO Rs. 4.21 lakhs	March '88 onwards	Dr. R. S. Sirohi Dr. M. P. Kothiyal Dr. D. K. Sharma Dr. V. V. Rao
14.	'Automatic lens design for space application'	ISRO Rs. 5.15 lakhs	May '88 onwards	Dr. D. K. Sharma Dr. R. S. Sirohi
15.	'Design of COLD BOX for Liquid Helium Instrumentation and design of a purity monitor'	DST Rs. 6.1 lakhs	Feb. 89 onwards	Dr. G. Rangarajan Dr. T. S. Natarajan
16.	'Development of optical photonic Amplifying Techniques'	Ministry of HRD Rs. 15.00 lakhs	Dec. '88 onwards	Dr. B. M. Sivaram Dr. J. P. Raina (EE)

<i>Sl. No.</i>	<i>Title</i>	<i>Sponsoring Agency and value</i>	<i>Period</i>	<i>Co-ordinators</i>
17.	'Development of Manpower in the area of Engineering Application of Lasers and to carry out advanced R and D programme'	Ministry of HRD Rs. 20.00 lakhs	Dec. '88 onwards	Dr. R. S. Sirohi
18.	'Development of optical sensors'	Ministry of HRD Rs. 10.00 lakhs	Dec. '88 onwards	Dr. R. S. Sirohi Dr. M. P. Kothiyal

**4. (ii) Sponsored Projects completed during the year :**

<i>Sl. No.</i>	<i>Title</i>	<i>Sponsoring Agency and value</i>	<i>Co-ordinators</i>
1.	'Development of Semiconducting Electrooptic Devices'	DST Rs. 5.4 lakhs	Dr. K. Srinivasan
2.	'Development of High power solid state Laser sources'	DOE Rs. 15.41 lakhs	Dr. T. A. Prasada Rao
3.	'Hologram interferometry and Speckle Methods for NDT'	DST Rs. 19.25 lakhs	Dr. R. S. Sirohi Dr. M. P. Kothiyal Dr. D. K. Sharma Dr. V. V. Rao
4.	'Amorphous Solar cells Development and Evaluation'	DNES Rs. 9.11 lakhs	Dr. V. Ramachandran Dr. J. Majhi Dr. G. V. Subba Rao
5.	'Microprocessor controlled Instrumentation for stirling cycle Nitrogen Liquefier'	DST Rs. 2.95 lakhs	Dr. G. Rangarajan Dr. T. S. Natarajan Dr. V. Sankaranarayanan

**5. Assistance to Students and Major Consultancy Assignments :**

<i>Name of the faculty</i>	<i>Name of client</i>	<i>Title of consultancy work</i>
1. Dr. R. Srinivasan	Metallic Billows India Pvt. Ltd. Madras-41	Helium leak testing of Metallic Billows

**6. (a) Papers presented at Conference attended : INDIA**

<i>Sl. No.</i>	<i>Name of faculty member attending the Conference</i>	<i>Title of paper presented and authors</i>	<i>Name, Dates and Venue of the Conference</i>
1.	Dr. G. Rangarajan	Studies on Superconductivity of $\text{Bi}_2\text{Sr}_2\text{Ca}_2\text{Cu}_2\text{O}_{10+y}$ and Tl-Ca-Ba-Cu-O systems G. Rangarajan	Int. Workshop on High Temperature, Srinagar, 1988
2.	Dr. G. Rangarajan	National Symposium on Personal Computers in Science and Engineering M. V. Ansuya, T. S. Natarajan, V. Sankaranarayanan and G. Rangarajan	BARC, Bombay Feb. 1988

<i>Sl. No.</i>	<i>Name of faculty member attending the Conference</i>	<i>Title of paper Presented and authors</i>	<i>Name, Dates and Venue of the Conference</i>
3.	Dr. S. B. S. Sastry	Role of Hydroxyl Ion in the Thermoluminescence of RbVe : OH S. B. S. Sastry and G. Muralidharan	Second National Seminar on Defects in Insulating Solids, IIT, Madras-36, Feb. 1988
4.	Dr. S. B. S. Sastry	Thermoluminescence of Cobalt-doped KCl S. B. S. Sastry and G. Muralidharan	-do-
5.	Dr. S. B. S. Sastry	Optical absorption luminescence and laser Raman spectra of RbI : $S_r^{2+}$ S. Nagarajan and S. B. S. Sastry	-do-
6.	Dr. R. S. Sirohi	Experiments with He-Ne Laser R. S. Sirohi	Int. Workshop on Teaching aids in Physics Education 2-6 Jan. 1989, India
7.	Dr. R. S. Sirohi	Solid State Laser Materials R. S. Sirohi	7th Int. Conference on Physics of materials, 21 Nov. -3 Dec. 1988 Madras
8.	Dr. R. S. Sirohi	Investigations of in-plane stresses on bolted flange joints using digital U. K Choudhury, Chandrasekhar, P. B. Godbole, A. R. Ganesan and R. S. Sirohi	Int. Workshop on Advances of Holography and Speckle Phenomena and their Industrial Applications, 12-17, Dec. 1988, Madras, India.
9.	Dr. R. S. Sirohi	Digital Speckle Pattern Inteferometry R. S. Sirohi	Int. Workshop on Advances of Holography and Speckle Phenomena and their Industrial Applications 12-17, Dec. 1988, Madras, India.
10.	Dr. R. S. Sirohi	Velocity measurement of rotating diffuse object using speckle photography C. S. Narayanamurty, C. Joenathan and R. S. Sirohi	16th OSI symposium on optical and Optoelectronic Applied Science and Engineering, 16 18 Jan. 1988, NIL Calcutta.
11.	Dr. R. S. Sirohi	Methods of fringe Sharpening in Digital Speckle Pattern Interferometry. A. R. Ganesan, C. Joenathan and R. S. Sirohi	-do-
12.	Dr. B. M. Sivaram	Distributed Feedback Dye Lasers B. M. Sivaram	National Workshop on Laser Spectroscopy and Laser Applications Jan. 1988, Varanasi.
13.	Dr. B. M. Sivaram	Gain Studies of TICT States Chandrasekhar, B. M. Sivaram and S. Natarajan	-do-

<i>Sl. No.</i>	<i>Name of faculty member attending the Conference</i>	<i>Title of paper presented and authors</i>	<i>Name, Dates and Venue of the Conference</i>
14.	Dr. V. Sivaramakrishnan	Thickness dependence of induction activation energy of Cd Se <sub>0.6</sub> Te <sub>0.4</sub> Thin Films P. J. Sebastian and V. Sivaramakrishnan	DAE Solid State Symposium India. 1988.
15.	Dr. V. Sivaramakrishnan	Dependence of Conduction activation energy on depention on deposition temperature of Cd Se <sub>0.2</sub> Te <sub>0.8</sub> Thin films. P. J. Sebastian and V. Sivaramakrishnan	Proc. Sym. of current trends in pure and App. Sciences, India, 1988
16.	Dr. R. Srinivasan	Specific heat of the oxide Superconductors R. Srinivasan and V. Sankaranarayanan	Intl. Workshop on High T <sub>c</sub> Superconductors, May 1988 Srinagar
17.	Dr. R. Srinivasan	Single particle tunneling in YBa <sub>2</sub> Cu <sub>3</sub> O <sub>7-x</sub> GdBa <sub>2</sub> Cu <sub>3</sub> O <sub>7-x</sub> C. K. Subramaniam, S. Kasiviswanathan and R. Srinivasan	Intl. Workshop on High temperature, Superconductors, Srinagar, May 1988
18.	Dr. R. Srinivasan	Electrical resistivity measurements on zinc doped yttrium barium coppor oxide. H. Krishnan, C. K. Subramaniam, V. Sankaranarayanan, R. Srinivasan, T. A. Mary U. V. Varadaraju and G. V. Subba Rao	National Seminar on Superconductivity organised by the IEEE branch of Kerala at Trivandrum, Dec. 1-3, 1988.
19.	Dr. R. Srinivasan	Thermoelectric power in zinc doped yttrium-barium-copper-oxide Vijayashree Radhakrishnan C. K. Subramaniam, V. Sankaranarayanan and R. Srinivasan	-do-
20.	Dr. R. Srinivasan	Possible intergrain effect in the electrical resistivity of zinc doped YBa <sub>2</sub> Cu <sub>3</sub> O <sub>7</sub> superconducting transition H. Krishnan, V. Sankaranarayanan, C.K. Subramaniam and R Srinivasan	DAE Solid State Physics Symposium Bhopal, Dec. 1988
21.	Dr. M. P. Kothiyal	Digital Speckle Shearing interferometry D. K, Sharma, A. R. Ganesan and M. P. Kothiyal	HOSPIA, IIT, Madras Dec. 1988
22.	Dr. M. P. Kothiyal	A Universal speckle Shearing interferometer A. R. Ganesan, D. K. Sharma and M. P. Kothiyal	16th Symposium of the Optical Society of India Calcutta, 1988.

<i>Sl. No.</i>	<i>Name of faculty member attending the Conference</i>	<i>Title of paper presented and authors</i>	<i>Name, Dates and Venue of the Conference</i>
23.	Dr V.. Damodara Das	Hopping conduction in Se-Te alloy thin films V. Damodara Das and P. Jansi Lakshmi	Indo-US Workshop on recent trends in Science and Tech. of glasses. IISC, Bangalore, 1988
24.	Dr. V. Damodara Das	Size effects on resistivity and temperature coefficient of resistivity of silver telluride thin films V. Damodara Das and D. Karunakaran	Intl. Conference on Semiconductor Materials New Delhi, 1988
25.	Dr. B. S. V. Gopalam	Symmetry of superlattices : As systematic approach: Enge Wang B. S. V. Gopalam	Intl. Workshop on Semiconductors Delhi, 1988.
26.	Dr. Mrs. M. Seshasayee	Structure of Bis (2-benzimidazolyl) disulphide V. Ganesh, M. Seshasayee Sp. Chidambaram and G Aravamudam	National Crystallographic Conference at Varanasi, 1988
27.	Dr. Mrs. M. Seshasayee	Crystal and Molecular structure of b-phenylenethiourea) Se (II) Chloridedihydrate Sp. Chidambaram, G. Aravamudam, V. Ganesh and M. Seshasayee	Indo-US Workshop on Glass Science and Tech., Bangalore, 1988.
28.	Dr. Mrs. M. Seshasayee	Molecular dynamics study of Glasses $V_2O_5$ and $AgI-Ag_2O-V_2O_5$ M. Seshasayee	- do -
29.	Dr. J. Majhi	Surface and Interface states in Silicon and Si-SiO <sub>2</sub> J. Majhi	Intl. Workshop on Surface and Interfaces of Metals and Semiconductors, Aug. 1987, Poona.
30.	Dr. J. Majhi	Thickness dependence of subband gap absorption of a-Si: H thin films J. Majhi, R. Ramachandran, R. Sridhar and R. Venkatasubbaiah	Intl. Conf. on Semiconductor Materials, Dec. 1 -16, 1988 New Delhi.
31.	Dr. V. R. K. Murthy	Dielectric properties of Lithium ferrites V. R. K. Murthy, R. Raman and B. Viswanathan	Intl. conference on Ferrites-5 Bombay 1989.
32.	Dr. V. R. K. Murthy	Magnetic properties of Lithium ferrites V. R. K. Murthy, R. Raman and B. Viswanathan	- do -
33.	Dr. S. Srinivasan	Crystal structure of 1, 4, 4a, 5, 8, 8a, 9, 9a, 10, 10a, decahydro 1, 4-5, 8 Gilroy Alex, S. Srinivasan, S. R. Ramdas and Bhakthavakchalam	National Conference BHU, Varanasi 1988.

<i>Sl. No.</i>	<i>Name of faculty member attending the Conference</i>	<i>Title of paper presented and authors</i>	<i>Name, Dates and Venue of the Conference</i>
34.	Dr. S. Srinivasan	-do- more fledine plusphate Rahul Banerjee, S. Srinivasan and Basu Varghese	National Conference BHU, Varanasi 1988.
35.	Dr. S. Srinivasan	—do— 2, 4-dihydro-8-methoxy model-1-one Sudarshan Kumar, S. Srinivasan S. R. Ramadas and R. Chandramoule	- do -
36.	Dr. K. Hariharan	Electrical Transport String on the system Molar [160-x AgI x InI] 30 Ah <sub>w</sub> -10 B, O, A. Mary Sukhesini and K. Hariharan	Solid State Physics Symp Bhopal, 1988.
37.	Dr. K. Muraleedharan	Possible evidence of a 'Spin Fluid' state in cupric oxide K. Muraleedharan, T.K. Gundu Rao, N. Venkataramani and C. M. Srivastava	National Seminar on Superconductivity, Trivandrum, Dec., 1988.
38.	Dr. V. S. Murthy	State of PG Programmes in Physics-scope for improvement V. S. Murthy	Third annual convention of IAPT Nov. 1988.
99.	Dr. V. S. Murthy	Structure and organisation of teacher reorientation programmes V. S. Murthy	- do -
40.	Dr. T. S. Natarajan	Learning Digital clatronics using IBM PC compatibles M. V. Anasuya, N. Srikanth and T. S. Natarajan	National symposium on Personal Computers in Science and Engineering, BARC Bombay, Feb. 1988.
41.	Dr. T. S. Natarajan	PC-based dielectric measurement of liquids at Microwave frequencies M. V. Anasuya, T. S. Natarajan	- do -
42.	Dr. A. Subrahmanyam	Investigations on Indium Tin Oxide (ITO)/ GaAs Heterojunctions N. Balasubramanian and A. Subrahmanyam	Intl. Conf. and Intensive Tutorial course on Semiconductor materials and devices, Dec. 1988 New Delhi.
43.	Dr. A. Subrahmanyam	Studies on Absorption Edge shift in evaporated Indium Tin Oxide (ITO) films at high carrier densities N. Balasubramanian, V. Vasu and A. Subrahmanyam	Solid State Physics Symposium, Bhopal Dec. 1988.

<i>Sl. No.</i>	<i>Name, of faculty member attending the Conference</i>	<i>Title of paper presented and authors</i>	<i>Name, Dates and Venue of the Conference</i>
44.	Dr. V. V. Rao	Applications of Holoelements in image processing—Advances in Holography and Speckle Phenomena and their Industrial Applications V. Venkateswara Rao	HOSPIA IIT, Madras Dec. 1988.
45.	Dr. D.K. Sharma	Digital Speckle shear Interferometry D. K. Sharma, A. R. Ganesan and M.P. Kothiyal	HOSPIA IIT, Madras Dec. 1988.
46.	Dr. Y. S. Rao	Fabrication of an R. F. oscillator and its use as a capacitance meter Y. Syamasundara Rao and K. B. Suresh	National Symposium on Instrumentation, Mysore 1988.
47.	Dr. Y. S. Rao	A continuously variable power supply from 600 V to 1200 V at 10 M. A. current using all solid devices. Y. Syamasundara Rao and M. N. Gangaiah	National Symposium on Instrumentation, NSI-13.88, Mysore, 1988.
48.	Dr. V. Sankaranarayanan	Electrical Resistivity measurements on $YBa_2Cu_{3-x}Zn_xO_{7-y}$ H. Krishnan, C. K. Subramaniam, V. Sankaranarayanan, R. Srinivasan, T.A. Mary, U. V. Varadaraju and G. V. Subba Rao	National Seminar on Superconductivity, Trivandrum Nov. 1988.
49.	Dr. V. Sankaranarayanan	Thermopower of Zinc doped Yttrium Barium Copper Oxide Vijayshree Radhakrishnan C.K. Subramaniam, V. Sankaranarayanan, R. Srinivasan T. A. Mary, U. V. Varadaraju and G. V. Subba Rao	National Seminar on Superconductivity, Trivandrum Nov. 1988
50.	Dr. V. Sankaranarayanan	Possible intergrain effects in Electrical Resistivity of Zn doped Zn doped Yttrium Barium Copper Oxide at the Superconducting Transition H. Krishnan, V. Sankaranarayanan, C. K. Subramaniam, R. Srinivasan and G. V. Subba Rao	Solid State Symposium (Dept.) of Atomic Energy Bhopal, 1988.
51.	Dr. V. Sankaranarayanan	Determination of Absolute Thermopower of Copper using High Temperature Superconductor $YBa_2Cu_3O_7$ Vijayashree Radhakrishnan C. K. Subramaniam, V. Sankaranarayanan, R. Srinivasan and G. V. Subba Rao	— do —



**(b) Papers presented at Conferences attended : ABROAD**

<i>Sl. No.</i>	<i>Name of faculty member attending the conference</i>	<i>Title of paper presented and authors</i>	<i>Name, Dates and Venue of the Conference</i>
1.	Dr. Y. V. G. S. Murti	Enhanced Diffusion of Silver Ion in Silver Chloride—Alumina Composites. A. L. Laskar, W. C. Miller and Y. V. G. S. Murti	American Physical Society Meeting, New Orleans, USA March 1988.
2.	Dr. S. Radhakrishna	Experimental Techniques for Characterisation of fast Ion Conducting Materials. PSSN. Prasad and S. Radhakrishna	Workshop on Analytical Techniques for Material Characterisation, Baton Rouge, USA.
3.	Dr. S. Radhakrishna	Material Characterization of $Ag_{1-x}Pb_x$ Solution Ionic Conductor. RVGK. Sarma, PSSN Prasad and S. Radhakrishna	— do —
4.	Dr. R. S. Sirohi	Some new Techniques with Digital Speckle Pattern Interferometry. R. S. Sirohi, A. R. Ganesan and M. P. Kothiyal	SPIE, Conference on optical Testing and Metrology at Detroit, USA June 25-29 USA 1988.
5.	Dr. R. S. Sirohi	A new method of contouring using Digital Speckle Pattern Interferometry. A. R. Ganesan and R. S. Sirohi	— do —
6.	Dr. R. Srinivasan	Specific heat of Pr doped Yttrium barium copper oxide. N. Sankar, V. Sankaranarayanan, R. Srinivasan and G Rangarajan	International Cryogenic Engineering Conference ICEC 12, Southampton, UK July 1988
7.	Dr. R. Srinivasan	Specific heat of the oxide superconductors. R. Srinivasan and V. Sankaranarayanan	International Workshop on High $T_c$ Superconductor.
8.	Dr. V. Ramachandran	Acoustic Wave Velocity and attenuation in the High $T_c$ superconductor $YBa_2Cu_3O_7$ . V. Ramachandran G. A. Ramadass and R. Srinivasan	International Conference on high temperature Superconductors and Materials and Mechanisms of Superconductivity Interlaken, Switzerland Feb. 28 to March 4, 88.
9.	Dr. K. Hariharan	Characterisation of Solid State Cells with AgI-Ag <sub>2</sub> O-CrO <sub>3</sub> Glassy Electrotype and organomineral methods. A. Durgarani and K. Hariharan	International Symposium on Solid State Ionic Devices. Singapore 18-23 July 1988.

## 7. Research Publications :

### In Indian Journals

Sl. No.	Authors	Title	Name of the Journal	Vol. & Issue No.	Month and year	Pages
1.	B. Sobha and YVGS Murti	Low Frequency Internal Friction Spectra of $\text{Cu}_{0.81}\text{Pd}_{0.19}$ alloy	Bull Materials Science	11	1988	319-328
2.	N. Sankar, V. Sankaranarayanan, R. Srinivasan, G. Rangarajan and G. V. Subba Rao	Specific Heat of $\text{YBa}_2\text{Cu}_3\text{O}_7$ from 4.2 K to 60 K	Pramana J. Phys.	30	1988	419-422
3.	P. K. Palanisamy, A. Ramalingam, V. Masilamani and B. M. Sivaram	Frequency tunability and temporal characteristics of DAMC distributed feedback dye laser	Pramana J. Phys.	30	1988	543-548
4.	R. Srinivasan, V. Ramachandran, A. T. Seshadri and G. Ananda Ramadass	Anomalous behaviour of sound velocity in the high $T_c$ superconductor $\text{YBa}_2\text{Cu}_3\text{O}_7$	Pramana J. Phys.	29	1988	L603-L609
5.	H. Kumar and M. P. Kothiyal	Fabrication and Testing of a special purpose beam splitter	J. of Optics	17	1988	18-23
6.	P. R. Vaya, J. Majhi and M. Sadhana	C-V and IR Absorption study of thin oxide films thermally grown on silicon	Indian J. Pure Appl. Phys.	26	1988	294-296
7.	A. Durgarani and K. Hariharan	Investigation of $\text{AgI-AgI}_2\text{O-PrO}_3$ super-ionic material as an electrolyte in solid state batteries	Bulletin of electro-chem. Society	4	1988	1717-7120
8.	A. Durgarani and K. Hariharan	Characterisation of Solid State cells with $\text{AgI-Ag}_2\text{O - PrO}_3$ glasses eletrolyte and organiminiral cathods	Solid State Ionic Devices	—	1988	431-438
9.	N. Venkataramani, K. Muraleedharan, A. Datta, S. N. Bhatia, Om Prakash and C. M. Srivastava	Effect of Zr, Ti Substitution on $T_c$ in superconducting $\text{YBa}_2\text{Cu}_3\text{O}_7$ -system	Pramana J. Phys.	30	1988	L455-L457
10.	M. V. Anusuya, T. S. Natarajan	Simple Interfacing for IBM PC compasibles using printer post	Physics Education	4	1988	

<i>Sl. No.</i>	<i>Authors</i>	<i>Title</i>	<i>Name of Journal</i>	<i>Vol. and Issue No.</i>	<i>Month &amp; Year</i>	<i>Pages</i>
11.	M. Dhanabalan, Y. Svamasundara Rao, K. V. Reddy	Self diffusion and electro-migration in tin films	Proc. of Solid State Physics	31C	1988	479
12.	Y. Syamasundara Rao, M. N. Gangaiah	A full solid state device power supply for x band klystron	Jourl. of Ind. Soc. India	18	1988	3
13.	S. Natarajan, V. V. Varadaraju, G. V. Subba Rao, V. Sankaranarayanan N. P. Raju and R. Srinivasan	Superconductivity studies on $(Y_{1-x}Ln_x)Ba_2Cu_3O_{7-x}$ Ln=La, Gd, Ho and Tm	Proc. Indian National Science Academy	54A	1988	706-710

**In Foreign Journals :**

1.	V. Balakrishnan, S. Lakshmibala and C. Van den Broeck	The renewal equation for persistent diffusion	Physica	153A	1988	57-66
2.	V. Balakrishnan and S. Chaturvedi	Persistent diffusion of a line	Physica	148A	1988	581-596
3.	V. Balakrishnan, C. Van den Broeck and P. Hanggi	First passage times of non - Markovian processes : The case of a boundary	Physical Review	A38	1988	4213-4222
4.	M. L. Dalal, S. Sivaraman, and YVGS Murti	Space charge limited currents in alkali halide crystals during electrolytic coloration	J. Phys. and Chem. of Solids	49	1988	223
5.	R. Subrahmanyam and YVGS Murti	Laser induced and F to F conversions in KC1 crystals	Physica status solidi (b)	151	1989	
6.	C. Vijayan and YVGS Murti	Thermoluminescence of KC1: Gd containing $Z_1$ centers	Crystal Latt. defects and amorphous materials		1988	
7.	S. H. Tang, E. C. Looi S. Radhakrishna	Raman and Infrared studies of Tetramethyl ammonium tetrachloro zincate	Phys. Stat Sol.	135(b)	1988	516
8.	P. Sathya Sai nath Prasad S. Radhakrishna	Electronic transitions nickel ion in cadmium ammonium sulphate hexahydrate single crystals	Solid St. Comm.	67	1988	147

<i>Sl. No.</i>	<i>Authors</i>	<i>Title</i>	<i>Name of the Journal</i>	<i>Vol. &amp; Issue No.</i>	<i>Month and Year</i>	<i>Pages</i>
9.	J. K. Rath, S. Radhakrishna	Optical properties of $\text{SeO}_3^{2-}$ centres in $\text{NH}_4\text{H}_2\text{PO}_4$ single crystals	Solid St. Commn.	65	1988	1621
10.	P. S. S. N. Prasad, S. Radhakrishna	Structural, thermal and transport studies on silver phosphovanadate glasses	J. Sol. St. Chem.	76	1988	7
11.	P. S. S. N. Prasad, S. Radhakrishna	Transport and dielectric studies on 66.67AgI-22.22 Ag <sub>2</sub> O-11.11 (0.8V <sub>2</sub> O <sub>5</sub> -0.2 P <sub>2</sub> O <sub>5</sub> ) electrolyte	J. Mat. Sci. Lett.	7	1988	113
12.	R. V. G. K. Sharma, S. Radhakrishna	Transport studies on silver boromolybdate superionic conducting glass	Solid St. Ionics	28-30	1988	808
13.	P. S. S. N. Prasad, S. Radhakrishna	Transport and dielectric studies on superionic conducting AgI-Ag <sub>2</sub> O-MoO <sub>3</sub> -WO <sub>3</sub>	Solid St. Ionics	28-30	1988	814
14.	N. Sathyanarayana S. Radhakrishna	Spectroscopic and transport studies on AgI-Ag <sub>2</sub> O-MoO <sub>3</sub> -V <sub>2</sub> O <sub>5</sub> superionic conducting glasses	Solid St. Ionics	28-30	1988	811
15.	R. V. G. K. Sarma, S. Radhakrishna	Application of AgI-Ag <sub>2</sub> O-B <sub>2</sub> O <sub>3</sub> -MoO <sub>3</sub> system to the solid state battery	Solid St. Ionic Devices, S'pore	425	1988	
16.	P. S. S. N. Prasad, S. Radhakrishna	A study of chromium Centres in 3CdSO <sub>4</sub> , BH <sub>2</sub> O single crystals	Phys. Stat. Solidi (b)	151	1989	48
17.	P. S. S. N. Prasad, S. Radhakrishna	Electrical conductivity, TEP and dielectric studies on mole % 66.67 AgI-22.2 Ag <sub>2</sub> O-11.1 (0.8V <sub>2</sub> O <sub>5</sub> -0.2 P <sub>2</sub> O <sub>5</sub> ) electrolyte for solid state batteries	J. Mat. Sci.	23	1988	4492-4502
18.	R. Ramji Rao	The effective second-order elastic constants of a strained crystal using the elastic wave propagation in a homogeneously deformed material	J. Appl. Phys.	63	1988	5728

<i>Sl. No.</i>	<i>Authors</i>	<i>Title</i>	<i>Name of the Journal</i>	<i>Vol. &amp; issue No.</i>	<i>Month and Year</i>	<i>Pages</i>
19.	R. Ramji Rao	Effective second-order elastic constants of a strained cubic crystal in the finite strain theory	J. Appl. Physics	64	1988	3320
20.	R. Ramji Rao	Second pressure derivatives of the second order elastic constants of some alkali halides	Phys. Rev. B.	38	1988	10087
21.	R. Ramji Rao	Fourth order elastic constants of sodium	Physica Status Solidi (b)	148	1988	k1
22.	R. Ramji Rao	Elastic constants and pressure derivatives of hexagonal Lanthanum	J. of the Less Common Metals	141	1988	133
23.	R. Ramji Rao	Phonon dispersion relations in copper and silver	Physica Status Solidi (b)	147	1988	k11
24.	N. P. Raju, G. Rangarajan, and R. Srinivasan	Magnetic susceptibility of the compounds $(Dy_x Y_{1-x}) Mo_2O_7$ in the temperature range 600 - 4.2K	J. Phys. Solid State Physics	21	1988	5427
25.	N. Sankar, V. Sankaranarayanan, L. S. Vaidhayanathan, G. Rangarajan and R. Srinivasan	Specific Heat of Praseodymium doped $YBa_2Cu_3O_{7-y}$	Solid State Communications	67	1988	391
26.	S. B. S. Sastry and G. Muralidharan	Thermoluminescence and Fluorescence studies on RbBr : Gd <sup>2+</sup>	Phys. State. Solidi (b)	146	1988	727-31
27.	S. B. S. Sastry and G. Muralidharan	Thermoluminescence and Laser Raman studies on RbI : Gd <sup>2+</sup>	Nucl. Inst. and Methods in Phys. Res.	B32	1988	226-31
28.	S. B. S. Sastry and G. Muralidharan	Thermoluminescence and other optical studies on - irradiated RbCl : Gd <sup>2+</sup>	Phys. Stat. Sol. (b)	150	1988	315-322
29.	M. S. Muralisastry, Manjunath pattabi, V. D. Das and V. Sivaramakrishnan	Repeated deposition studies of the occurrence of large scale co-alescence... aging of island silver films	Vacuum	38	1988	21-25

<i>Sl. No.</i>	<i>Authors</i>	<i>Title</i>	<i>Name of the Journal</i>	<i>Vol. &amp; Issue No.</i>	<i>Month and year</i>	<i>Pages</i>
30.	Manjunath Pattabi, M. S. Muralisastry and V. Sivaramakrishnan	Aging and field effect studies of Cu Island films at near liquid Nitrogen temperatures	J. App. Phys.	63(3)	1988	983
31.	Manjunath Pattabi, M. S. Muralisastry and V. Sivaramakrishnan	Studies on the stability of discontinuous silver films with over layers of Al <sub>2</sub> O <sub>3</sub> and SiO <sub>2</sub>	Phys. Stat. Sl.(a)	106	1988	145
32.	Manjunath Pattabi and V. Sivaramakrishnan	effect of overlayers on the instability of copper island film	Jour. Mat. Sci.	23	1988	1502
33.	Manjunath Pattabi, M. S. Muralisastry and V. Sivaramakrishnan	Studies in the stability of Cu island films deposited on a softenable substrate	J. App. Phys.	64	1988	437
34.	N. Ganesan and V. Sivaramakrishnan	Variation in Electrical properties of Sn Te thin films with substrate temperature	Phys. Stat. Sol. (a)	105	1988	461
35.	N. Ganesan and V. Sivaramakrishnan	Effect of excess tin on the electrical properties of Sn Te thin films	Jour. Mat. Sci.	23	1988	1237-42
36.	R. Srinivasan, K. S. Girirajan, V. Ganesan, Vijayashree Radha- krishnan and G. V. Subba Rao	Anomalous variation of the lattice parameter of a sample of YBa <sub>2</sub> Cu <sub>3</sub> O <sub>7</sub> through the superconducting transition	Phys. Rev.	B38	1988	—
37.	R. Srinivasan and V. Sankaranarayanan	Specific heat of the high temperature oxide superconductors	Rev. of Solid State Science	2	1988	277-301
38.	V. Ramachandran G. A. Ramadass and R. Srinivasan	Acoustic wave velocity and attenuation in the High T <sub>c</sub> superconductor YBa <sub>2</sub> Cu <sub>3</sub> O <sub>7</sub>	Physica C	153	1988	278-279
39.	P. F. Rajam, C. K. Subramaniam, S. Kasiviswanathan and R. Srinivasan	Single particle tunneling in YBa <sub>2</sub> Cu <sub>3</sub> O <sub>7-x</sub> and GdBa <sub>2</sub> Cu <sub>3</sub> O <sub>7-x</sub>	Rev. Solid State Sci.	2	1988	339
40.	C. Joenathan, C. S. Narayanamurthy, and R. S. Sirohi	Localization of fringes in speckle photography due to axial motion of the diffuse object	JOSA (A)	5	1988	1035-40

Sl. No.	Authors	Title	Name of the Journal	Vol. & Issue No.	Month and year	Pages
41.	A. R. Ganesan, C. Joenathan and R. S. Sirohi	Sharpening of fringes in digital speckle pattern interferometry	Appl. Opt.	27	1988	2099-2100
42.	M. P. Kothiyal, R. S. Sirohi and K. J. Rosenbruch	Improved techniques on collimation technique	Opt. Laser Technol.	20	1988	139-144
43.	V. Parthibhan, C. Joenathan and R. S. Sirohi	A simple inverting interferometer with holo elements	Appl. Opt.	27	1988	1913-14
44.	N. Krishna Mohan, C. Joenathan and R. S. Sirohi	Investigations on multi-aperture white light speckle photography	Opt. Commun.	67	1988	27-33
45.	A. R. Ganesan, D. K. Sharma and M. P. Kothiyal	Universal digital speckle shearing interferometer	Appl. Opt.	27	1988	4731-34
46.	J. J. B. Prasad and K. V. Reddy	Electromigration in Thin Solid Films	Thin Solid Films	164	1988	123-127
47.	A. L. Laskar, K. V. Reddy and G. A. Popson	Mass and charge transport in AgCl: Ce <sup>3+</sup> system	Solid State Ionics	28	1988	294-297
48.	B. S. V. S. R. Acharyulu and V. S. Kishan Kumar	Optical and thermoluminescence studies on thollium doped supra pure cesium sulphate	Phys. Stat. Solidi.	165	1988	303-307
49.	V. Damodara Das and P. Jansi Lakshmi	Electron beam induced explosive crystallisation of amorphous Se <sub>30</sub> Te <sub>20</sub> alloy thin films and oriented growth of crystallites	Phys. Rev. (B)	37	1988	720-726
50.	V. Damodara Das and N. Soundararajan	Size and temperature effects on the thermo-electric power and the electrical resistivity of bismuth telluride (Bi <sub>2</sub> Te <sub>3</sub> ) thin films	Phys. Rev. (B)	37	1988	4552-4559
51.	V. Damodara Das and P. Jansi Lakshmi	In-Situ electrical conductivity and amorphous crystalline transition in vacuum-deposited thin films of Se <sub>30</sub> Te <sub>20</sub> alloy	J. Mater Sci.	23	1988	
52.	S. P. Chidambaram, G. Aravamudam, M. Seshasayee, T. A. Shebanova and V. I. Simonov	Synthesis of unusual mixed ligand Te (IV) dte with perchlorate	Polyhedress	1(14)	1988	1267-1271

<i>Sl. No.</i>	<i>Authors</i>	<i>Title</i>	<i>Name of the Journal</i>	<i>Vol. &amp; Issue No.</i>	<i>Month and year</i>	<i>Pages</i>
53.	S. P. Chidambaram, V. Aravamudam and M. Seshasayee	Structure of Benzimidazole-2-sulphonic acid monohydrate	Acta Cryst.	C44	1988	898-900
54.	A. Radha, M. Seshasayee and G. Aravamudam	Crystal and molecular structure of Bis (piperidinedtc) Ni(II) and Cu(II)	Acta Cryst.	C44	1988	1378-81
55.	P. R. Vaya and J. Majhi	Effect of surface treatment on Al-Si Schottky structures	Physics stat. Solidi (a)	106	1988	K209-213
56.	V. R. K. Murthy, B. Viswanathan and R. Raman	Microwave loss of measurements and XPS studies of 1-2-3 superconductors	Solid State Commu.	66	1988	406-411
57.	S. S. Sastry, G. Satyanandam, VRK Murthy, A. Subrahmanyam	Low frequency properties of HgCl <sub>2</sub> · 2H <sub>2</sub> O single crystals	Physics Status Solidi (a)	105	1988	K71
58.	N. Shanthi, P. C. Deshmukh and S. T. Manson	Near Threshold structure in photoionization of krypton 3p	Phys. Rev.	A37	1988	1773
59.	N. Shanthi, P. C. Deshmukh and S. T. Manson	Photoionization cross-section Angular distribution and spin polarization calculations for the 3p subshells of krypton	Phys. Rev.	A37	1988	4720
60.	D. W. Lirdle, L. J. Medhurst, T. A. Ferrett, P. A. Heimann, M. N. Piacastelli, S.M. Liu, D. A. Shirley, T. A. Carlson, P. C. Deshmukh, G. Nazreen and S. T. Manson	Angle resolved photoemission from the Ar 2p subshell	Phys. Rev.	A38	1988	2371
61.	G. Nazreen, P. C. Deshmukh and S. T. Manson	Photoionization from the Al <sup>+</sup> in the RRPA	Phys. Rev.	A38	1988	504
62.	P. C. Deshmukh, G. Nazreen and S. T. Manson	Photoionization from single ionized potassium	J. Phys.	B21	1988	L281
63.	K. Srigouri and T. A. Prasada Rao	Resonance Radiation trapping effects in CuCl laser	J. Appl. Phys.	65(4)	1989	15



Sl. No.	Authors	Title	Name of the Journal	Vol. & Issue No.	Month and year	Pages
64.	S. Lakshmi Raghavan, N. Ramesh and K. Srinivasan	Electro optical effect in $KCl: Cd^{2+}$ and $KCl: Sr^{2+}$	Physica STATUS Solidi (a)	108	1988	771
65.	K. Hariharan and A. Durgarani	Transport studies on superionic AgI-Ag <sub>2</sub> O-PrO <sub>3</sub> glasses	Solid State Ionics	28-30	1988	799-803
66.	Rajiv Kaushik and K. Hariharan	Glass formation in AgI-Ag <sub>2</sub> O-V <sub>2</sub> O <sub>5</sub> and AgI-Ag <sub>2</sub> O (V <sub>2</sub> O <sub>5</sub> +B <sub>2</sub> O <sub>3</sub> ) systems application to Solid State Battery	Solid Ionics	28-30	1988	732
67.	M. Muraleedharan, C. V. Tomy, S. K. Malik, Ram Prasad and N. C. Soni	Infrared evidence for BaCO <sub>3</sub> segregation during the preparation of High Tc superconductors	Solid State Commun.	68	1988	227-229
68.	A. Datta, K. Muraleedharan, N. Venkatramani and C. M. Srivastava	On the resistivity anomaly above 500K in some high Tc ceramic superconductors	J. Phys. C		1988	L757-762
69.	N. Balasubramanian and A. Subrahmanyam	Effect of substrate temperature on the Electrical and optical properties of reactively evaporated Indium Tin Oxide (ITO) films	Mat. Sci. and Engg. B	B1	1988	279-282
70.	S. Sreehari Sastry, G. Satyanandam, A. Subramanyam and V. R. K. Murthy	Dielectric properties of HgCl <sub>2</sub> :2KCl.H <sub>2</sub> O single crystals in rf range	Physics Solidi (a)	105	1988	K71-73
71.	D. K. Sharma, N. Krishnamohan and C. Delisle	Real time holospeckle shear interferometry	Optics Commu.	65	1988	70-72
72.	A. Radha, M. Seshasayee and P. Kuppaswamy	Structure of Bis (1,2-bis (diphenylphosphinoethyl) iodo Co (II) tetraphenylporate	Acta. Crystal.	C44	1988	1008-11

#### 8. Books and Monographs Brought Out :

- (1) S. Radhakrishna and B.V.R. Choudhari (National University of Singapore) '*Solid State Ionics*' World Scientific Publishing Co. Singapore 1988.
- (2) S. Radhakrishna, B. V. R. Choudhari (National University of Singapore) W. E. Collins '*Analytical Techniques for Material Characterisations*' World Scientific Publishing Co. Singapore 1988.

(3) S. Radhakrishna and K. Srinivasan, *Proceedings of the International Conference on Physics of Materials 1985 and 1986*, World Scientific Publishing Co. Singapore 1988.

**9. National and International Conferences, Symposium Organised :**

<i>Title of the conference</i>	<i>Dates</i>
International W/S. on Advances in holography and speckle phenomena and their Industrial applications IIT, Madras.	Dec. 12 — 17 1988.
International Workshop on Microcomputers in physics Teaching (supported by ICIP, Trieste COSTED).	Jan. 9 — 13 1988.
Seminar on "Raman Effect and Applications" in commemoration of the birth centenary of Sir C. V. Raman	12-11-1988.

**10. Professional Activities :**

<i>Name of the faculty member</i>	<i>Professional activities</i>
1. Dr. R. Srinivasan	<ol style="list-style-type: none"> <li>1. Member, Indian Academy of Sciences</li> <li>2. Member of National Committee               <ol style="list-style-type: none"> <li>(i) Program Advisory Committee on Cryogenics of the DST.</li> <li>(ii) Program Advisory Committee on Condensed Matter Physics of the DST.</li> <li>(iii) UGC Panel on Physics</li> <li>(iv) UGC Standing Committee on Superconductivity</li> <li>(v) Electronics and Instrumentation Advisory Committee of the Board of Research on Nuclear Science of the DAE.</li> </ol> </li> <li>3. Member of the Editorial Board               <ol style="list-style-type: none"> <li>(i) Advisory Editor, Cryogenics, International Journal Published in U.K.,</li> <li>(ii) Editorial Committee of Physics News brought out by the Indian Physics Association.</li> </ol> </li> <li>4. Co-editor 'High T<sub>c</sub> News Letter' for the PMB of DST.</li> <li>5. Chaired a session at ICEC-12</li> </ol>
2. Dr. R. S. Sirohi	<ol style="list-style-type: none"> <li>1. Member, International Advisory Editorial Board, Journal of Modern Optics, U.K.,</li> <li>2. Indian correspondent of 'Holography News', U.S.A.</li> </ol>
3. Dr. V. Balakrishnan	<ol style="list-style-type: none"> <li>1. Member, Indian Academy of Sciences.</li> <li>2. Associate, International Centre for Theoretical Physics, Trieste, Italy.</li> </ol>
4. Dr. S. Radhakrishnan	Scientific Secretary, COSTED
5. Dr. K. Srinivasan	Secretary, Asian Physical Society

### 11. Invited Lectures By I.I.T. Faculty at other Institutions

<i>Name of the faculty</i>	<i>Institution where lectures were delivered</i>	<i>Dates of lectures</i>
Dr. T. S. Natarajan	MOI University, Eldoret, Kenya.	8-7-88 to 12-7-88
"	International Training program on Electronics at Khon Kaen, Thailand.	Aug. '88
Dr. T. S. Natarajan	S. K. University Anantapur.	Jan. 2-7 '89
Dr. K. Srinivasan	Khon Kaeon, Thailand University.	
Dr. R. S. Sirohi	Sri Krishnadevaraja Univ. Anantpur, Andhra Pradesh.	Jan. 2-7 '89
Dr. V. R. K. Murthy	Indian Institute of Technology, Bombay.	April '88
Dr. V. Sivaramkrishnan	University of Kebangsaan Malaysia.	Jan. 18-21 '89
Dr. A. Subrahmanyam	"	Jan. 18-21 '89
Dr. R. Srinivasan	BHEL, Trichy and Hardwar.	

### 12. Visitors to the Department

<i>Sl. No.</i>	<i>Name and Addresses of distinguished visitors</i>
1.	Dr. Papousck Dusan Czechoslovak Academy of Sciences (Prague 8,) Czechoslovakia.
2.	Dr. K. Linga Murthy Dept. of Physics University of North Caroline Releigh, USA.
3.	Dr. N. G. Ushakov Institute of Problems of Microelectronics and the USSR Academy of Sciences, Moscow.
4.	Dr. Milan Jergal Electro-Technical Institute CEPR, Slovat Academy of Sciences (Dubravska Cesta 84239 Bratislava) Czechoslovakia.

<b>Sl. No.</b>	<b>Name and Addresses of distinguished visitors</b>
5.	Prof. J. Grigas USSR
6.	Prof. A. K. Jonscher Bedford College London.
7.	Prof. E. Gmelin Max Planck Institute fur Festkorperforschung Stuttgart, F. R. G.
8.	Dr. Milos Nevřiva Institute of Physics Czechoslovak Academy of Sciences Prague, Czechoslovakia.
9.	Prof. P. N. Butcher Dept. of Physics University of Warwick U. K.
10.	Prof. Dr. W. Fuhs Dept. of Physics Philips University Mamburg, FRG.
11.	Dr. Mahir Omar Ogly Godzhaev Institute of Physics Azerbaijan Academy of Sciences USSR.
12.	Dr. E. L. Ivachenko and Dr. A. I. Kosarev A. F. Ioffe Institute USSR Academy of Sciences Moscow.
13.	Dr. A. L. Petrov Lebedev Physical Institute Moscow.

### 13. Future Plans

It is proposed to start a 5-year integrated M.Sc. Physics Programme and a 18-month M.Tech Programme in 'Opto Electronics and Laser Technology' with the approval of the Senate. The areas of research in solid State Physics will be strengthened.

**14. Short-Term Courses/Continuing Education Programmes Conducted :**

<i>Title</i>	<i>Dates</i>
1. 7th International course on physics of Materials	23-11-88 to 3-12-88
2. A 4-week course on cryogenics for Scientists and Engineers	20-6-88 to 15-7-89
3. A 2-week training programme for Liquid Nitrogen plant operators	20-2-89 to 3-3 89
4. A 9-day programme on Maintenance and repair of laboratory Electronic equipment for technicians, in collaboration with COSTED.	15-10-88 to 23-10-89

**15. Awards and Honors Faculty/Students :**

1. Dr. V. Damodara Das has been awarded the "Hari Om Ashram Prerit Shri Harivallabhadas Chunilal Shah Research Endowment" prize for the years 1987 - 88 for the best research papers published in the area of 'Solid State Physics'.
2. Shri T. A. S Srinivas, a M.Sc. Physics student at the Institute during 1986 - 88 was awarded the "Cambridge Nehru Scholarship 1988" in the area of "Microelectronics".

**OTHER REPORTS :**

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## INDO-GERMAN PROGRAMME

1. Four projects, for laboratory development, with an outlay of DM 14,4 million is being executed during the period 1987-90.
2. During this year 13 staff members were permitted to visit Federal Republic of Germany for short-term.
3. The Institute recently organised a very successful workshop on Software Technology in collaboration with Siemens - Germany. This workshop was led by Dr. Schwaertzel of Siemens. Now Siemens - Germany have also offered a joint Ph D programme with opportunities for a few Ph. D. scholars of IIT Madras to visit Germany and spend upto 18 months in Siemens Research Institute.

## CENTRAL LIBRARY

### **Administration, Reprography and Bindery Division (ARB) :**

#### **Library Building :**

The recently constructed Stack-IV has been occupied and put into use. The back volumes of Periodicals relating to Engineering subjects are housed there.

On completion of Stack-V which is in its final stage of completion the less used collections will be shifted to this stack as recommended by the Library Advisory Committee.

#### **Staff :**

Two posts of Senior Professional Assistants have been filled up and two staff members have been promoted as Professional Assistant and Senior Professional Assistant.

#### **Reprography :**

As usual the Reprographic Services have been utilised by all the Departments/Centres and Industrial Associates to the full utilization capacity. It has been rendered on the "same day service" basis in almost all the cases. The Section has also printed the papers of the International Conference on Mathematical Modelling in Science and Technology held at I.I.T. Madras during August 1988 by the existing xerox operators themselves besides several small publications/newsletters.

#### **Bindery :**

The Library Bindery continued to meet the immediate requirements of the Library as well as those of different Departments and Centres of the Institute. The External Binders were retained for clearing the ever increasing workload in the Library Binder which has greatly brought to use the newly bound volumes as soon as the supply is completed.

The Library Budget has been fully utilized except for certain computing equipment like CD Rom etc., worth about Rs. 2 lakhs which could not be utilised for lack of timely decision.

#### **Acquisition and Processing Division (A & P) :**

Publications to the value of Rs. 10.12 lakhs been added to the Library collection during the year besides an about equal amount spent on books from various Project funds and loaned them on permanent basis.

#### **Circulation, Reference and Maintenance Division (CRM) :**

As usual, the entrants to various courses in the Institute were enrolled as members and the borrowing facilities provided. Similarly, the renewal of borrowers tickets for students after one year and faculty after 4 years was undertaken and completed in time as programmed.

The Corporate Membership of the library has been largely taken over by the Industrial Associateship, leaving a few Academic Institutions and individual membership to the direct care of Central Library. The membership of the Library including Industrial Associateship has risen to a total of 3,849.

Periodically Video and other Audio-Visual programmes on technical subjects were continued to be held as part of User Education Programmes.

The Book Banks for General and Weaker Sections continued to be used by the students to its full capacity although it has to be increased greatly to meet the increasing demand of students.

#### **Periodicals and Serials Division (P & S) :**

##### **Computerisation :**

The data base of the current periodical holdings is being prepared. It is proposed to use the print out not only to bring out an updated version of the Catalogue of Periodical Holdings of



I.I.T. Madras but also use the programme for sending timely renewals of subscriptions, arranging their payments and timely claims for non-receipted ones.

**Budget Allocation :**

Enhancement of Subscription rates by the Publishers, frequent upward revision of conversion rates, and ordering of new journals have proved inadequate to meet the requirements for periodicals subscription. An additional sum of Rs. 17.5 lakhs was therefore sanctioned towards cost of subscriptions which was fully expanded.

**Serials ;**

Prompt and timely action resulted in a steady flow of serials and full utilization of the allotment of Rs. 75,000/-

**Binding :**

All the Journals received upto December 1987 were collected, karded and got bound.

**Translation Service :**

Articles and reports in German and French language sent by the Research Scholars were got translated with the help of the Panel of translators from I.I.T. and supplied to the parties.

**GENERAL :**

**Computerisation of Library Services :**

As a first step in the Computerisation of Library Services one PC AT, 2XTs and 3 PCs have been acquired during the year under review. A data base of Ph D. Theses submitted to the Institute from its inception till last Convocation has been created with CD/ISIS software which has provided by Unesco through Department of Science & Technology Using this software a very helpful index for the Key words, Authors or Research Scholars and their Guides has been created for printing and distribution to various organisations in the country. This effort has been highly commended by Chairman-UGC with promise for financial support for the endeavour. The database can be updated easily as and when theses are submitted and queries answered on line.

The staff members mentioned below attended Seminars/Conferences/Workshop noted against their names respectively :

Mr. V.S. Nazir Ahmed, Librarian, Mr. C. Deenadayalu, Deputy Librarian and Mr. P.N. Swamy, Senior Professional Assistant have attended the Seminar on Desk Top Publishing (DTP) on April 9, 1988 at College of Engineering, Madras.

Mr. C. Deenadayalu, Dy. Librarian and Mrs. Zahida Basha, Library Assistant attended a Summer School on Computerised Library Information System during 6-13th June 1988 held at Sri Jayachamarajendra College of Engineering, Mysore.

Mr. P. Venkatesan, Assistant Librarian (SG) participated in the Seminar-cum-Workshop "The Environment Tight Rope" organised by Green Canopy of I.I.T. Madras during 7th and 8th January 1989.

Mrs. J. Durairaj, Assistant Librarian (SG), attended the Workshop on Information for Industry at CFTRI Library, Mysore from 8-10th February 1989.

The following are the basic statistics of Library performance during the year under review :

1987-88		1988-89
	<b>Library Membership</b>	
3,712	Institute Members (Staff & Students)	3,677
	Outside Members :	

70	Individual	53
2	Corporate	2
122	Industrial Associateship	117
283	Consultation Permits	326
<b>Circulation</b>		
94,109	Number of Readers visited	1,04,383
1,13,901	Number of Volumes issued	1,36,210
To Individuals-Subjectwise		
32,062	Science	41,677
50,002	Technology	53,504
20,640	Humanities	29,453
2,711	Textbook Reference	2,761
8,223	Periodicals	8,815
9,594	To Departments	8,739
8,300	Departmental Loan	7,026
1,294	Permanent Loan	1,713
1987-88		1988-89

#### In-Book Banks

<i>General</i>	<i>Weaker section</i>		<i>General</i>	<i>Weaker section</i>
1,284	4,432	Collection	1,463	4,557
1,600	800	Issued	1,800	870
<b>Number of Reservation for books</b>				
5,512		Registered		7,835
4,313		Fulfilled		6,570
Rs.				Rs.
87,225		Amount of Overdue and other charges realised		1,71,796
<b>Inter-Library Loans</b>				
62		Borrowed for Institute Members		108
25		Lent out from Institute Library		65
<b>Audio-Visual Activities</b>				
52		No. of Audio-Visual software available		52
43		No. of Video Cassettes available		50
19		No. of Audio-Visual programs conducted		23
121		No. of Persons attended		410
<b>Acquisition of Books and Back Volumes</b>				
5,701		Books		5,138
2,754		Bound volumes of Periodicals		2,062
319		Pamphlets and Reports		524
2		Microfilms/Fische		9
60		Institute Ph.D. Theses		71
8,835		Total intake during the year		7,804
2,36,365		Total accessions as at the end of March 1989		2,46,245

<i>General</i>	<i>Weaker section</i>	<i>General</i>	<i>Weaker section</i>
<b>Current Periodicals</b>			
1,406	By Subscription		1,612
195	By Exchange/Gift		195
9	Translation arranged		10
<b>Reprographic Services</b>			
1,29,353	Xerox copies made		1,78,730
117	Gestafax (Electronic Stencils)		182
1,238	Rotamasters prepared and printed		837
<b>Binding</b>			
851	No. of books and journals bound with Library Bindery		1,083
2,756	No. of books and journals spot bound		1,004
2,621	No. of books and journals through external Binders		891
900	No. of other publications (Reports, Lecture Notes etc.) bound in Library Bindery		94

## CENTRAL WORKSHOP

The various units of the Central Workshop are Carpentry and Pattern making, Fitters and Tool Maker's shop, Machine Shop, Gear Shop and Gear testing, Instrument shop, Electrical shop, Foundry, Smithy and Heat treatment, Welding shop, Automobile repair, Electroplating shop, Design cell and Stores. The Central Workshop gives practical training for B.Tech and M.Sc. (Physics) students, the Employees of I.I.T., Madras through Apprentice training programme and personnel from private industries. Besides this, they undertake fabrication of components, gadgets, apparatus etc. required by the various Departments for research and development projects. The Central Workshop also undertakes design and manufacture of components, machine tools etc. for industries,

### Facilities :

Gear cutting, Gear grinding and testing (spur and bevel gears) Jig boring, grinding, copy milling, manufacture of precision instruments scales, precision instrument repairing, calibration of pressure gauges and dynamic balancing of rotors etc.

The transport system of the Institute is also controlled and maintained by the Central Workshop.

In the year 1988-89, Workshop received 770 Work Orders from various departments in connection with Projects Research and Development and maintenance work in addition to the regular programme for the students of B.Tech.

Advanced Workshop course was conducted during the Summer (April to May 1988) to the B.Tech students and 47 students were trained.

## INSTITUTE HOSPITAL

The Institute Hospital consisting of 30 beds, rendering medical aid to a population of nearly 10,000 (Students Staff) on an average, 300 patients are daily treated in the out-patient department. Hospital offers out-patient and in-patient services for Medical, Surgical, Obstetrics, Gynaecological, Paediatric, Psychiatric, ENT and Ophthalmic treatment.

Dr. A. Ganesan, M.D. is the Chief Medical Officer.

The following Medical Officers are rendering their services in their respective specialities.

- |  |                                     |
|--|-------------------------------------|
| 1. Dr. N. A. JAYAVELAN, M.B.B.S.   | Resident Medical Officer            |
| 2. Dr. SUMATI KHANGAONKAR, M.B.B.S., D.A.  | Anaesthetist                        |
| 3. Dr. LALITHAKUMARI, M.B.B.S., D.G.O.   | Obstetrician & Gynaecologist        |
| 4. Dr. S. ARUNA, B.Sc., M.B.B.S.   | Medical Officer                     |
| 5. Dr. C. SRIDEVI, M D., D.Ch.   | Paediatrician                       |
| 6. Dr. S. KAMESWARAN, M.S., Ph.D.,<br>F.R.C.S. (Ed.)<br>F.R.C.S. (Clax)<br>F.R.C.S., DLO | ENT Consultant<br>(Part time)       |
| 7. Dr. S. DEVAJI RAO, M.S., MNAMS, FICS  | Consultant Surgeon (Part time)      |
| 8. Dr. R. SATHYANATHAN, M.D., D.P.M.   | Consultant Psychiatrist (Part time) |
| 9. Dr. S. RATHNAMALA, M.B.B.S., D.O.   | EYE Specialist (Part time)          |
| 10. Dr. VIJAY NAGASWAMI, M.B.B.S., D.P.M.  | Consultant Psychiatrist (Part time) |

Sri L. Palaniappan is the Lay Secretary and is assisting the Chief Medical Officer in administrative work of the Hospital to which Medical Reimbursement Unit is also attached.

Two ambulances are available at Hospital and are being used round the clock. One Medical Officer is posted for call duty and is available for all the 24 hours of a day to attend the emergency cases in the Hospital.

Laboratory tests are undertaken for Bacteriological and a few Bio-chemical investigations. 2 ECG machines are available with the Hospital. Some major operations for conditions like Hernia and Peptic Ulcer are undertaken in our modernised Operation Theatre.

From April 1988 to March 1989, 307 doses against Polio and 252 doses of Triple Antigen and 17 doses of double Antigen (against Diphtheria, Pertusis and Tetanus) as 3 primary doses a month apart and a single booster doses at appropriate intervals were given.

Regarding incentive scheme for promotion of small family norms introduced by Government of India, Family Planning Operations are conducted at this Hospital.

### STATISTICS : April 1988 to March 1989

- |  |        |
|--|--------|
| 1. Total number visits of in outpatients | 91,086 |
| 2. Total number of inpatients            | 603    |
| 3. Emergencies attended                  | 3461   |
| 4. Dressings                             | 24,636 |
| 5. Injections                            | 22 571 |

6. Delivery	10
7. Pathology	
a) Urine	3924
b) Motion	2469
c) Blood	4746
8. Bio-Chemistry	
a) Blood Sugar	1281
b) Urea	182
9. Operations	
a) General Surgery	
Surgery of the abdominal wall	18
Surgery of appendix (emergency)	3
Ano-rectal Surgery	6
Surgery of genitalia	32
Surgery of Breasts	3
Minor Operations	85
b) ENT Operations	
Tonsillectomy	27
Mastoidectomy	2
Stapedectomy	2
Minor Procedures	14
c) EYE Operations	
Cataract Surgery	19
Minor procedures	8
d) Obstetric Procedures	
Normal deliveries	10
Gynaecological Operations	5

## PLACEMENT OFFICE

The placement Office, designated with the responsibility to procure placements and arrange inplant training in various industrial establishments for students of this Institute, was very active during the academic year 1938 89. Towards this end, this office maintained very close interaction with industrial establishments in private as well as public sectors. It liaised with as many as over 150 companies during the year. As a result, about 90 companies visited this office to hold campus-interviews. The placement office was able to get jobs in the Indian industries for almost all the students who were serious about making their career immediately on completion of their academic programme at the Institute.

During the year that passed, a number of steps were taken to serve the student community more effectively :—

1. Each of the student was provided with complete details relating to career opportunities available in the country in different disciplines much before the placement session began so that they could plan their future programme of action with knowledge and forethought.
2. All the final year students were given complete brief about the modus operandi adopted by various companies in recruiting their personnel.

For the benefit of the M. Tech. students who are passing out in December, the placement office started the campus recruitment programmes in September itself. Because of the early commencement of the campus interviews, most of the Post-Graduates who used the services of this office could get employment well in time.

On the recommendations of the students Placement Committee, the students were offered one firm job and one 'Dream Job'. The student-representatives helped the Placement Office in monitoring the implementation of this scheme.

In so far as training was concerned, this office continued to make energetic efforts to get training facilities for our students who made a request to this effect. The office also wrote letters to a number of companies and the response from them was as good as was in previous years.

## INSTITUTE GYMKHANA

### Cultural Events :

#### Lit-Soc Rally :

The cultural calendar for the year 1988-89 took off on a bright note with the Lit-Soc Rally. Basically this was meant for the freshers to get used to the cultural scene of the Institute. This year this rally evoked enthusiastic response from the senior students also.

#### Institute Open Events :

The Institute Open events, carrying cash prizes, were scheduled through-out the odd semester. The events scheduled for this competition were Dumb Charades, Crossword, Treasure Hunt, Elocution, Light Music, Quiz, Debate and Jam. The Institute Open Events this year attracted an unprecedented participation by students. The Quiz finals and Debate finals were very well attended by the students. The Western Music and the Light Music finals this year had unfolded new talents.

#### Inter-Hostel Events :

The Inter Hostel events this year included Jam Quiz, Crossword, Debate, Creative writing, Western Music, and were conducted during the final semester. In view of the organisation of Mardi Gras events were restricted to fewer in number, much less than what had been planned earlier.

#### Special Evenings :

Apart from the above regular cultural activities, this year witnessed a host of special evenings of cultural programmes such as, the Amalgamation Debate and Quiz meant for increasing informal interaction between the staff and the students.

#### Spic-Macay Concerts and Lecture Demonstration :

This year our association with Spic-Macay proved to be a real fruitful one and we could arrange a variety of high level lecture demonstrations and concerts. Important personalities like Birju Maharaj, Imraat Khan, Hariprasad Chaurasia Pandit C. R. Vyas, Shujaat Khan and Pandit Ram Narain gave recitals and demonstrations.

#### Out-station Participation of Cultural Events :

This year the participation of our students in out-station and local cultural festivals were fruitful. Distinctions were achieved in events like Western Music, Quiz, Debate and JAM.

#### Other Cultural Events :

This year we had the opportunity to watch Peter Schaffer's 'Public Eye and Private Ear', presented by IIT Madras and MCC group.

A novel feature this year was the show by the Nadaka's East-West fusion Jazz in co-operation with the German Consulate and the Madras Jazz club.

The semester came to an end with a fine performance of musical extravaganza presented by the IIT group "The Haze".

#### Mardi Gras '89 :

The festival, has over the years, gained a reputation of being a trend-setter. The Mardi Gras this year was conducted from 12th to 16th January 1989. This year Mardi Gras was an unprecedented success. The level of competitions were very high.

Competitions were held for the following events : Western Music, Jam, Creative Writing, Painting and carving, Elocution, Tintoretto, Classical Music, Debate, Password, paper Collage and Pot painting, Light Music, Dumb Charades, Quiz, Treasure Hunt, Sketching, Rangoli and Extempore.

The following Professional Shows were arranged for Mardi Gras '89 :

1. Shri Pankaj Udhas — GHAZALS
2. Ustad Amjad Ali Khan — SAROD



## SPORTS EVENTS

### 1. The Inter I.I.T. Sports Meet :

We had the pleasure of hosting the 25th All India Inter IIT Sports Meet of the 1988-89 at our campus from 11-16 December 1988. Our students practised hard in all sports and games with determination from the beginning of the year and won the coveted General Championship after five years with 88 points even though we had won the General Championship twelve times since its inception. This time the General Championship was won with a big margin of 42 points. We won the gold in Basketball, Badminton (Shuttle), Tennis, Table Tennis and Kabaddi and won the silver in Athletics, Cricket, Hockey, Volleyball and weight lifting. The important feature of this Inter IIT Sports Meet was that there was not even a single protest by any of the IITs.

### 2. Sportsfest 1988 :

The Sportsfest 1988 Inter Collegiate level Tournament was organised and conducted by the Institute Gymkhana successfully. Our Institute team performed creditably and gained rich experiences for the Inter IIT Tournaments. We were the runner-up in Volleyball.

### 3. All India Gerhard Fisher and Kokila Rajaiah Inter-Collegiate Flood Light Basket Ball Tournaments :

The Gerhard Fisher and Kokila Rajaiah Basketball Tournaments for men and women attracted 15 and 7 teams respectively. P.S.G. Arts College, Coimbatore retained the trophy and Loyola College, Madras was the runner-up in the men section. St. Mary's Higher Secondary School, Chengelpet was the winner and Stella Mary's College, Madras was the runner-up in the women section. The matches were keenly contested. Our students conducted the tournaments like professional organisers. These tournaments lasted for five days in January '89. It was a feast for the sports loving community of our campus.

### 4. All India Philips and Trinity inter collegiate floodlight Volley Ball Tournament :

Our students also had the pleasure of conducting the Philips and Trinity Volleyball Tournament in the first week of February '89. All the matches were held at the Students Activities Centre under floodlights. It gave the spectators a panoramic view of the game. 15 men teams and 7 women teams comprising both outstation and local teams were invited to participate. St. Xavier's College, Palayankottai won the men's event and the Aditanar College, Trichendur was the runner-up. Madras Seva-Sadan Higher Secondary School won the Championship and Stella Mary's College, Madras claimed the runner-up position in the women's section. All teams enjoyed their participation and SAC proved to be an excellent venue from the spectators and the participants' point of view.

### 5. The SAC Building :

The student activities centre, a multipurpose floodlight auditorium with wooden flooring is being put to use to the maximum. Our students are profiting a lot through this added facility. Some of the events that were given below :

- a. Inter Collegiate Table Tennis Tournaments
- b. All India Philips and Trinity Volleyball Tournament
- c. Inter IIT Badminton (Shuttle), Table Tennis, Gymnastics and weightlifting competitions.
- d. 3-a-side Basketball Tournaments
- e. Institute Basketball and Volley Ball teams' practice.
- f. Erection of Multi-gym.

### 6. Installation of Multigym in the SAC building:

A multigym with 12 stations was installed in the first week of October '88 at a cost of Rs. 42,000. The purpose of installing this equipment is (a) to provide health, physical fitness and

body building to our students, staff and their wards, (b) the sportsmen in different disciplines can strengthen the specific muscles and increase the performance in the respective sport. The club is being run in the morning and evening on the membership basis. It has attracted more than 400 members from students staff and their wards. This has evoked interest among the students towards health, fitness and body building.

#### **7. Open Bridge Tournament :**

In the Open Bridge Tournament conducted by the Gymkhana during 10-12 March '89, 22 teams in team events and 30 teams in pair events participated. In the pair events, Dr. A. Venkatesh Advisor Sports of Gymkhana and his partner Dr. V. Sriramalu were the winners and in the team events Mahalakshmi Club of Madras was the winner and the "Association Engineers" of Madras was the runner-up. Our players Mr. Mamman Sali and Mr. Sivaraman were declared "The Best Student Players" of the Tournament.

#### **8. Our Institute Football Team's Feat :**

In the Inter Collegiate sports festival organised and conducted by the Anna University in March '89 our Institute football team won the tournament after beating Champion teams in the city.

#### **9. Sports Star IIT Inter Collegiate Cricket Tournament :**

The above tournament was sponsored by the "Sports star in which 16 colleges participated, Loyola College annexed the trophy and our team became the runner-up.

Prof. Ramana, Principal of the Guru Nanak College, Madras presided over the final function and distributed the prizes and certificates.

#### **10. Inter-Collegiate Tennis Tournament for Mr Nikolaus Merten Cup :**

Twenty players have entered in this tournament. Sri C. V. Anand of Padma Seshadri School, Nungambakkam won the tournament.

#### **11. Tournaments among Students and Campus Members :**

In order to secure maximum participants from the students, staff and their wards, and to improve skills and techniques the following competitions were also conducted by the Institute Gymkhana.

- a. Annual Road Race
- b. Open Cycle Race
- c. 3-a-side Basketball
- d. 3-a-side Volleyball (48 teams)
- e. 6-a-side Hockey
- f. 6-a-side Football (70 teams)
- g. Skating Hockey
- h. Institute Chess Competition

#### **12. Inter Hostel Competitions :**

The Inter-Hostel Competitions serve as one of the important programmes of the Gymkhana to ensure larger participation from the student body in sports and games. Competitions were held in all the disciplines. Matches were keenly contested and the Schroeter Trophy for the inter Hostel Championship was annexed by the Narmada Hostel. Matches played in a healthy atmosphere,

#### **13. N.S.O. and H A L Programmes :**

The national sports organisation programme for the I Year B.Tech students and the physical training and the games programme. for the HAL Management and design trainees were effectively organised by the PTIs of the Gymkhana.

## 4 (TN) AIR SQN (TECH) NCC IIT MADRAS

### Introduction

The Air Wing NCC unit is functioning at IIT Madras from 16 SEP 65, to provide NCC training, exclusively to the student population of the institute. Regular IAF officers and airmen are posted to this unit and the strength is augmented by part time officers and other supporting staff drawn from the institute. NCC Syllabus includes drill, weapon training, civil defence, health/hygiene, leadership training, history of airpower, principles of flight, air armaments, Radio/Radar aids, Avionics and instrumentation. The training is imparted by a team comprising of the Air Force elements and the institute part time office.

### 2. Unit Organisation :

- a) Commanding Officer : Wing Commander  
M Murugesan
- b) Administrative Officer : Flight Lieutenant  
TPT Pillai
- c) Part time NCC Officer : Flight Lieutenant (NCC)  
KV Chalapathi Rao

### 3. Activities During the Year :

141 Cadets from first year B. Tech were enrolled as cadets during the year. In addition to the regular NCC training, the following activities were carried out.

- a) A conducted tour to Air Force Station Tambaram for all the cadets.
- b) Range firing practice on Rifle and Revolver.
- c) Glider flying experience at Airforce Tambaram for selected cadets
- d) One blood donation camp at Red Cross Society, Madras for the eligible cadets.
- e) Pledging for donation of eyes by volunteer cadets.
- f) Participation by NCC in the institute celebrations of the Republic day.
- g) Social service by the NCC cadets in the clearing and levelling the new tennis ground of the institute staff club.

### 4. Other Developments :

A qualified part time aeromodelling instructor was employed during the current year.

### 5. Conclusion :

The NCC activities during the year were broad based and made more interesting. In addition NCC offers ample opportunities to interested cadets in several adventure activities. Thus 4(TN) Air Sqn (Tech) NCC located within the IIT campus helps to instill a sense of discipline, comradeship a spirit of adventure and leadership capability in the life of IIT students.

## NSS ACTIVITIES

NSS activities were started in July 1988 with about 78 student volunteers and 4 student secretaries. The following activities have taken place during this year:

- 1) Coaching classes for X Std. students were held in Vana Vani Matriculation Higher Secondary School for 5 months from September 1988 to January 1989.
- 2) Spoken English classes are being conducted for adults in Velacheri and for sweepers in hostel sector since October, 1988.
- 3) After successful training in tailoring 11 women of neighbouring villages were given certificates on 30-7-88. Next training course in tailoring was started on 3-10-88 with a new batch of 9 ladies. The final trade test for this batch is scheduled on 29-3-89 and the certificates will be issued on 8-4-89.
- 4) Spoken Tamil classes are conducted for Non-Tamil students and these classes are going on since January 1989.
- 5) Reading to blind students is going on since Feb. 1989 in Thakkar Baba Vidyalaya, T' Nagar.
- 6) NSS volunteers associated themselves in the blood donation camps arranged by Blood Donor's Club in Krishna (10-9-88) and Cauvery Hostel (18-2-89). In total about 60 donors donated blood during the above camps.
- 7) Five NSS volunteers took part in organising "Whither Madras Seminar" by SMN Consumers' Protection Council held on 2-9-88 at Rajaji Hall Madras.
- 8) Fortieth Year of Independence was celebrated by NSS by conducting an oratorical contest for school children on 7-9-88. Five schools took part in the above contest.
- 9) Bharathiar's Day was celebrated in association with Muthamil Mandram on 10-9-88. About 140 students from schools and colleges in the city took part in the oratorical contest conducted in this connection.
- 10) National Youth Day was celebrated by arranging a talk by Shri C. Subramaniam, former Union Minister, on the topic "Influence of Swami Vivekananda and Pandit Jawaharlal Nehru on our Youths" on 18-1-89.
- 11) Skill Development Day was observed by conducting an Arts and Crafts Workshop in Vana Vani Matriculation Higher Secondary School. Under this workshop painting, fabric painting, embroidery, pot painting, collage work, and clay work were held. About 60 school children took part in the above workshop on 26-1-89.
- 12) Physical Fitness Day was celebrated by conducting sports events for school children in Advent Christian Middle School, Velacheri on 16-3-89. 75 prizes were distributed among the students on that day.
- 13) A visit to the following 3 social service organisations was arranged on 7-1-89, and 10 persons took part in the visit: 1) Daya Sadan, Madras-12. ii) German Leprosy Relief Association, Madras-30, and iii) Mithra, Madras-102.
- 14) Books Exhibition by Bharatiya Vidya Bhavan was arranged to be held the campus during the period 31-10-88 to 4-11-88.

## HOSTEL MANAGEMENT

As a residential institution, all the students admitted to I.I.T., Madras, are required to reside within the campus. There are about 2350 single room accommodation distributed in eleven men's hostels and one ladies hostel.

Each hostel is administered by a Warden and an assistant Warden. The Warden is assisted by hostel council, constituting student secretaries in day to day functioning of the hostel. The hostel management is a centrally administered body and is overall incharge of functioning of all the hostels and Central Supplies Unit. There are about 250 hostel staff and they are responsible to the management through the respective Wardens of the hostels. The Chairman Council of Wardens is the Chairman of the hostel management. He is supported by an Assistant Registrar in the administration of hostel affairs.

## CENTRAL SUPPLIES UNIT

The Central Supplies Unit is administered by a warden. It procures under the milk supply scheme, the milk from the nearby villages and from Tamilnadu Cooperative Milk Producers' Federation, distributes to the student hostels, to the residents of the campus and to the staff of the Institute residing around the campus. Under the provisions supply scheme, the unit procures the items of major consumption to hostels and distributes to them. It also procures non-perishable vegetables from sale suppliers and supplies to the individual hostels, thus enabling to reduce the overall mess rates of hostel inmates.

## CONSTRUCTION UNIT

The list of major works completed during the year 1988-89 are as detailed below.

<i>Sl. No.</i>	<i>Name of work</i>	<i>Amount</i>
1.	Widening and deepening lake.	Rs. 6.10 lakhs.
2.	First floor (West wing) Extension for Chemical Kinetics Lab.	Rs. 3.28 ..
3.	Relaying Asphalt concrete over Delhi Avenue Road.	Rs. 8.18 ..
4.	Extension of Fluid Mechanics Lab	Rs. 3.82 ..
5.	Digging 25 Nos deep bore wells in the campus.	Rs. 4.41 ..

Besides the above listed major works, many minor works have also been undertaken and completed.

## **ADMINISTRATION**

### **Director**

Prof. L. S. Srinath

### **Deputy Director**

Prof. N. V. C. Swamy

### **Deans**

Prof. V. G. K. Murthi, Dean Academic Research

Prof. Surjit Singh, Dean Academic Courses

Prof. D. Prithviraj, Dean Staff Affairs

Prof. R. Natarajan, Dean Students

Prof. V. Radhakrishnan, Dean, Industrial Consultancy and Sponsored Research

### **Heads of Departments**

Prof. G. Subramanian	...	Aerospace Engineering (from 26-12-88)
Prof. B. V. A. Rao	...	Applied Mechanics
Prof. N. Subramanian	...	Chemical Engineering
Prof. C. Kalidas	...	Chemistry
Prof. T. P. Ganesan	...	Civil Engineering
Prof. B. Yegnanarayana	...	Computer Science and Engineering
Prof. B. Ramaswami	...	Electrical Engineering
Prof. A. V. Krishna Rao	...	Humanities and Social Sciences
Prof. P. Achuthan	...	Mathematics
Prof. V. M. Krishna Sastri	...	Mechanical Engineering
Prof. O. Prabhakar	...	Metallurgical Engineering
Prof. V. Sivaramakrishnan	...	Physics

### **Central Administration**

#### **Registrar**

Sri V. Shanmugam

#### **Deputy Registrar (SG)**

Sri M. Gopalan

#### **Finance & Accounts Officer (SG)**

Sri A. V. Karunakaran Nambiar

#### **Stores & Purchase Officer**

Sri A. Thirunavukkarasu

#### **Internal Audit Officer**

Sri R. Srinivasan

#### **Security Officer**

Sri G. Selvamani

**Assistant Registrar (SG)**

Sri G. R. Raghunatha Rao

**Assistant Registrars**

Kum. G. Saroja

Sri B. Nagaraja Rao

Sri K. Sekar

Sri K. R. Raghavan

Sri K. Ramaswamy

Sri K. Rangarajan

Sri R. N. Sankaran

**Assistant Finance and Accounts Officer (SG)**

Sri R. Kannan

**Assistant Finance and Accounts Officers**

Sri V. Ramamurthy

Sri S. Ramakrishnan

Sri G. Sreenivasulu

**Assistant Stores and Purchase Officer (SG)**

Sri M. C. James

**Assistant Stores and Purchase Officer**

Sri M. Manickam

**Secretary (SG) to Director**

Sri V. V. Natarajan

**Librarian**

Sri V. S. Nazir Ahmed

**Deputy Librarian**

Sri C. Deenadayalu

**Assistant Librarian (SG)**

Sri P. Venkatesan

Smt. Jeyarani Durairaj

Sri N. Sathyamurthy

**Engineering Unit**

**Executive Engineer**

Sri N. Malayalam

**Assistant Engineers (SG)**

Sri D. Ramanathan

Sri Abraham Varghese

Sri M. Doorvasulu Reddy

**Horticultural Superintendent (SG)**

Sri P. Manickavasagam

## NAMES OF FACULTY MEMBERS, DEPARTMENT-WISE

### Aerospace Engineering

#### Professors

1. Dr. A. K. Sreekanth
2. Dr. T. K. Bose
3. Dr. T. K. Varadan
4. Sri K. Balaraman (Head from 1-6-88 to 25-12-88)
5. Dr. K. A. Damodaran
6. Dr. G. Subramanian (Head from 26-12-88)
7. Dr. S. Krishnan

#### Asst. Professors

1. Dr. R. M. Siddeveera Gowda
2. Dr. E. G. Tulapurkara
3. Dr. S. S. Gokhale
4. Dr. A. Krishnan
5. Dr. S. Santhakumar

#### Lecturer

Sri S. C. Rajan  
Senior Scientific Officer Grade I  
Sri Job Kurian

#### Technical Officer (SG)

Sri G. A. Venceslas

### Applied Mechanics

#### Professors

1. Dr. N. V. Chandrasekaraswamy
2. Dr. B. V. Aswathanarayana Rao (Head)
3. Dr. R. S. Alwar
4. Dr. V. Ramamurthi
5. Dr. P. S. Srinivasan
6. Dr. R. S. Srinivasan
7. Dr. T. M. Srinivasan
8. Dr. K. M. Patil
9. Dr. Megha Singh
10. Dr. N. Ganesan
11. Dr. B. Srinivasa Prabhu
12. Dr. V. Ramjee
13. Dr. B. H. Lakshmana Gowda
14. Dr. P. A. Aswathanarayana



### Assistant Professors

1. Dr. M. Balakrishnan
2. Dr. S. Narayanan
3. Dr. J. Ramachandran
4. Dr. S. Radhakrishnan
5. Dr. P. Krishna Iyer
6. Dr. J. Lakshminarasimhan

### Senior Scientific Officers Grade II

1. Sri S. Swarnamani
2. Smt. Sujatha Chandramohan
3. Sri G. Thomas

### Chemical Engineering

#### Professors

1. Dr. T. Gopichand
2. Dr. M. Satyanarayana
3. Dr. Y. B. G. Varma
4. Dr. M. Ramanujam
5. Dr. N. Subramanian (Head)
6. Dr. C. A. Sastry
7. Dr. M. S. Ananth
8. Dr. Ch. Durga Prasada Rao

#### Associate Professors

1. Dr. T. Venkatram
2. Dr. G. S. Davies
3. Dr. A. Baradarajan
4. Dr. C. Chandra Prasad

#### Assistant Professors

1. Dr. K. Remananda Rao
2. Dr. R. Subramaniam
3. Dr. S. Subba Rao
4. Dr. N. R. Neelakantan
5. Dr. R. Vedaraman
6. Dr. D. V. Seetharamamurthy
7. Dr. T. K. Ramanujam
8. Dr. K. Krishnaiah
9. Dr. Tapobrata Panda
10. Dr. V. Sriramachandra Rao
11. Dr. A. R. Balakrishnan

#### Lecturer

Dr. S. K. Rakshit

## Chemistry

### Professors

1. Dr. J. C. Kuriacose
2. Dr. V. Srinivasan
3. Dr. G. Aravamudhan
4. Dr. C. Narayana Pillai
5. Dr. P. T. Manoharan
6. Dr. C. Kalidas (Head)
7. Dr. S. R. Ramadas
8. Dr. V. Ramakrishnan
9. Dr. T. V. Ramakrishna
10. Dr. M. Ramakrishna Udupa
11. Dr. C. S. Swamy
12. Dr. J. Rajaram
13. Dr. V. Mahadeva Iyer
14. Dr. R. Narayan
15. Dr. M. S. Gopinathan
16. Dr. M. Srinivasan
17. Dr. D.V. Ramana

### Associate Professors

1. Dr. K. K. Balasubramanian
2. Dr. B. Viswanathan
3. Dr. V. R. Satyanarayana Rao

### Assistant Professors

1. Dr. (Mrs.) Chandra Sainathan
2. Dr. R. Ramasamy
3. Dr. C. S. Venkatachalam
4. Dr. S. Vancheesan
5. Dr. T. K. Varadarajan
6. Dr. N. Balasubramanian

### Lecturers

1. Dr. R. P. Viswanath
2. Dr. N. Sundaram
3. Dr. (Smt.) K. Lalitha
4. Dr. M.N. Sudheendra Rao

### Senior Scientific Officers Grade II

1. Dr. M. S. Subramanian
2. Dr. T. Subramanian

## Civil Engineering

### Professors

1. Dr. P. Srinivasa Rao
2. Dr. D. Johnson Victor
3. Dr. L. N. Ramamurthy
4. Dr. H. Raman
5. Dr. T. P. Ganesan (Head)
6. Dr. C. S. Krishnamurthy
7. Dr. R. Radhakrishnan
8. Dr. N. Rajagopalan
9. Dr. K. Elango
10. Dr. Nainan P. Kurian
11. Dr. V. Paramasivam
12. Dr. H. Suresh Rao
13. Dr. P. Kalyanasundaram
14. Dr. P. K. Aravindan
15. Dr. V. Kalyanaraman
16. Dr. H. Achyutha

**Chief Techno Economic Officer**

Sri D. Hariharan

**Assistant Professors**

- |                            |                         |
|----------------------------|-------------------------|
| 1. Dr. N. R. Krishnaswamy  | 4. Dr. M. S. Mathews    |
| 2. Dr. V. R. Rengaraju     | 5. Sri K. Gopalakrishna |
| 3. Dr. B. S. Thandaveswara | 6. Dr. S. B. Pattnaik   |

**Lecturers**

- |                         |                        |
|-------------------------|------------------------|
| 1. Sri S. Rajeev        | 4. Sri S. Mohan        |
| 2. Dr. K. Srinivasan    | 5. Dr. A. Bhoominathan |
| 3. Sri V. Thamizharasan |                        |

**Senior Scientific Officers Grade II**

- |                       |                            |
|-----------------------|----------------------------|
| 1. Sri M. Subbi Reddy | 3. Sri A. Ramachandriah    |
| 2. Sri R. Ambalavanan | 4. Sri K. Ananthanarayanan |

**Technical Officers (SG)**

Sri P. R. Kothandaraman

**Senior Scientific Officer Grade I**

Dr. N. Indrasenan

**Computer Science and Engineering**

**Professors**

- |                            |                                |
|----------------------------|--------------------------------|
| 1. Dr. H. N. Mahabala      | 4. Dr. R. Nagarajan            |
| 2. Dr. C. R. Muthukrishnan | 5. Dr. B. Yegnanarayana (Head) |
| 3. Dr. R. Kalyana Krishnan |                                |

**Associate Professor**

Dr. (Mrs.) Kamala Krithivasan

**Assistant Professors**

- |                        |                             |
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| 1. Dr. N. Parameswaran | 4. Dr. C. Pandurangan       |
| 2. Dr. S. V. Raghavan  | 5. Dr. Timothy A. Gonsolves |
| 3. Dr. S. Raman        |                             |

**Manager**

Sri P. Seshasayi

**Lecturers**

1. Sri R. Sundar
2. Sri G. V. Ramana Rao
3. Smt. Hema Arunachalam Murthy
4. Dr. C. Siva Ram Murthy
5. Sri Deepak Khemani

**Senior Scientific Officers Grade II**

1. Sri L. V. Satyanarayana
2. Sri S. K. Ramesh
3. Sri T. Ramalingom
4. Sri C. Chandrasekhar

**Senior Systems Programmer (SG)**

Dr. M. Kothanda Ramanujam

**Senior Systems Engineer**

Sri R. Deenadayalu

**Shift Engineer**

Sri K. G. Sundararajan

**Programmer Grade I**

Smt. Vatsala

Dr. (Smt.) Vijayalaxmi Sirohi

**Electrical Engineering**

**Professors**

1. Dr. V. G. K. Murti
2. Dr. M. K. Achuthan
3. Dr. D. K. Banerjee
4. Dr. B. Ramaswami (Head)
5. Dr. V. Seshadri
6. Dr. A. Kuppurajulu
7. Dr. Y. Narayana Rao
8. Dr. J. P. Raina
9. Dr. V. V. Sastry
10. Dr. K. Radhakrishna Rao
11. Dr. P. Sankaran
12. Dr. P. Subbarami Reddy
13. Dr. V. Venkat Rao
14. Dr. M. Mukunda Rao
15. Dr. K. N. Bhat
16. Dr. G. Sridhara Rao
17. Dr. S. S. Yegnanarayanan
18. Dr. Vedam Subrahmaniam
19. Dr. M. S. Narasimhan

**Associate Professors**

1. Dr. C. Dattatrayan
2. Dr. C. Eswaran
3. Dr. M. V. Chalapathy Rao

**Principal Scientific Officer**

Dr. P. R. Vaya

**Assistant Professors**

- |                             |                             |
|-----------------------------|-----------------------------|
| 1. Dr. T. A. Ramalinga Bhat | 7. Dr. C. Venkateshaiah     |
| 2. Dr. T. J. Vitto          | 8. Dr. P. Sashidhara Rao    |
| 3. Dr. Antony Reddy         | 9. Dr. K. Ramar             |
| 4. Dr. R. Parimelazagan     | 10. Sri G. T. Manohar       |
| 5. Dr. P. A. Janakiraman    | 11. Dr. Bhaskar Ramamoorthy |
| 6. Dr. Ashok Jhun Jhunwala  |                             |

**Lecturers**

- |                                  |                              |
|----------------------------------|------------------------------|
| 1. Sri Varadharajan Subrahmanian | 4. Sri G. Govardhanagiri Rao |
| 2. Sri M. Krishnamurthi          | 5. Dr. V. Jagadesh Kumar     |
| 3. Sri P. C. Majhee              | 6. Dr. V. R. Udpikar         |

**Senior Design Engineer**

- |                        |                              |
|------------------------|------------------------------|
| 1. Sri R. Ramachandran | 2. Sri P. Rama Seshagiri Rao |
|------------------------|------------------------------|

**Senior Scientific Officer Grade II**

Dr. S. Karmalkar

**Technical Officer (SG)**

- |                        |                              |
|------------------------|------------------------------|
| 1. Sri A. S. Satheesan | 2. Sri P. S. Kalyanasundaram |
|------------------------|------------------------------|

**Humanities & Social Sciences**

**Professors**

- |                                 |                                 |
|---------------------------------|---------------------------------|
| 1. Dr. S. Ambirajan             | 4. Dr. L. V. L. N. Sarma        |
| 2. Dr. A. V. Krishna Rao (Head) | 5. Dr. R. Rajagopalan           |
| 3. Dr. Dipak Chaudhuri          | 6. Mr. Hans-Juergen Maciejewski |

**Assistant Professors**

- |                           |                                       |
|---------------------------|---------------------------------------|
| 1. Dr. C. Ramachandran    | 4. Dr. T. T. Narendran                |
| 2. Sri V. S. Kumar        | 5. Dr. L. S. Ganesh                   |
| 3. Dr. R. N. Anantharaman | 6. Dr. (Mrs.) Elizebeth Nainan Kurian |

**Lecturers**

- |                                     |                            |
|-------------------------------------|----------------------------|
| 1. Sri M. Durgaprasada Rao          | 5. Dr. (Kumari) R. Malathy |
| 2. Dr. (Kumari) Evangeline Manickam | 6. Sri C. Rajendran        |
| 3. Sri S. Mohan                     | 7. Dr. V. R. Muraleedharan |
| 4. Dr. B. Subramanian               |                            |

## Senior Scientific Officer Grade II

Sri S. Jayachandran

### Mathematics

#### Professors

1. Dr. S. K. Srinivasan
2. Dr. L. V. K. V. Sarma
3. Dr. H. S. Paul
4. Dr. K. R. Parthasarathy
5. Dr. R. Subramanian
6. Dr. V. B. Johri
7. Dr. U. N. Srivastava
8. Dr. P. Achuthan (Head)
9. Dr. Surendranath Majhi

#### Associate Professors

1. Dr. V. Subba Rao
2. Dr. C. M. Purushotham
3. Dr. P. Bhattacharya
4. Dr. P. R. Parthasarathy
5. Dr. A. Avudainayagam
6. Dr. (Mrs.) S. Kalpakam

#### Assistant Professors

1. Dr. D. S. Subramanyam
2. Dr. Y. Nagendra
3. Dr. S. N. Venkatrangan
4. Dr. C. V. Raghava Rao
5. Dr. S. H. Kulkarni
6. Dr. P. V. Subrahmanyam

## Senior Scientific Officer Grade I

Dr. K. Swaminathan

#### Lecturer

1. Dr. A. Rangan
2. Dr. S. G. Kamath
3. Dr. W. B. Vasantha
4. Dr. P. Veeramani

### Mechanical Engineering

#### Professors

1. Dr. H. C. Radhakrishna
2. Dr. D. Prithviraj
3. Dr. M. A. Parameswaran
4. Dr. G. V. N. Rayudu
5. Dr. V. M. Krishna Sastry (Head)
6. Dr. V. Radhakrishnan
7. Dr. R. Natarajan
8. Dr. K. Lakshminarayana
9. Dr. K. A. Bhaskaran
10. Dr. K. V. Gopalakrishnan
11. Dr. K. N. Seetharamu
12. Dr. V. Sriramulu
13. Dr. A. Rammohana Rao
14. Dr. N. Venkatrayulu
15. Dr. P. K. Philip
16. Dr. M. A. Veluswami
17. Dr. S. Srinivasa Murthy
18. Dr. V. Ganesan
19. Dr. R. Raman
20. Dr. R. Krishnamurthy

**Associate Professors**

1. Dr. M. S. Shunmugam
2. Dr. B. Nagalingam

**Chief Design Engineer**

Sri T. S. Chennabasavan

**Assistant Professors**

1. Dr. P. Srinivasa Rao
2. Dr. M. Madhusudhana Rao
3. Dr. A. Venkatesh
4. Dr. Vijay R. Ragavan
5. Dr. U. S. P. Shet
6. Dr. K. Gopinath
7. Dr. O. V. Krishnaiah Chetty
8. Dr. K. R. Govinda Mallan
9. Dr. K. Narayanaswamy
10. Dr. K. V. Chalapathi Rao
11. Dr. T. Nagarajan
12. Dr. K. N. Gopalan
13. Dr. V. Balabaskaran
14. Dr. A. K. Kolar
15. Dr. K. Ramakoteswara Rao
16. Dr. G. Muthuveerappan
17. Dr. S. Kumaraswamy
18. Dr. Y. G. Srinivasa
19. Dr. N. Sivaprasad
20. Dr. G. Kuppusamy
21. Sri M. Singaperumal

**Lecturers**

1. Sri K. S. Padiyar
2. Sri V. N. Rajan
3. Sri D. V. Ramalingeswara Rao
4. Sri K. V. Thyagarajan
5. Dr. V. Jayaprakash
6. Dr. S. Krishnamurthy
7. Dr. N. Sitaram
8. Dr. M. Govardhan
9. Dr. M. M. Mayuram
10. Dr. L. Vijayaraghavan
11. Dr. B. Ramamurthy
12. Sri N. Ramesh Babu
13. Dr. Prakash Maiya
14. Dr. A. Mani

**Senior Design Engineer**

Sri S. D. Kalender Saheb

**Senior Maintenance Engineer**

Sri A. Arun

**Technical Officers (SG)**

Sri K. S. Veerazhavan

Sri G. S. Ramachandran

Sri A. V. Sundaram

## **Metallurgical Engineering**

### **Professors**

1. Dr. K. Srinivasa Raghavan
2. Dr. R. Vasudevan
3. Dr. H. Md. Roshan
4. Dr. K. Ananthapadmanabhan
5. Dr. V. M. Radhakrishnan
6. Dr. O. Prabhakar (Head 20-6-88)
7. D. R. G. Achar

### **Associate Professor**

Dr. K. J. Lakshminarayana Iyer

### **Assistant Professors**

1. Dr. C. V. Gokularathnam
2. Dr. S. K. Seshadri
3. Dr. P. Venugopal
4. Dr. S. Ramakrishna Iyer
5. Dr. S. D. Pathak
6. Dr. S. Raghavan
7. Dr. K. Prasada Rao
8. Dr. Ganapath Ram Sharma
9. Dr. V. Jagasivamani
10. Dr. P. Kesavan Nair

### **Senior Scientific Officers Grade II**

1. Sri S. Annamalai
2. Sri S. Kumaran

### **Technical Officers (SG)**

1. Sri B. Raghunatha Rao
2. V. K. Vidyasagar

## **Physics**

### **Professors**

1. Dr. R. Srinivasan
2. Dr. S. Radhakrishna
3. Dr. Y. V. G. S. Murthi
4. Dr. J. Sobhanadri
5. Dr. V. Balakrishnan
6. Dr. K. V. S. Rama Rao
7. Dr. V. Sivaramakrishnan (Head)
8. Dr. G. Rangarajan
9. Dr. R. Ramji Rao
10. Dr. S.B.S. Sastri
11. Dr. B. M. Sivaram
12. Dr. R. S. Sirohi

### **Associate Professors**

1. Dr. C. K. Narayanaswamy
2. Dr. M. P. Kothiyal
3. Dr. K. Viswanatha Reddy



**Chief Design Engineer**

Dr. Dev Kishore Sharma

**Assistant Professors**

- |                                     |                              |
|-------------------------------------|------------------------------|
| 1. Dr. A. V. Narasimhan             | 9. Dr. B. S. V. Gopalam      |
| 2. Dr. (Smt.) Maha Seshasayee       | 10. Dr. V. Ramakrishnamurthy |
| 3. Dr. T. A. Prasada Rao            | 11. Dr. P. C. Deshmukh       |
| 4. Dr. B.S.V.S. Ramachandracharyulu | 12. Dr. Sriraman Srinivasan  |
| 5. Dr. V. Damodara Das              | 13. Dr. B. Subramanyam       |
| 6. Dr. V. Ramachandran              | 14. Dr. Jagabandu Majhi      |
| 7. Dr. S. Srinivasan                | 15. Dr. G. Sreenivasamurthy  |
| 8. Dr. K. Srinivasan                |                              |

**Lecturers**

- |                              |                              |
|------------------------------|------------------------------|
| 1. Dr. V. Subrahmanya Murthy | 5. Sri V. Venkateswara Rao   |
| 2. Dr. K. Hariharan          | 6. Dr. (Kumari) T. M. Vimala |
| 3. Dr. A. Subrahmanyam       | 7. Dr. K. Muraleedharan      |
| 4. Dr. T. S. Natarajan       |                              |

**Senior Scientific Officer Grade I**

Dr. Y. Syamasundar Rao

**Senior Scientific Officers Grade II**

- |                       |                            |
|-----------------------|----------------------------|
| 1. Sri K. Sarangapani | 2. Dr. V. Sankaranarayanan |
|-----------------------|----------------------------|

**Technical Officers (SG)**

Sri U. D. Venkatarangaiah

**Ocean Engineering Centre**

**Professors**

- |                              |                         |
|------------------------------|-------------------------|
| 1. Dr. V. Satyanarayana Raju | 4. Dr. S. Narasimha Rao |
| 2. Dr. C. Ganapathy Chettiar | 5. Dr. M. R. Pranesh    |
| 3. Dr. M. Ravindran (Head)   |                         |

**Associate Professors**

- |                           |                      |
|---------------------------|----------------------|
| 1. Dr. K. Muthukrishnaiah | 2. Dr. C. P. Vendhan |
|---------------------------|----------------------|

**Assistant Professors**

1. Dr. K. Ganesh Babu
2. Dr. Sp. Subramanian
3. Sri R. L. Roy Chawdhry
4. Sri P. Sambandam
5. Dr. R. Mahadevan
6. Dr. V. Sundar
7. Dr. V. G. Idichandy

**Lecturer**

Dr. Debabratta Sen

**Senior Scientific Officers Grade I**

1. Sri S. Meenakshisundaram
2. Dr. K. Rajagopalan
3. Sri R. Natarajan

**Senior Scientific Officers Grade II**

1. Sri S. K. Battacharya
2. Dr. R. Sundaravadivelu
3. Dr. S. R. Gandhi
4. Sri V. Ananthasubramanian
5. Sri C. K. Vijayan
6. Sri J. S. Mani

**Regional Sophisticated Instrumentation Centre**

**Professors**

1. Dr. Surjit Singh
2. Dr. P. T. Manoharan
3. Dr. S. Subramanian (Head)

**Associate Professor**

Dr. T. K. K. Srinivasan

**Assistant Professor**

Dr. S. P. Venkateshan

**Senior Scientific Officers Grade II**

1. Sri M. S. Moni
2. Sri G. Palaniswami
3. Dr. Babu Varghese

**Central Electronics Centre**

**Chief Instrumentation Engineer**

Sri T. N. Ranganathan

**Instrument Engineer**

Sri K. R. Venkatachalam

**Materials Science Research Centre**

**Professor**

Dr. G. V. Subba Rao

**Senior Scientific Officer Grade II**

Dr. U. V. Varada Raju

**Fibre Reinforced Plastic Research Centre**

**Chief Design Engineer**

Dr. N. Gopalakrishnan Nair (Head)

Dr. R. Palaninathan

**Senior Design Engineer**

Dr. S. K. Malhotra

Sri B. Jagadish Chandra Babu

**Centre for Industrial Consultancy and Sponsored Research**

**Chief Techno Economic Officer**

Dr. D. Balakrishnan

**Senior Techno Economic Officers**

1. Dr. C. Sivaprasada Rao

2. Sri Y. G. Narasimha

**Central Workshop**

**Senior Workshop Superintendent**

Sri S. Jambunathan

**Assistant Workshop Superintendent**

Sri N. L. N. N. Kumar

**Technical Officers (S.G.)**

Sri K. S. Veeraraghavan

Sri G. S. Ramachandran

Sri A. V. Sundaram

## BUDGET PROPOSALS

1988—89 & 1989—90

Description	Budget Estimates for 1988—89		Revised	Budget
	(as proposed)	as allocated by Board of Governors	Estimates 1988—89 as per Finance Committee	Estimates 1989—90 (as proposed)
(Rupees In Lakhs)				
(1)	(2)	(3)	(4)	(5)
<b>NON-PLAN</b>				
RECURRING	1,413.78	1,579.77	1,490.00	1,559.00
NON—RECURRING	10.00	15.00	10.00	15.00
<b>TOTAL NON—PLAN</b>	<b>1,423.78</b>	<b>1,594.77</b>	<b>1,500.00</b>	<b>1,574.00</b>
<b>PLAN</b>				
RECURRING	92.50	31.75	20.00	45.40
NON—RECURRING	811.15	654.63	380.00	753.95
<b>TOTAL PLAN</b>	<b>903.65</b>	<b>686.38</b>	<b>400.00</b>	<b>799.35</b>
<b>INCOME</b>	<b>153.20</b>	<b>209.83</b>	<b>216.83</b>	<b>188.78</b>

Faculty -

AG	-	13
AM	-	20
CH	-	24
CY	-	30
CE	-	27
CS	-	16
EE	-	39
HS	-	19
MA	-	25
ME	-	57
MT	-	18
OE	-	15
PH	-	37
R-SIC	-	5
M <del>S</del> RC	-	1

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**Statement of Accounts  
1987 - 88**

**INDIAN INSTITUTE OF**  
**INCOME AND EXPENDITURE ACCOUNT**

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**EXPENDITURE**

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	Rs.	Rs.
<b>Educational Expenses :-</b>		
<b>Pay of Teaching Staff :-</b>		
<b>Department of</b>		
Chemistry	24,31,526	
Physics	25,99,246	
Mathematics	14,04,276	
Humanities and Social Sciences	10,42,813	
Civil Engineering	23,18,009	
Mechanical Engineering	37,45,065	
Electrical Engineering	36,96,952	
Chemical Engineering	17,10,004	
Metallurgical Engineering	14,55,931	
Applied Mechanics	17,29,641	
Aeronautical Engineering	11,30,030	
Ocean Engineering	11,46,083	
Computer Science and Engg.	14,07,572	
	<hr/>	2,58,17,148

c/o

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2,58,17,148

**TECHNOLOGY, MADRAS-600 036**

FOR THE YEAR ENDED 31ST MARCH 1988

**INCOME**

	Rs.	Rs.
Grant from Govt. of India (On Revenue Account)	10,00,48,000	
<b>Less : 1986-87 Transfer</b>	<u>1,01,00,000</u>	
	8,99,48,000	
<b>Add : 1987-88 Outstanding Adjustment</b>	<u>2,73,52,000</u>	11,73,00,000
<b>General Income</b>		
Tuition Fees	4,85,100	
Hostel Seat Rent	2,71,179	
Gymkhana Fees :	49,560	
Medical Fees:	<u>17,366</u>	
	66,926	
Students Amenities Fund	54,547	
Fine	6,046	
Examination Fees	67,600	
Degree in Absentia	4,097	
Application Fees from students	34,34,192	
Application Fees for Appointments	3,722	
Admission Fees	66,977	
Grade Card	<u>4,605</u>	
		44,64,991
		<u>12,17,64,991</u>
c/o		



# INDIAN INSTITUTE OF

## INCOME AND EXPENDITURE ACCOUNT

### EXPENDITURE

	Rs.	Rs.
B/f		2,58,17,148
<b>Pay of Non-Teaching Staff:</b>		
Department of Chemistry	8,51,005	
Physics	15,77,420	
Mathematics	1,44,815	
Humanities and Social Sciences	2,65,592	
Civil Engineering	16,83,664	
Mechanical Engineering	26,20,983	
Electrical Engineering	20,35,145	
Chemical Engineering	10,12,002	
Metallurgical Engineering	11,47,141	
Applied Mechanics	8,59,161	
Aeronautical Engineering	7,22,380	
Ocean Engineering	5,59,919	
Computer Science and Engg.	6,27,135	
	1,41,06,362	
<b>Pay and Allowances :</b>		
Centres-Officers	11,51,005	
Centres-Others	15,36,501	
	26,87,506	
Central Electronic Centre (Pay and Allowances)		3,86,057
Air-Conditioning Unit (Pay and Allowances)		3,86,539
<b>Pay and Allowances :</b>		
Indo-German Projects		69,030
c/o		4,34,52,642

**TECHNOLOGY, MADRAS-600 036**

FOR THE YEAR ENDED 31ST MARCH 1988

<b>INCOME</b>		
	Rs.	Rs.
B/o		12,17,64,991
<b>Miscellaneous Receipts</b>		
Institute Bus Collections	7,20,747	
Hire Charges on Institute Vehicles	24,936	
Licence Fee	14,84,455	
Electricity, Water and Service Charges	8,79,419	
Lawns and Gardens (Auction Sale of Trees Usufructs)	25,074	
Income from Computer Centre	5,62,415	
Income from Vax II Computer	20,546	
Other Receipts	1,15,06,736	
Sale of Motor Vehicles	32,055	
	<hr/>	1,52,56,383
c/o		<hr/> 13,70,21,374

**INDIAN INSTITUTE OF**

**INCOME AND EXPENDITURE ACCOUNT**

**EXPENDITURE**

	Rs.	Rs.
B/f		4,34,52,642
<b>Department Expenses :-</b>		
Chemistry	5,26,009	
Physics	6,26,157	
Mathematics	62,967	
Humanities and Social Sciences	36,150	
Civil Engineering	4,85,132	
Mechanical Engineering	8,69,757	
Electrical Engineering	2,94,840	
Chemical Engineering	3,59,084	
Metallurgical Engineering	5,61,598	
Applied Mechanics	3,38,378	
Aeronautical Engineering	2,95,133	
Ocean Engineering	3,65,734	
Computer Science and Engg.	26,17,521	
	74,38,460	
<b>Library:</b>		
<b>Pay and Allowances :</b>		
Officers	3,87,519	
Establishment	18,82,024	
Contingencies-Operational cost	2,77,708	
Binding Charges	40,186	
Journal of General Interest	3,481	
NMR Charges	36,847	
	3,58,222	
	26,27,765	
c/o		5,35,18,867

**TECHNOLOGY, MADRAS-600 036**

FOR THE YEAR ENDED 31ST MARCH 1988

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**INCOME**

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B/f

Rs.

13,70,21,374.

c/o

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13,70,21,374

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**INDIAN INSTITUTE OF**

INCOME AND EXPENDITURE ACCOUNT

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**EXPENDITURE**

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	Rs.	Rs.
B/f		5,35,18,867
 <b>WORKSHOPS :</b>		
Pay and Allowances of Workshop Superintendents	6,20,160	
Pay and Allowances of Other staff	35,93,444	
Working Expenses (Instruments Tools and Other Consumables)	2,96,543	
		45,10,147
Stipend to Apprentices		2,22,476
 <b>Centres/Central Services Working Expenses :</b>		
Fibre Reinforced Plastic Research Centre		1,53,186
Material Science Research Centre		2,31,481
Bio-Science and Bio-Technology		80,296
Engineering Design Centre		1,66,128
Central Electronic Centre		2,01,902
Regional Sophisticated Instrumentation Centre		1,59,456
Central Glass Blowing Section		4,245
Central Photographic Section		21,963
Air-Conditioning Unit		4,09,902
Central Gas Supply Unit		14,708
Rural Development Research Activities Pay and Allowances	10,195	
-Do- Other Expenses	3,00,471	
		3,10,666
Indo-German Project		1,96,109
		6,02,01,532
c/o		

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**TECHNOLOGY, MADRAS-600 036**

FOR THE YEAR ENDED 31ST MARCH 1988

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**INCOME**

---

B/f

Rs.

13,70,21,374

c/o

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13,70,21,374

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**TECHNOLOGY, MADRAS-600 036**

**FOR THE YEAR ENDED 31ST MARCH 1988**

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**INCOME**

---

B/f

Rs.

13,70,21,374

c/o

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13,70,21,374

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# INDIAN INSTITUTE OF

## INCOME AND EXPENDITURE ACCOUNT

### EXPENDITURE

	Rs.	Rs.
B/f		6,90,82,376
Quality Improvement Programme		11,713
Director's Discretionary Fund for Research		11,895
H.A.L. Trainees		1,00,000
Membership Fees to Outside Bodies		36,021
Remuneration to External Examiners		60,346
Joint Entrance Examination		13,76,300
Graduate Aptitude Test in Engineering (GATE)		9,05,300
ISRO-IITM Cell		34,043
Convocation		55,551
Prizes for Academic Distinction		12,648
Contribution towards Institute Participation in Programme of National conference		74,000
<b>Hostels</b>		
Allowances to Wardens		41,452
Subsidy to Hostels		49,67,786
Security to Hostels		1,63,874
<b>Central Administration</b>		
Pay and Allowances-Officers	29,08,969	
Pay and Allowances-Establishment	81,47,293	
	1,10,56,262	
c/o		8,79,89,567

**TECHNOLOGY, MADRAS-600 036**

**FOR THE YEAR ENDED 31ST MARCH 1988**

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**INCOME**

---

B/f

Rs.

13,70,21,374

c/o

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13,70,21,374

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**INDIAN INSTITUTE OF**  
**INCOME AND EXPENDITURE ACCOUNT**

**EXPENDITURE**

	Rs.	Rs.
B/f		8,79,89,567
<b>Contingencies :</b>		
Postage	4,64,958	
Entertainment	1,04,214	
Telephone	10,75,094	
Liveries	3,49,471	
Stationery	6,68,557	
Printing	3,20,258	
Advertisement	7,51,153	
Sundries (Misc. Expenses)	3,85,793	
Guest House Provisions	59,016	
	41,78,514	
<b>Other Items :</b>		
Director's Discretionary payment		6,371
<b>Stores :</b>		
General Stores	15,787	
Pay and Allowances—Officers	2,76,145	
Pay and Allowances—Estt.	6,68,201	
	9,60,133	
<b>Security :</b>		
Other Charges		3,13,404
Fire fighting operating cost		22,825
<b>Lawns and Gardens :</b>		
Pay and Allowances of Horticultural Superintendent	49,533	
Pay and Allowances—Others	1,27,111	
	1,76,644	
c/o		9,36,47,458

**TECHNOLOGY, MADRAS-600 036**

FOR THE YEAR ENDED 31ST MARCH 1988

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**INCOME**

---

	Rs.
B/f	13,70,21,374

c/o

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13,70,21,374

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**INDIAN INSTITUTE OF**

**INCOME AND EXPENDITURE ACCOUNT**

**EXPENDITURE**

	Rs.	Rs.
B/f		9,36,47,458
Power		48,21,128
Mosquito Control		15,675
Water		22,28,351
Oil and Petrol		2,85,672
<b>Repairs and Maintenance :</b>		
a) Furniture	2,10,513	
b) Typewriters and Duplicators	97,542	
c) Motor Vehicles	2,99,703	
	6,07,758	6,07,758
Duty Insurance and Road Taxes		1,07,658
<b>Works and Maintenance :</b>		
Pay and Allowances—Officers	2,29,538	
Pay and Allowances—Estt.	74,03,283	
Other Charges	45,59,079	
	1,21,91,900	1,21,91,900
Property Tax		3,24,822
<b>Hospital :</b>		
Pay and Allowances—Medical officers	3,61,095	
Pay and Allowances—Estt.	7,60,486	
Purchase of Medicines	6,66,670	
	17,88,251	17,88,251
c/o		11,60,18,673

**TECHNOLOGY, MADRAS-600 036**

FOR THE YEAR ENDED 31ST MARCH 1988

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**INCOME**

---

	Rs.
B/f	13,70,21,374

c/o

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13,70,21,374

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**INDIAN INSTITUTE OF****INCOME AND EXPENDITURE ACCOUNT**

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**EXPENDITURE**

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	Rs.
B/f	11,60,18,673
Subsidy to Vanavani School	1,55,911
Central School	964
Audit Charges	1,37,665
Legal Expenses	22,260
Reimbursement of Stamp Duty	45,787
<b>TRAVELLING EXPENSES</b>	
Board of Governors	11,500
Staff Selection Commission and other Committees	53,132
Candidates called for Interview for appointments	55,407
External Examiners	99,672
	<hr/>
c/o	11,66,00,971

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**TECHNOLOGY, MADRAS-600 036**

FOR THE YEAR ENDED 31ST MARCH 1988

---

**INCOME**

---

	Rs.
B/f	13,70,21,374

c/o

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13,70,21,374

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# INDIAN INSTITUTE OF

## INCOME AND EXPENDITURE ACCOUNT

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### EXPENDITURE

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	Rs.
B/f	11,66,00,971
Leave Salary and Pension Contribution on account of Personnel on foreign services	1,28,012
Campus Amenties	34,064
G.P.F. Contribution, etc.,	1,01,34,615
Hostel Contingencies	2,435
Excess of Income over Expenditure	1,01,21,277

TOTAL

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13,70,21,374

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**TECHNOLOGY, MADRAS-600 036**

**FOR THE YEAR ENDED 31ST MARCH 1988**

---

**INCOME**

---


	Rs.
B/f	13,70,21,374

**TOTAL**

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**13,70,21,374**

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Finance & Accounts Officer,  
**INDIAN INSTITUTE OF TECHNOLOGY**  
MADRAS-600036.

  
Registrar  
**INDIAN INSTITUTE OF TECHNOLOGY**  
MADRAS-36.

  
Director,  
**INDIAN INSTITUTE OF TECHNOLOGY**  
MADRAS-600 036.

**INDIAN INSTITUTE OF**

**BALANCE SHEET**

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**CAPITAL FUND AND LIABILITIES**

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	Rs.	Rs.
<b>CAPITAL</b>		
Value of land per contra		1,12,17,262
Block value of German aid per contra	13,07,89,963	
Equipment Technical Books and Journals per contra	15,56,230	
		13,23,46,193
Value of aid Alexander van Humboldt Foundation	10,83,000	
Value of aid from German Volks Wagon Foundation	2,99,860	
		13,82,860
<b>COMPUTER SYSTEM PER CONTRA</b>		
As per last Balance Sheet		1,54,50,458
Value of Siemens Computer per contra (German Contribution)		3,09,97,578
Capital Fund and Balance of Income and Expenditure a/c as on 31.3.87	34,58,95,504	
<b>Less : Adjustment</b>	65,424	
	34,58,30,080	
<b>Add : Capital Grant during 1987-88</b>	4,35,77,000	
<b>Excess of Income over Expenditure during 87-88</b>	1,01,21,277	
	39,95,28,357	
<b>Less : Value of Equipments Written off</b>	96,445	
		39,94,31,912
C/o		59,08,26,263

**TECHNOLOGY, MADRAS-600 036**

AS ON 31-3-1988

**PROPERTY AND ASSETS**

	Rs.	Rs.	Rs.
<b>LAND</b>			
Value of Land gifted by the Tamil Nadu Govt.			1,12,17,262
<b>BUILDING</b>			
(Cost of Completed Buildings as on 31-3-87	13,35,20,547		
Add : Building completed during the year	47,44,956		
	<u>13,82,65,503</u>		
Buildings under construction as on 31-3-87	71,44,344		
Add : Expenditure during the year	1,17,18,197		
	<u>1,88,62,541</u>		
Less : Transferred to completed building a/c	47,44,956		
	<u>1,41,17,585</u>		
			15,23,83,088
<b>DIESEL GENERATORS</b>			2,14,232
			<u>16,38,14,582</u>
C/o			

**INDIAN INSTITUTE OF**

BALANCE SHEET

**CAPITAL FUND AND LIABILITIES**

	Rs.	Rs.	Rs.
B/f			59,08,26,263
Cost of Projector etc., (Gymkhana) per contra Endowment Fund (Governors prize etc.)			49,811 4,20,350
<b>DEPOSITS</b>			
EMD/ICC & other Deposits	7,09,04,798		
Refund of customs duty (Projects)	1,89,847		
Less : Adjustment	1,89,847		
	—		
	—————	7,09,04,78	
Modernization of Labs/New plan schemes Emerging Technology approved by G.O.I. Add : Receipts 1987-88	84,87,960 3,88,00,000		
	—————		
Less : Payments for the year	4,72,87,960 1,17,08,545		
	—————	3,55,79,415	
		—————	
Add : Adj. refundable to IRDF (Sale proceeds of Motor Vehicles)		10,64,84,213 33,369	
		—————	10,65,17,582
<b>SUNDRY CREDITORS</b>			
i. On works accounts		18,70,653	
ii. supplies made/service rendered Department/sections		14,83,075	
		—————	33,53,728
			—————
C/o			70,11,67,734

**TECHNOLOGY, MADRAS-600 036**

AS ON 31-3-1988

<b>PROPERTY AND ASSETS</b>		
	Rs.	Rs.
B/f		16,38,14,582
Equipment Furniture & Fittings at cost as per Balance Sheet as at 31-3-87	11,11,73,537	
Add : Additions during the year	1,99,54,737	
	<u>13,11,28,274</u>	
Less : Cost of Equipments written off during the year	95,980	
	<u>13,10,32,294</u>	13,10,32,294
Computer acquired thro' German Food Aid fund under the Indo-German agreement at cost as per B/S as on 31-3-88		1,54,50,458
Value of Siemens Computer acquired under Indo-German agreement		
Cost of German contribution	3,09,97,578	
Add : Indian contribution	78,45,934	
	<u>3,88,43,512</u>	3,88,43,512
Block value of Equipts. from Alexander Von Humboldt Foundation as on 31-3-88	10,83,000	
Block value of Refrigerator and components from German Volks Wagon Foundation as on 31-3-88	2,99,860	
	<u>13,82,860</u>	13,82,860
Block value of Equipment from W.G.as on 31-3-87	10,14,32,739	
Add : Additions during the year	2,93,57,840	
	<u>13,07,90,579</u>	
Less : Value of equipts. written off during the year	616	
	<u>13,07,89,963</u>	13,07,89,963
C/o		<u>48,13,13,669</u>

**INDIAN INSTITUTE OF**

**BALANCE SHEET**

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**CAPITAL FUND AND LIABILITIES**

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	Rs.	Rs.
B/f		70,11,67,734
<b>OUTSTANDING EXPENSES :</b>		
<b>Payable :</b>		
a. Pay & Allowances	46,65,278	
b. Scholarships	1,49,072	
c. Other allowances Medical	37,700	
d. Wages to NMR labourers Depts./Sections	46,099	
e. Audit fees	1,47,490	
f. Stipend to Apprentices	18,174	
g. Computer Centre remuneration to staff	1,100	
h. L.S. & P.C. payable	57,874	
i. Power	4,54,984	
	55,77,771	
Computer Receipts received in advance		9,922
Grant in Aid from American Chemical Society per contra Balance as per last year balance sheet		1,10,934
		70,68,66,361
C/o		

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**TECHNOLOGY, MADRAS-600 036**

AS ON 31-3-1988

		<b>PROPERTY AND ASSETS</b>	
		Rs.	Rs.
B/f			48,13,13,669
Customs Duty and Clearance charges on equipment from W.G. as per B/S as on 31-3-87		3,07,59,797	
Less : Adjustments (Projects) per contra		<u>1,89,847</u>	
		3,05,69,950	
Add : Customs duty paid during the year			
Customs Duty	4,01,013		
Clearing Charges & Transport	<u>1,71,972</u>		
		5,72,985	
		3,11,42,935	
Less : Recoveries		<u>9,96,198</u>	
			3,01,46,737
Motor Vehicles at cost as per balance sheet as at 31-3-87		22,84,024	
Add : Additions during the year		<u>1,44,013</u>	
			24,28,037
Library Books & Scientific journals at cost as on 31-3-87		2,89,87,028	
Add : Additions during the year		<u>59,74,606</u>	
			3,49,61,634
Block value of Technical books from W.G. as per B/S as at 31-3-87		15,56,230	
Add : Additions during the year		<u>—</u>	
			15,56,230
Typewriters and Duplicators at cost as per B/S as at 31-3-87		14,60,606	
Add : Additions during the year		<u>3,35,560</u>	
			17,96,166
C/o			<u>55,22,02,473</u>



**INDIAN INSTITUTE OF**

**BALANCE SHEET**

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**CAPITAL FUND AND LIABILITIES**

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B/f	Rs.
	70,68,66,361
Unpaid items as on 31-3-88 as per undisbursed pay register	59,847
New Plan Schemes-Engineering Technology approved by Government of India (per contra) 31.3.1987	1,70,48,804

C/o

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72,39,75,012

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## TECHNOLOGY, MADRAS-600 036

AS ON 31-3-1988

### PROPERTY AND ASSETS

	Rs.	Rs.
B/f		55,22,02,473
Tools and Plants as at 31.3.1987	5,20,887	
Add : Additions during the year	56,636	
	<hr/>	5,77,523
Cycles at cost as per Balance Sheet as at 31.3.87	67,934	
Less : Cost of cycles written off during the year	465	
	<hr/>	
Add : Additions during the year	67,469	
	9,509	
	<hr/>	76,978
<b>INVESTMENT ACCOUNTS</b>		
Endowment Fund Governor's Prize etc., as on 31.3.88		4,20,350
<b>Stock as on 31.3.88</b>		
Consumable Stores with Departments		61,30,039
Construction materials with Engineering Unit Works A/c		23,91,127
Stationery Articles		2,99,035
Stock of Tyres and Tubes, Spare parts,		40,392
Liveries etc.,		33,220
UNESCO Coupons		50,139
Diesel Oil		27,080
		<hr/>
C/o		56,22,48,356

**INDIAN INSTITUTE OF**

BALANCE SHEET

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**CAPITAL FUND AND LIABILITIES**

---

	Rs.	Rs.
B/f		72,39,75,012
<b>Industrial Research and Development Fund A/c</b>		
Balance as on 1.4.87 (as per separate Statement of account)	86,45,591	
<b>Add</b> : Receipt for the year	15,87,510	
	1,02,33,101	
<b>Less</b> : Payment during the year	16,49,810	
	85,83,291	85,83,291
<b>Gymkhana Management A/c</b>		
Opening Balance as on 1-4-87 as per separate statement of account	1,00,697	
<b>Add</b> : Receipts of the year	10,70,939	
	11,71,636	
<b>Less</b> : Payments during the year	10,23,530	
	1,48,106	1,48,106
C/o		73,27,06,409

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# TECHNOLOGY, MADRAS-600 036

AS ON 31-3-1988

## PROPERTY AND ASSETS

	Rs.
B/f	56,22,48,356
Projector and Tape Recorders (Gymkhana Assets) at cost as per last year B/S	49,811
Grant receivable from Govt.	2,73,52,000
Furniture Hire Charges recoverable	24
Licence Fees etc. recoverable	6,179
Fees recoverable	53,685
Leave salary recoverable from parent Departments	45,783
P.F. Contribution and interest recoverable	10,74,858
Income receivable from the Computer Centre	2,98,140
Hire Charges of Institute Vehicles etc., Recoverable	6,616
Pre-paid Taxes and Insurance	24,927
Stamps in hand	51,167
<b>Equipments procured from Grant in-Aid received from the American Chemical Society :</b>	
Balance carried over from last year	1,10,934
<b>Equipments procured from Grant-in-aid received from G.O.I New plan schemes :</b>	
Opening balance	86,80,436
Add : Adjustment	83,68,368
	1,70,48,804
Deposit with Telephones	10,800
Deposit with Firms	32,207
C/o	60,84,14,291



**TECHNOLOGY, MADRAS-600 036**

AS ON 31-3-1988

**PROPERTY AND ASSETS**

	Rs.	Rs.	Rs.
B/f			60,84,14,291
Works Advance			28,97,018
Central Supplies Unit Advance Recoverable			5,00,000
Others (General)			1,18,35,273
Deposit with Tamil Nadu Electricity Board			4,92,730
Deposit with National Insurance Co. Ltd.			20,000
<b>COLLECTOR OF CUSTOMS</b>			
Account no.1 & Air Cargo Complex o/b	6,32,359		
Advance paid	13,00,000		
	<u>19,32,359</u>		
Less : Transferred to Customs Duty (Projects)	9,66,702		
	<u>9,66,702</u>	9,65,657	
Collector of Customs Account No.II		45,828	
		<u>10,11,485</u>	
Customs Duty on Projects	6,01,715		
Add : Payments during the year	9,66,702		
	<u>15,68,417</u>	15,68,417	
		<u>25,79,902</u>	
Less : Recoveries		16,00,425	
		<u>9,79,477</u>	
C/o			62,51,38,789

**INDIAN INSTITUTE OF**

**BALANCE SHEET**

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**CAPITAL FUND AND LIABILITIES**

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	Rs.
B/f	73,28,56,137

TOTAL

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73,28,56,137

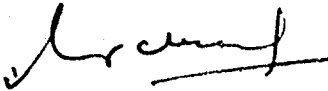
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# TECHNOLOGY, MADRAS-600 036

AS ON 31-3-1988

## PROPERTY AND ASSETS

	Rs.	Rs.
B/f		62,51,38,789
<b>T.H. (G.H.A/c) Assets</b>		
Equipments on the date of take over	2,176	
Deposits with Suppliers on the date of take over	1,725	
Stock of provisions	7,818	
Mess dues outstanding	1,23,263	
		1,34,982
Stock at Guest House Provisions		527
<b>Unpaid Balance per contra with State Bank of India</b>		
<b>Cash on Hand UPD</b>	59,847	
Imprest	500	
		60,347
Cash on Hand (other than 'C' Account)	62,162	
With S.B.I. (other than IRDF Account)	9,87,12,809	
With I.I.T.P.O. Savings bank A/c	378	
		9,87,75,349
With S.B.I. IRD Fund A/c		85,83,291
With S.B.I. Gymkhana Management Account		1,48,106
With S.B.I. Guest House A/c		14,746
EMD/Caution and other Deposits	7,09,04,798	
New Plan Schemes	3,55,79,415	
IRDF Deposits Adjustment	33,369	
	10,65,17,582	
<b>Less : Drawn from Refundable Deposits</b>	77,42,233	
		9,87,75,349
<b>TOTAL</b>		<b>73,28,56,137</b>

  
Finance & Accounts Officer,  
INDIAN INSTITUTE OF TECHNOLOGY  
MADRAS-600036.

  
Registrar  
INDIAN INSTITUTE OF TECHNOLOGY  
MADRAS-36.

  
Director.  
INDIAN INSTITUTE OF TECHNOLOGY  
MADRAS-600 036.



**INDIAN INSTITUTE OF**

**RECEIPTS AND PAYMENTS**

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**RECEIPTS**

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Rs.

Opening Balance

5,66,63,854

**RECEIPTS ON CAPITAL ACCOUNT**

Grants from Government of India on Capital Account

4,35,77,000

**OTHER CAPITAL RECEIPTS**

Customs Duty on West German Equipments (per Contra)

5,95,186

C/o

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10,08,36,040

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# TECHNOLOGY, MADRAS-600 036

FOR THE YEAR 1987-88

## PAYMENTS

		Rs.	Rs.
<b>ON CAPITAL ACCOUNT</b>			
i. Building and Works			1,05,66,890
ii. a. Furniture, Equipments and Fittings			
<b>DEPARTMENTS</b>			
1. Chemistry		1,39,056	
2. Physics		12,09,329	
3. Mathematics		2,57,222	
4. Humanities and Social Sciences		4,98,477	
5. Civil Engineering		7,70,924	
6. Electrical Engineering		21,33,094	
7. Mechanical Engineering		13,56,898	
8. Chemical Engineering		3,75,627	
9. Metallurgy		15,01,797	
10. Applied Mechanics		4,42,448	
11. Aeronautical Engineering		2,94,244	
12. Ocean Engineering		10,11,313	
13. Computer Science and Engg.			
Furniture, Equip. and fittings	50,26,176		
Indian Contribution for Siemens Computer	78,45,934		
		<u>1,28,72,110</u>	
			2,28,62,539
<b>b. RESEARCH CENTRES CENTRAL SERVICES</b>			
1. Fibre Reinforced Plastic Research Centre		1,11,724	
2. Bio-Science and Bio-Technology		1,87,639	
3. Material Sci. and Rese. Centre		5,39,979	
4. Engineering Design Centre		4,915	
5. Central Electronic Centre		5,21,658	
		<u>13,65,915</u>	
C/o			3,34,29,429

**INDIAN INSTITUTE OF****RECEIPTS AND PAYMENTS**

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**RECEIPTS**

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	Rs.	Rs.
B/f		10,08,36,040
<b>GRANT FROM GOVERNMENT OF INDIA</b>		
on Revenue Account		10,00,48,000
<b>RECEIPTS FROM ACADEMIC SECTION</b>		
Tuition Fees	4,81,700	
Hostel Seat Rent	2,70,160	
Gymkhana Fee	49,560	
Students Amenities Fund	54,067	
Medical Fees	17,366	
Fines	6,046	
Examination Fees	45,200	
Degree in Absentia	4,097	
Admission Fees	66,977	
Thesis Fees	22,400	
Grade Card	4,605	
	<hr/>	10,22,178
Application Fees From Students		34,34,191
Recredit of Contribution and interest due to change over to G.P.F. Scheme		11,34,732
Institute Bus Collection	7,18,777	
Hire Charges on Instt. Vehicles	26,261	
	<hr/>	7,45,038
<b>RECEIPTS FROM BUILDINGS</b>		
Licence Fees	14,86,652	
Electricity, Water and service charges	8,82,778	
	<hr/>	23,69,430
		<hr/>
C/o		20,95,89,609

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# TECHNOLOGY, MADRAS-600 036

FOR THE YEAR 1987-88

PAYMENTS		
	Rs.	Rs.
B/f	13,65,915	3,34,29,429
6. Regional Sophisticated Instrumentation Centre	45,757	
7. Central Photographic Sec.	9,450	
8. Air Conditioning Unit	1,06,293	
9. Central X-Ray Diff. Lab.	36,876	
10. Central Glass Blowing Sec.	59,314	
		16,23,605
c. Central Workshops		3,71,639
d. Indo-German Collo. Programme (Eqpt) etc.		90,927
e. Replacement of obsolete Equipment		4,67,913
<b>LIBRARY</b>		
a. Books	14,17,999	
b. Journals and Back Vol.	45,56,607	
c. Equipment	5,35,924	
d. Film Media Resources	16,865	
		65,27,395
<b>CUSTOMS DUTY ON WEST GERMAN EQUIPMENT</b>		
Payments	4,01,012	
Less : Refunds per Contra	9,96,198	
	5,95,186	
Clearance charges on West German Equipment		1,71,972
<b>FURNITURE AND FITTINGS</b>		
Office, Library etc.	8,50,184	
Utensils of Hostels	1,05,299	
		9,55,483
C/o		4,36,38,363

**INDIAN INSTITUTE OF****RECEIPTS AND PAYMENTS**

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**RECEIPTS**

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	Rs.	Rs.
B/f		20,95,89,609
Usufructs and Receipts from Sewage Farm		25,074
Receipts from Computer Centre		6,32,248
Overhead Charges from Consultancy Service		3,93,085
<b>OTHER RECEIPTS</b>		
Application Fee for posts in Institute	3,723	
Library Overdue Collection	67,825	
Institute Day and Assn. Fees	4,997	
Migration Certificate	454	
Industrial Associate Membership	2,20,758	
Short term and other courses	24,694	
Hire Charges for Gowns	2,043	
Subscription of Journal of Mathematical and Physical Sciences and Sale Proceeds of Institute Publication	1,18,350	
Interest on Donv. Adv.	34,088	
Interest on Deposit with TNEB	17,591	
Interest on Call Deposit with SBI	26,62,890	
Interest on P.F. Invests.	55,01,533	
Maintenance of Fans	18,088	
VAX II/750 Computer earnings	20,546	
		<hr/> 86,97,580
C/o		<hr/> 21,93,37,596

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# TECHNOLOGY, MADRAS-600 036

FOR THE YEAR 1987-88

## PAYMENTS

	Rs.	Rs.
B/f		4,36,38,363
<b>OTHERS :</b>		
a. Hospital Equipment	9,296	
b. Motor Vehicles	1,43,465	
c. Office Equipment	4,15,433	
d. NCC Design Models, etc.	10,370	
		<u>5,78,564</u>
<b>REVENUE ACCOUNTS :</b>		
<b>Academic Section Pay and Allowances of Teaching Staff</b>		
Chemistry	23,96,498	
Physics	25,47,152	
Mathematics	13,85,689	
Humanities and Social Sciences	10,19,702	
Civil Engineering	22,75,071	
Mechanical Engineering	37,00,277	
Electrical Engineering	36,05,959	
Chemical Engineering	16,84,577	
Metallurgical Engineering	14,21,543	
Applied Mechanics	17,12,155	
Aeronautical Engineering	11,26,432	
Ocean Engineering	11,42,664	
Computer Science and Engineering	13,82,642	
		<u>2,54,00,361</u>
C/o		<u>6,96,17,288</u>

**INDIAN INSTITUTE OF****RECEIPTS AND PAYMENTS**

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**RECEIPTS**

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	Rs.	Rs.
B/f		21,93,37,596
Interest on House Building Advance	14,245	
Furniture Hire Charges	8,881	
Central Photographic Sec.	4,788	
Miscellaneous Receipts	5,73,261	
	<hr/>	6,01,175
<b>RECOVERY OF ADVANCES</b>		
Motor Car and other Conveyance	3,72,543	
Festival Advance	4,94,848	
Miscellaneous Advance	8,52,780	
Flood/Drought Advance	2,17,652	
House Building Advance	7,16,996	
Customs Duty	16,00,426	
	<hr/>	42,55,245
		<hr/>
C/o		22,41,94,016

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# TECHNOLOGY, MADRAS-600 036

FOR THE YEAR 1987-88

## PAYMENTS

	Rs.	Rs.
B/f		6,96,17,288
<b>PAY AND ALLOWANCES OF NON-TEACHING STAFF</b>		
Chemistry	8,34,418	
Physics	15,39,886	
Mathematics	1,42,053	
Humanities and Social Science	2,60,247	
Civil Engineering	16,49,362	
Mechanical Engineering	25,57,249	
Electrical Engineering	19,98,409	
Chemical Engineering	9,97,619	
Metallurgical Engineering	11,23,051	
Applied Mechanics	8,44,139	
Aeronautical Engineering	7,10,573	
Ocean Engineering	5,47,575	
Computer Science and Engineering	6,18,751	
		1,38,23,332
<b>DEPARTMENTAL EXPENSES</b>		
Chemistry	5,22,303	
Physics	6,12,667	
Mathematics	58,804	
Civil Engineering	4,38,127	
Humanities and Social Sciences	35,993	
C/o	16,67,894	8,34,40,620



**INDIAN INSTITUTE OF****RECEIPTS AND PAYMENTS**

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**RECEIPTS**

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	Rs.	Rs.
B/f		22,41,94,016
<b>DEPOSITS</b>		
Contractors Deposit (Works)	13,09,443	
Suppliers Deposit (Inst.)	5,60,898	
External Scholarship	5,87,464	
C.S.I.R.	7,59,808	
Students Caution Deposit	29,455	
New Plan Schemes etc. H A/c	4,54,53,276	
Miscellaneous Deposits	11,92,938	
Q.I.P. and C.S.D. Scheme	9,02,036	
I.C.S.R. Projects	5,09,96,941	
R.S.I.C. Receipts	73,167	
Library Deposits	99,400	
Students aid and Welfare Fund receipts from students	21,210	
Interest on Endowments	44,691	
Alumni Association	52,191	
	<hr/>	10,20,82,918
C/o		<hr/>
		32,62,76,934

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# TECHNOLOGY, MADRAS-600 036

FOR THE YEAR 1987-88

PAYMENTS		
	Rs.	Rs.
B/f	16,67,894	8,34,40,620
Mechanical Engineering	9,50,189	
Electrical Engineering	4,11,300	
Chemical Engineering	4,18,482	
Metallurgical Engineering	4,72,956	
Applied Mechanics	3,29,050	
Aeronautical Engineering	2,75,183	
Ocean Engineering	3,35,235	
Computer Science and Engineering	24,65,587	
		73,25,876
<b>LIBRARY</b>		
Pay and Allowances-Officers	3,81,302	
Pay and Allowances-Estt.	18,48,593	
Journal of General Interest	3,481	
Contingencies Operating Cost	21,726	
Binding Charges	40,186	
N.M.R. Charges	39,077	
		23,34,365
<b>CENTRAL WORKSHOPS</b>		
Pay and Allowances-Officers	5,90,706	
Pay and Allowances-Estt.	35,24,101	
Working Expences-Tools and other Consumbles	2,19,794	
		43,34,601
Indo-German Projects (Pay and Allowances)		71,420
		9,75,06,882
C/o		

**INDIAN INSTITUTE OF**

**RECEIPTS AND PAYMENTS**

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**RECEIPTS**

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	Rs.	Rs.
B/f		32,62,76,934

C/o

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32,62,76,934

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# TECHNOLOGY, MADRAS-600 036

FOR THE YEAR 1987-88

## PAYMENTS

	Rs.	Rs.
B/f		9,75,06,882
<b>RESEARCH CENTRE</b>		
Pay and Allowances-Officers	11,65,492	
Pay and Allowances-Estt.	15,24,926	
		<u>26,90,418</u>
Central Electronics Centre Pay and Allowances		3,77,829
Air-Conditioning Unit Pay and Allowances		3,77,721
<b>CENTRES, CENTRAL SERVICES WORKING EXPENSES</b>		
Fibre Reinforced Plastic Res. Cen.	1,36,794	
Material Science Res. Centre	2,60,035	
Bio-Science and Bio-Technology	80,546	
Engineering Design Centre	87,300	
Central Electronics Centre	1,30,348	
Regional Sophisticated Instrumentation Centre	1,52,458	
Central Glass Blowing Section	5,991	
Central Photographic Section	29,310	
Air-Conditioning Unit	4,10,493	
Central Gas Supplies Unit	14,359	
Central X-Ray Diffraction Lab.	40,047	
<b>Rural Development and Res. Activities</b>		
Pay and Allowances	10,195	
Working Expenses	2,59,609	
		<u>2,69,804</u>
Indo-German Project	1,96,109	
		<u>18,13,594</u>
<b>INSTITUTE SCHOLARSHIPS</b>		
Post Graduate and Research	69,48,569	
Under Graduate	5,22,314	
		<u>74,70,883</u>
C/o		<u>11,02,37,327</u>

**INDIAN INSTITUTE OF**

**RECEIPTS AND PAYMENTS**

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**RECEIPTS**

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	Rs.
B/f	32,62,76,934

C/o	<hr/> 32,62,76,934
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# TECHNOLOGY, MADRAS-600 036

FOR THE YEAR 1987-88

## PAYMENTS

	Rs.	Rs.
B/f		11,02,37,327
<b>OTHER ITEMS :</b>		
Part-Time Lecturers	1,000	
Visiting Professors	22,559	
Technical Bulletins and Journals	2,30,696	
Symposia and Seminars	50,120	
Inplant Training/Courses/Visits	62,258	
Continuing Education Programme organised by the Institute	30,737	
Quality Improvement Programme	11,713	
Contribution towards Institute's participation in National Conference	74,000	
Director's Discretionary Fund for Research	11,895	
Stipend for Apprentices	2,19,601	
H.A.L. Trainee	1,00,000	
Membership to out-side bodies	36,021	
Remuneration to External Examination	60,347	
Joint Entrance Examination	13,74,198	
Graduate Aptitude Test in Engg.	9,05,592	
Convocation	55,551	
Prizes for Acad. Distinction	12,548	
I.S.R.O.-IIT-Madras Cell	34,043	
		32,92,879
C/o		11,35,30,206

**INDIAN INSTITUTE OF**

**RECEIPTS AND PAYMENTS**

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**RECEIPTS**

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	Rs.
B/f	32,62,76,934

C/o	<hr/> 32,62,76,934
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# TECHNOLOGY, MADRAS-600 036

FOR THE YEAR 1987-88

## PAYMENTS

	Rs.	Rs.
B/f		11,35,30,206
<b>N.C.C. AND N.S.S.</b>		
Pay and Allowance	1,27,503	
Other Expenditure	43,700	
		<u>1,71,203</u>
<b>Central Administration</b>		
Pay and Allowances-Officers	28,59,174	
Pay and Allowances-Others	80,32,196	
		<u>1,08,91,370</u>
<b>Hostels</b>		
Security (Hostels)	1,63,874	
Allowances to Wardens	41,452	
Subsidy to Hostels	49,67,786	
		<u>51,73,112</u>
<b>STORES</b>		
Pay and Allowances-Officers	2,71,643	
Pay and Allowances-Others	6,52,354	
General Stores	16,939	
Security-other Charges	3,14,585	
Fire fighting Operating Cost	22,824	
		<u>12,78,345</u>
<b>LAWNS AND GARDENS</b>		
Pay and Allowances of Horticultural Superintendent	48,794	
Other Expenses	1,27,111	
		<u>1,75,905</u>
C/o		13,12,20,141



**INDIAN INSTITUTE OF**

**RECEIPTS AND PAYMENTS**

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**RECEIPTS**

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	Rs.
B/f	32,62,76,934

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C/o	32,62,76,934
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# TECHNOLOGY, MADRAS-600 036

FOR THE YEAR 1987-88

## PAYMENTS

	Rs.	Rs.
B/f		13,12,20,141
<b>SERVICES AND MAINTENANCE</b>		
Telephones	10,75,094	
Power	47,76,768	
Water	22,28,351	
Furniture-Repair and Maintenance	2,10,513	
Oil and Petrol	2,91,099	
Duty, Insurance and Taxes	96,901	
Repairs and Maintenance to Motor Vehicles and Cycles	3,14,256	
Property Tax	3,24,822	
		<u>93,17,804</u>
<b>MEDICAL DISPENSARY</b>		
Pay and Allowances-Medical Officers	3,54,546	
Pay and Allowances-Estt.	7,43,330	
Purchase of Medicines	7,67,896	
		<u>18,65,772</u>
<b>ATHLETIC AND GYMKHANA</b>		
Pay and Allowances	2,96,205	
Contribution to Gymkhana Management Account	7,48,028	
		<u>10,44,233</u>
Mosquito Control	15,675	
Subsidy to Vanavani School	1,55,911	
Campus Amenities	32,284	
Special Coaching Courses to S/C, S/T Students	6,958	
Training and Welfare activities including Spl.Training to SC, ST Staff	1,240	
Guidance and Counselling	16,012	
Central School	964	
		<u>2,29,044</u>
C/o		<u>14,36,76,994</u>

**INDIAN INSTITUTE OF**

**RECEIPTS AND PAYMENTS**

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**RECEIPTS**

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	Rs.
B/f	32,62,76,93-

C/o	<hr/> 32,62,76,934
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**TECHNOLOGY, MADRAS-600 036**

FOR THE YEAR 1987-88

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**PAYMENTS**

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	Rs.	Rs.
B/f		14,36,76,994
Director's Discretionary Fund		6,372
<b>WORKS AND MAINTENANCE</b>		
Pay and Allowances - Officers	2,28,798	
Pay and Allowances - Others	73,71,642	
Other Expenditure on Maintenance	41,20,761	
	<hr/>	1,17,21,201
<b>ADMINISTRATION-GENERAL EXPENSES</b>		
Postage	4,82,655	
Entertainment	1,04,525	
Liveries	3,81,900	
Stationery	5,16,739	
Printing	3,36,463	
Guest House and Taramani House	61,755	
Advertisement	6,31,128	
Repairs to Office Equipment	94,703	
Audit Charges	65,175	
Legal Expenses	22,260	
	<hr/>	26,97,303
C/o		<hr/> 15,81,01,870

**INDIAN INSTITUTE OF**

**RECEIPTS AND PAYMENTS**

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**RECEIPTS**

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	Rs.
B/f	32,62,76,934

C/o	<hr/> 32,62,76,934
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**TECHNOLOGY, MADRAS-600 036**

FOR THE YEAR 1987-88

**PAYMENTS**

	Rs.	Rs.
B/f		15,81,01,870
<b>TRAVELLING EXPENSES</b>		
Board of Governors	11,500	
Staff Committee, Selection Committee etc.	53,132	
Candidates called for interview	55,407	
External Examiners	99,672	
		<u>2,19,711</u>
Leave Salary and Pension Contribution on account of personnel on foreign services		55,947
Reimbursement of Stamp Duty		45,787
Sundries		3,80,802
Hostel Contingencies		2,436
<b>PROVIDENT FUND/GRATUITY/PENSION</b>		
Pension/Commutation of Pension	19,53,695	
Family Pension	4,35,328	
Institute Share of Contribution	68,74,136	
Gratuity	10,04,993	
Deposit linked Insurance	20,000	
		<u>1,02,88,152</u>
<b>ADVANCES</b>		
Motor Car and other Conveyance	4,09,805	
Customs Duty - Non-Plan	13,00,000	
Festival Advances	4,68,000	
Other Miscellaneous Advance	13,63,672	
House Building Advance	19,06,160	
		<u>54,47,637</u>
C/o		<u>17,45,42,342</u>

**INDIAN INSTITUTE OF**

**RECEIPTS AND PAYMENTS**

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**RECEIPTS**

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Rs.

B/f

32,62,76,934

TOTAL

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32,62,76,934

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# TECHNOLOGY, MADRAS-600 036

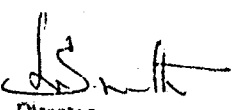
FOR THE YEAR 1987-88

## PAYMENTS

	Rs.	Rs.
B/f		17,45,42,342
<b>REFUND OF DEPOSITS</b>		
Suppliers Deposits (Inst.)	3,91,182	
Contractors Deposit (Works)	10,09,495	
External Scholarships	5,94,118	
C.S.I.R.	8,34,558	
Miscellaneous Deposit	19,03,260	
Students Caution Deposit	90,021	
Library Deposit	55,275	
Microprocessor Lab., Centres etc.,	1,34,30,840	
QIP Programme Organised by GOI/CSD	16,42,080	
Industrial Consultancy works and Projects	3,29,34,265	
Endowments towards Prizes etc.	8,829	
Alumni Association	42,050	
Students Welfare Fund	23,270	
R.S.I.C. Payments	-	
	<hr/>	5,29,59,243
<b>CLOSING BALANCE</b>		
Cash in hand	62,162	
With State Bank of India	9,87,12,809	
Savings Bank A/C	378	
	<hr/>	9,87,75,349
<b>TOTAL</b>		<hr/> 32,62,76,934

  
Finance & Accounts Officer,  
INDIAN INSTITUTE OF TECHNOLOGY  
MADRAS-600036.

  
Registrar  
INDIAN INSTITUTE OF TECHNOLOGY  
MADRAS-36.

  
Director,  
INDIAN INSTITUTE OF TECHNOLOGY  
MADRAS-600 036.



