Indian Institute of Space Science and Technology

(Declared as Deemed to be University under Section 3 of the UGC Act, 1956)

ANNUAL REPORT

2016-2017

Annual Report
2016-2017

Indian Institute of Space Science and Technology
An autonomous institute under Department of Space, Govt. of India
Declared as Deemed to be University under Section 3 of the UGC Act 1956
Valiamala, Thiruvananthapuram 695 547, Kerala

Vision & Mission

Vision

To be a world class educational and research institution contributing significantly to the Space endeavours.

Mission

- Create a unique learning environment enriched by the challenges of the Space Programme.
- Nurture the spirit of innovation and creativity.
- Establish Centres of Excellence in niche areas.
- Provide ethical and value based education.
- Promote activities to address societal needs.
- Network with national and international institutions of repute.

Shri. A S Kiran Kumar
(SECRETARY, DoS & Chairman, ISRO),
PRESIDENT, Governing Body
& CHAIRMAN, Governing Council

Prof. U R Rao
CHANCELLOR

Dr. Vinay Kumar Dadhwal
DIRECTOR
&
CHAIRMAN, Board of Management

Dr. A. Chandrasekar
Registrar

DEANS

Dr. A. Chandrasekar
Academics

Dr. Raju K. George
Research & Development
and
Student Welfare

Dr. Kurien Issac
Intellectual Property Rights &
Continuing Education

Dr. Kuruvilla Joseph
Student Activities

Contents

Foreword

It gives me immense pleasure to present the Annual Report of IIST for the academic year of 2016-2017 as IIST moves to the tenth year of its journey. The institute achieved excellent credentials and has done meritorious activities during this short time span. The year saw a change of guard at IIST and Dr K. S. Dasgupta after five and a half years of stewardship handed over the charge to me. I place on record my appreciation for his immense contributions in enhancing the academic and research profile of the institute.

This academic year 140 students joined for the three undergraduate programs and 79 students for the 15 post-graduate programs in various highly sought after specializations. In the same period, of the 145 undergraduate students who passed out, 101 students obtained placement in ISRO. A quantum jump in the strength of PhD scholars was achieved with the joining of 42 full time scholars and 9 sponsored by ISRO/DOS. Thus, for first time, the total PhD scholars strength exceeded 100.

During 2016-17, the institute welcomed 9 new faculty members with outstanding academic record and research credentials to its faculty pool. With this, the strength of faculty at IIST stands at 100. Our faculty members continue to make valuable contributions towards teaching, along with advancing their areas of research. More than 143 referred research publications came out in the reporting period from our faculty and research scholars.

This year, IIST organized fifteen national level workshops and conferences in various areas of space science, space technology, culture and humanities. Our students are vigorously involved in research projects within the institute and also in collaboration with various ISRO centers. Many eminent personalities of international repute visited our institute during this period to engage with students and staff on various scientific discussions and for knowledge sharing. The institute continues relentlessly on path of dedicated hard work and academic excellence. It was ranked 28th among all Engineering Institutions in the country (35th among all Indian Universities and 56th among overall category) in April 2017 by the National Institutional Ranking Framework (NIRF), set up by the Ministry of Human Resource Development (MHRD), Government of India.

As our nation shows economic and technological progress, as ISRO continues to enthrall us with its spectacular achievements and benefits and use of space technology becomes further entrenched in our society, the role of IIST in creating tomorrows space technology innovators and leaders will grow bigger. I am sure every student, faculty and staff of IIST will continue to contribute in building the space future, we all envision.

Dr. V. K. Dadhwal
Director &
Chairman, Board of Management

IIST at a glance 2016-17

CAMPUS

Total Land available: 117.62 acres of land

Plot-A 53.43 Acres	:	Houses all Academic and Adminstrative blocks, hostels and other areas such as basketball court
Plot-B 44.19 Acres	:	Earmarked for residential accommodation for staff and play ground
Ponmudi 20 Acres	:	Observatory. |Telescope and class rooms also planned

DEPARTMENTAL STRUCTURE

Department	Academic Faculty	Technical/Scientific Staff
Aerospace Engineering	25	6
Avionics	24	3
Chemistry	9	-
Earth and Space Sciences	13	-
Humanities	5	-
Mathematics	11	-
Physics	13	1

STAFF

Teaching (124)	
Academic	100
Scientific	1
Technical	23
Non Teaching (23)	
Officers	14
Administrative	9

STUDENTS ENROLLED

B. Tech.

Course	2013	2014	2015	2016	Total
Aerospace Engineering	55	54	60	60	229
Avionics	59	57	58	60	234
Physical Sciences/ Engineering Physics	35	31	20	20	106
Total	**151**	**143**	**138**	**140**	**569**

M .Tech.

Course	2015	2016	Total
Machine Learning & Computing	4	5	9
Optical Engineering	5	5	10
Solid State Technology	6	5	11
Materials Science and Technology	6	6	12
Aerodynamics & Flight Mechanics	7	7	14
Thermal & Propulsion	8	6	14
Structures & Design	8	7	15
Control System	6	3	9
Digital Signal Processing	6	5	11
R F& Microwave Engineering	7	5	12
VLSI & Microsystems	10	4	14
Geoinformatics	6	5	11
Earth System Science	4	6	10
Power Electronics		4	4
Master of Science			
Astronomy and Astrophysics	6	6	12
Total	**89**	**79**	**168**

Ph.D

Department	Full Time scholars	Part Time scholars	Total
Aerospace Engineering	22	12	34
Avionics	16	10	26
Chemistry	19	3	22
Earth and Space Sciences	17	1	18
Humanities	9	2	11
Mathematics	12	1	13
Physics	21	2	23
Total	**116**	**31**	**147**

THE INSTITUTE

1| THE INSTITUTE

Indian Institute of Space Science and Technology (IIST), a 'Deemed to be University' under Section 3 of the UGC Act 1956, established by the Department of Space(DOS), Government of India, in 2007, is marching its journey to the tenth year. It offers undergraduate, post-graduate, doctoral and post-doctoral programmes in broad areas of space science, technology and applications. The institute, committed to excellence in teaching, learning and research, fosters state-of-the-art research and development in space studies and provides a think-tank to explore new directions for the Indian space programme. IIST is a solid, concrete pathway where the sure-footed youth wishing to be a part of the Indian Space Program can find their way to being among the like minded scientists and engineers who have given us a comprehensive window to the Universe. The alumni of the college have become a part of several research facilities and have also gone on to study in various reputed universities in and outside India and have also opened their own start-ups.

1.1 Governing Body

A S Kiran Kumar	Vandita Sharma	P G Diwakar
Secretary Department of Space / Chairman ISRO **President**	Additional Secretary Department of Space	Scientific Secretary ISRO Headquarters
K Sivan	**S Somanath**	**Vinay Kumar Dadhwal**
Director Vikram Sarabhai Space Centre (VSSC) Thiruvananthapuram	Director Liquid Propulsion Systems Center (LPSC) Valiamala, Thiruvananthapuram	Director, IIST
A Chandrasekar	**Raju K George**	**Kuruvilla Joseph**
Dean (Academics), IIST	Dean (R&D) and (Student Welfare) IIST	Dean (Student Activities), IIST
M S Chandrashekar	**A Chandrasekar**	
Deputy Director Personnel Policy and Programme Management (PP&PM) ISRO Headquarters	Registrar, IIST **Secretary**	

1.2 Governing Council

A S Kiran Kumar	Vandita Sharma	P G Diwakar
Secretary Department of Space / Chairman ISRO **Chairman**	Additional Secretary Department of Space	Scientific Secretary ISRO Headquarters

S Kumaraswamy	Chintamani Manohar Sane	Vinay Kumar Dadhwal
Joint Secretary (Personnel) Department of Space	Joint Secretary (Finance) Department of Space	Director, IIST **Member Secretary**

1.3 Board of Management

Vinay Kumar Dadhwal	Vandita Sharma	P G Diwakar
Director, IIST **Chairman**	Additional Secretary Department of Space	Scientific Secretary ISRO Headquarters

Partha Pratim Chakrabarti	Bhaskar Ramamurthi	A Ajayaghosh
Director IIT Kharagpur	Director, IIT Madras	Director, NIIST Thiruvananthapuram

A Chandrasekar	K Kurien Issac	Raju K George
Dean (Academics), IIST	Dean (IPR &CE) , IIST	Dean (R&D) & (Student Welfare), IIST

Kuruvilla Joseph	A Chandrasekar
Dean (Student Activities), IIST	Registrar, IIST **Secretary**

1.4 Finance Committee

Vinay Kumar Dadhwal	Vandita Sharma	Bijay Kumar Behera
Director, IIST **Chairman**	Additional Secretary Department of Space	Associate Director, BEA, ISRO Headquarters

A Chandrasekar	Sivanandan G	Raju K George
Registrar, IIST	Sr. Head Accounts / IFA, LPSC, Valiamala	Dean (R&D) and (Student Welfare), IIST

R Hari Prasad
Deputy Registrar (Finance) / Finance Officer **Member Secretary**

1.5 Academic Council

Vinay Kumar Dadhwal	A Chandrasekar	Raju K George
Director, IIST **Chairman**	Dean (Academics), IIST	Dean (R&D) and (Student Welfare), IIST
Kuruvilla Joseph	**K Kurien Issac**	**C.S. Narayanamurthy**
Dean (Student Activities), IIST	Dean (IPR &CE) , IIST	Sr.Professor, Department of Physics, IIST
Abdusamad alias Salih	**B S Manoj**	**Nirmala Rachel James**
Head Department of Aerospace Engineering, IIST	Head Department of Avionics,IIST	Head, Department of Chemistry, IIST
Anandmayee Tej	**V Ravi**	**K S S Moosath**
Head, Department of Earth and Space Sciences, IIST	Head, Department of Humanities, IIST	Head, Department of Mathematics, IIST
S Murugesh	**N Sabu**	**C V Anil Kumar**
Head, Department of Physics, IIST	Professor, Department of Mathematics IIST	Professor, Department of Mathematics, IIST
S Anup	**L Gnanappazham**	**K Sudhakar**
Associate Professor, Department of Aerospace Engineering, IIST	Associate Professor, Department of Earth and Space Sciences, IIST	Former Professor, IIT, Bombay
K R Ramakrishnan	**A Ajayaghosh**	**A Chandrasekar**
Professor, IISc, Bangalore	Director, NIIST, Thiruvananthapuram	Registrar, IIST **Secretary**


BLUE STAR
BLUE STAR

FACULTY AND STAFF

2| FACULTY AND STAFF

Academics

Director
Dr. Vinay Kumar Dadhwal

Deans

Academics	:	Dr. A.Chandrasekar
Research and Development & Student Welfare	:	Dr. Raju K.George
Intellectual Property Rights and Continuing Education	:	Dr. Kurien Issac K
Student Activities	:	Dr. Kuruvilla Joseph

During 2016-17, nine faculty members joined and at present institute is having 100 Faculty members

DEPARTMENT OF AEROSPACE ENGINEERING

HOD

Abdusamad Alias Salih | PhD (IIT, Kharagpur)

SENIOR PROFESSOR, DEAN (INTELLECTUAL PROPERTY RIGHTS & CONTINUNG EDUCATION)

Kurien Issac K | PhD (IIT, Madras)

ADJUNCT PROFESSORS

Ramanan R V | PhD (University of Kerala)
Raveendranath P | PhD (IIT, Kharagpur)

ASSOCIATE PROFESSORS

Anup S | PhD (IT, Madras)
Aravind.V | PhD (University of Florida, USA)
Chakravarthy P | PhD (IIT, Madras)
Deepu M | PhD (NIT, Calicut)
Girish B S | PhD (Anna University, Chennai)
Manoj T Nair | PhD (IIT, Kanpur)

ASSISTANT PROFESSORS

Arun C O | PhD (IIT, Madras)
Bijudas C R | PhD (IIT, Bombay)
Mahesh S | PhD (IIT, Kanpur)
Manu K V | PhD (IISc, Banglore)

Pradeep Kumar P | PhD (IIT, Bombay)
Prathap C | PhD (IIT, Delhi)
Praveen Krishna I R | PhD (IIT, Madras)
Rajesh S | PhD (University of Karlsruhe, Germany)
Satheesh K | PhD (IISc, Bangalore)
Shine S R | PhD (IIST, Thiruvananthapuram)
Sooraj V S | PhD (IIST, Thiruvananthapuram)
Vinoth B R | PhD (IIT, Kanpur)

VISITING FACULTY

Devendra Prakash Ghate | PhD (University of Oxford, UK)
Dhayalan | PhD (IIT, Kanpur)

READER (on Contract)

Sam Noble | M.Tech. (University of Kerala)

DEPARTMENT OF AVIONICS

HOD

Manoj B S | PhD (IIT, Madras)

ADJUNCT PROFESSORS

Sam K Zachariah | M.Tech. (IIT, Bombay)

ASSOCIATE PROFESSORS

Basudeb Ghosh | PhD (IIT, Roorkee)
Chinmoy Saha | PhD (University of Calcutta)
Deepak Mishra | PhD (IIT, Kanpur)
Gorti R K S S Manyam | PhD (IIT, Madras)
Lakshmi Narayanan R | PhD (IIT, Madras)
Priyadarshnam | PhD (IIT, Bombay)
Rajeevan Puthan Purayil | PhD (IISc, Bangalore)
Rajesh Joseph Abraham | PhD (IIT, Kharagpur)
Seena V | PhD (IIT, Bombay)
Selvaganesan N | PhD (Anna University, Chennai)
Sheeba Rani J | PhD (Anna University, Chennai)

ASSISTANT PROFESSORS

Anindya Dasgupta | PhD (IIT, Kanpur)
Anoop C S | PhD (IIT, Madras)
Harsha Simha M S | PhD (IIT, Bombay)
Palash Kumar Basu | PhD (Jadavpur University, Kolkata)
Sanjeev Kumar Mishra | PhD (IIT, Bombay) #
Sooraj R | PhD (GIST, South Korea)
Sudharshan Kaarthik R | PhD (IISc, Bangalore)

VISITING FACULTY

Sharath Chandra Varma B | PhD (IIT, Delhi)
Vineeth B S | Ph D (IISc, Bangalore)

READER

Vani Devi M | ME (Bharathidasan University)

READER (on Contract)

Chris Prema | ME (Anna University)
#Sanjeev Kumar Mishra relieved on 05.08.2016

DEPARTMENT OF CHEMISTRY

HOD

Nirmala Rachel James | PhD (Pune University)

SENIOR PROFESSOR, DEAN (STUDENT ACTIVITIES)

Kuruvilla Joseph | PhD (M G University, Kottayam)

ASSOCIATE PROFESSORS

Gomathi N | PhD (IIT, Kharagpur)
Jobin Cyriac | PhD (IIT, Madras)
Prabhakaran K | PhD (University of Kerala)
Sandhya K Y | PhD (University of Kerala)
Sreejalekshmi K G | PhD (University of Kerala)

ASSISTANT PROFESSOR

Mary Gladis J | PhD (University of Kerala)

DST INSPIRE FACULTY

Mahesh S | Ph D (CUSAT)

DEPARTMENT OF HUMANITIES

HOD

Ravi. V | PhD (IIT, Delhi)

ASSOCIATE PROFESSOR

Lekshmi V Nair | PhD (University of Kerala)

ASSISTANT PROFESSORS

Babitha Justin | PhD (University of Hyderabad)
Gigy J Alex | PhD (M G University, Kottayam)
Shaijumon C S | PhD (University of Kerala)

DEPARTMENT OF EARTH AND SPACE SCIENCES

HOD

Anandmayee Tej | PhD (Gujarat University)

OUTSTANDING PROFESSOR, DEAN (ACADEMICS) and REGISTRAR

A Chandrasekar | PhD (IISc, Bangalore)

ASSOCIATE PROFESSORS

Anand Narayanan | Ph D (Pennsylvania State University, USA)
Gnanappazham L | PhD (University of Madras)
Jagadheep D | PhD (Cornell University, USA)
Rajesh VJ | PhD (Yokohama National University, Japan)
Rama Rao Nidamanuri | PhD (IIT, Roorkee)
Resmi L | PhD (IISc, Bangalore)
Samir Mandal | PhD (Jadavpur University, Kolkata)
Sarita Vig | PhD (TIFR, Mumbai)

ASSISTANT PROFESSORS

Govindan Kutty M | PhD (IIT, Kharagpur)

DST INSPIRE FACULTY

Ambili K M | Ph D (University of Kerala)

READER (on Contract)

A M Ramiya | M.S. (University of Southampton, UK)

DEPARTMENT OF MATHEMATICS

HOD

Subrahamanian Moosath K S | PhD (University of Hyderabad)

SENIOR PROFESSOR , DEAN (RESEARCH & DEVELOPMENT AND STUDENT WELFARE)

Raju K George | PhD (IIT, Bombay)

PROFESSORS

Anilkumar C V | PhD (CUSAT)
Sabu N | PhD (University of Madras)

ASSOCIATE PROFESSORS

Deepak T G | PhD (CUSAT)
Kaushik Mukherjee | PhD (IIT, Guwahati)

Prosenjit Das | PhD (Indian Statistical Institute, West Bengal)
Sarvesh Kumar | PhD (IIT, Bombay)

ASSISTANT PROFESSORS

Natarajan E | PhD (IIT, Madras)
Sakthivel K | Ph D (Bharathiar University, Coimbatore)
Sumitra S | PhD (Sheffield University, England)

DEPARTMENT OF PHYSICS

HOD

Murugesh S | PhD (University of Madras)

SENIOR PROFESSOR

Narayanamurthy C S | Ph (IIT, Madras)

ASSOCIATE PROFESSORS

Apoorva Nagar | PhD (Tata Institute of Fundamental Research, Mumbai)
Rakesh Kumar Singh | PhD (IIT, Delhi)
Sudheesh Chethil | PhD (IIT, Madras)
Umesh R.Kadhane | PhD (Mumbai University)

ASSISTANT PROFESSORS

Dinesh N Naik | PhD (The University of Electro-Communication, Tokyo)
Jayanthi S | PhD (IISc, Bangalore)
Jinesh K B | PhD (University of Twente, Netherlands) | PhD (Leiden University, Netherlands)
Kuntala Bhattacharjee | PhD (Institute of Physics, Utkal University, Odisha)
Naveen Surendran | PhD (University of Madras)
Solomon Ivan J | PhD (Homi Bhabha National Institute, Mumbai)
Sourin Mukhopadhyay | PhD (Tata Institute of Fundamental Research, Mumbai)

ADMINISTRATION

Registrar
A. Chandrasekar

Deputy Registrar (Academics)
V Sennaraj

Deputy Registrar (Finance)
R Hari Prasad

Computer System Administrator cum Manager
Mohan Sukumar

Sr. Administrative Officers
Bindya K R
S Ramanathan

Sr. Purchase and Stores Officers
Subash Chandran M B
Rakesh R Menon

Sr. Manager (Hostel Services)
Dr. Bipin P. Varghese (relieved on 24.08.2016)

Sr. Manager (Canteen Services)
Vinod Kaimal K P

Administrative Officer (In charge of Hostels and Transport)
Pradeep Kumar K R (joined on 15.12.2016)

Sr. Accounts Officers
A Rajeena Beegam
Reny Thomas

Hindi Officer
Jayapal R

Library Officer
Abdunnasar A

STUDENTS

3| STUDENTS

IIST offered three undergraduate and fifteen post graduate programmes during 2016-17.

3.1 B.Tech Programmes

- **Aerospace Engineering**
- **Avionics**
- **Dual Degree Programme**
  B.Tech degree in Engineering Physics
  leading to M.Tech in Earth System Sciences /
  M.Tech in Optical Engineering /
  Master of Science in Astronomy and Astrophysics /
  Master of Science in Solid State Physics

The Aerospace engineering program offers a mechanical engineering perspective to space technology. The students learn topics in mechanical design, flight mechanics, aerodynamics, thermal and propulsion systems, and space dynamics. The Avionics discipline covers electronics related to space systems. The course is a hybrid of electrical engineering, electronics and communication engineering and computer science. The first year is common for all the three undergraduate programmes that covers basic courses in science and engineering. For the Dual Degree programme the second and third years comprises mainly of foundation courses in Physics and Engineering. In the fourth year, the student pursues one of the four postgraduate specializations that will lead to a Master of Science (Astronomy and Astrophysics / Solid State Physics) or M.Tech. Degree (Optical Engineering / Earth System Science). The fifth year of the programme is dedicated to a research project work.

Admission for all the three undergraduate programmes for the academic year 2016-17 was completed through direct counseling of students based on their performance in JEE (Main) conducted by CBSE and performance in Class XII School Board Exam as well as JEE (Advanced) Examination conducted by IITs.

140 students were admitted for the academic year 2016-17 in the three branches

Branch	General	OBC	SC	ST	PwD	Total
Aerospace Engineering	26	18	10	5	1	60
Avionics	28	16	9	5	2	60
Engineering Physics	10	5	3	2		20
Total						**140**

3.2 M.Tech. and Master of Science Programme (2 years)

The various departments of the Institute offer post-graduate programmes in emerging and highly sought after specializations in their respective areas. These programmes are meant to provide an in-depth understanding of specialized topics. Applications for M.Tech and Master of Science programmes are screened based on NET/JEST/GATE score and the admission is through test and interview. The total number of seats in each programme is ten, out of which six seats are reserved for open merit candidates and the remaining four for DOS/ISRO employees.

IIST offers M.Tech. and Master of Science programmes in the following disciplines:

Sl No.	Department	Post Graduate Programmes
1	Aerospace Engineering	1. M.Tech. Aerodynamics & Flight Mechanics
		2. M.Tech. Thermal & Propulsion
		3. M.Tech. Structures & Design
2	Avionics	1. M.Tech. R F& Microwave Engineering
		2. M.Tech. Digital Signal Processing
		3. M.Tech. Control System
		4. M.Tech. VLSI & Microsystems
		5. M. Tech. Power Electronics
3	Chemistry	1. M.Tech. Materials Science and Technology
4	Earth & Space Sciences	1. M.Tech. Earth System Science
		2. M.Tech. Geoinformatics
		3. Master of Science Astronomy and Astrophysics
5	Mathematics	1. M.Tech. Machine Learning & Computing
6	Physics	1. M.Tech. Optical Engineering
		2. M.Tech. Solid State Technology

Category-wise details of students admitted during the report period across various M.Tech. and Master of Science Programmes of IIST are as follows:

Admission 2016-2017							
Sl.No.	**Name of the M.Tech. and Master of Science Programme**	**Gen**	**OBC**	**SC**	**ST**	**Sponsored from DOS/ISRO**	**Total**
1	Thermal and Propulsion	4	1	1	-	-	6
2	Aerodynamics and Flight Mechanics	3	2	1	1	-	7
3	Structures and Design	3	2	1	-	1	7
4	RF and Microwave Engineering	2	2	1	-	-	5
5	Digital Signal Processing	3	1	1	-	-	5
6	VLSI and Microsystems	2	1	-	-	1	4
7	Control Systems	2	1	-	-	-	3
8	Power Electronics	3	1	-	-	-	4
9	Machine Learning and Computing	3	1	-	-	1	5
10	Materials Science and Technology	3	1	1	-	1	6
11	Earth System Sciences	3	2	1	-	-	6
12	Geoinformatics	3	1	1	-	-	5
13	Astronomy and Astrophysics	3	2	1	-	-	6
14	Optical Engineering	2	2	1	-	-	5
15	Solid State Technology	3	2	-	-	-	5
Total		**42**	**22**	**10**	**1**	**4**	**79**

3.3 Doctoral Programmes

Admission was based on test and interview and is restricted to those candidates who qualified GATE/UGC/CSIR NET-JRF/JEST or equivalent exams. During this period, fifty one students registered for PhD, the details of which are given below:

Department	Full Time	Part Time	Total
Aerospace Engineering	9	5	14
Avionics	6	-	6
Chemistry	3	2	5
Earth and Space Sciences	9	-	9
Humanities	2	-	2
Mathematics	6	-	6
Physics	7	2	9
Total	**42**	**9**	**51**

3.4 Course-wise fee structure

UG Programmes				
Tuition Fee	Amenity Fee	Hostel Charges including dining	Establishment charges	Medical charges
20,000/-	4,000/-	14,400/-	8,000/-	2,000/-

Grand Total – Rs. 48,400/-

The expenditure per semester for tuition fees, hostel accommodation, dining and medical coverage are borne entirely by IIST for each UG student in the General and OBC category who secures a Grade Point Average (GPA) of at least 7.5 out of 10 and students of SC, ST and PD categories who secure 6.5 GPA. Besides, a book allowance of Rs 3000 is also provided to every student who meets the above GPA in each semester. If a student (other than the Student belonging to SC, ST and PD category) scores less than 7.5 GPA out of 10, he/she has to bear the entire pre-notified fees of the next semester. Students belonging to SC, ST and PD category, who secure a GPA of 5.5 and above, but less than 6.5 (on a scale of 10) in any semester, have to remit the pre-notified fees except for the tuition fees to continue the studies in the next semester. In the event the SC, ST, PD category student secures a GPA of less than 5.5 (on a scale of 10) in any semester, he/she will have to remit

the entire pre-notified fees (Statutory semester fees, Students Amenity Fees, Hostel Charges including dining, Establishment charges and medical coverage) as applicable at that time for that semester/year.

PG Programmes				
Statutory Semester Fees	Amenity Fee	Hostel Charges	Establishment charges	Medical charges
5,000	1,350/-	4,500/-	8,000/-	800/-

Grand Total – Rs. 19,650/-

For PG students, the external candidates are eligible for a stipend of Rs. 12,400 /- per month as specified by AICTE. The sponsored departmental candidates are eligible to draw their salary and other allowances as specified by DOS/ISRO at the time of their deputation. Admitted candidates have to pay the required fees for the semester (Rs 19,650/- per semester for non-SC/ST students and Rs 14,650/- for SC/ST students). PhD students are paid fellowships as per DST/ CSIR/UGC norms.

CONVOCATION

The Fourth Convocation of IIST was held on Saturday, 15th October, 2016 at 10 am at Girideepam Convention Centre, Mar Ivanios Campus, Nalanchira, Thiruvananthapuram. The Convocation ceremony was presided over by Prof. U. R. Rao, Honourable Chancellor of IIST, while Dr. V.K. Aatre, former Secretary, DDR&D and Director General, DRDO was the Chief Guest for the day.Sri. A. S. Kiran Kumar, Chairman, ISRO & president, Governing Council, IIST and Secretary, DOS addressed the gathering in video mode and Dr. V. K. Dadwal, Director, IIST presented the report of the institute. Three batches of students were conferred degrees on the same day. Degrees were awarded to 378 B.Tech. graduates, 178

M.Tech. graduates and 16 PhD students. Chairman, Board of Management's Gold Medal for the Best Academic Performer, the Directors Gold Medal for the Best All Rounder and Institute Gold medal for top scorer in B.Tech. Aerospace Engineering, Avioncis and Physical Sciecnes for the academic years 2010-2014, 2011-2015 and 2012 – 2016 were also awarded during the function.

3.5 Collaborative Academic Programmes

IIST has entered into international collaborations which provide ample opportunity for the students to study and carry out research in foreign universities and establishments.

California Institute of Technology (CALTECH), USA

Every year one student of B.Tech. Aerospace Engineering is admitted for a Master of Science degree in Space Engineering at the Graduate Aerospace Laboratories of CalTech (GALCIT), California, USA. Support for study is through Professor Satish Dhawan Fellowship, which covers full tuition and mandatory fees. Travel expenses and visa fees are met by IIST.

Mohit Singh Malik, topper in B.Tech. Aerospace Engineering in 2016 is pursuing his M.S degree in the 2016-17 session.

Anand Kumar, topper in B.Tech. Aerospace Engineering for the academic year 2015 completed his M.S degree in 2016.

3.6 Internship Programmes / Workshops Abroad

B.Tech

Jet Propulsion Laboratory (JPL), USA

The Jet Propulsion Laboratory is a federally funded research and development center and NASA field center located in La Canada Flintridge, California, United States. JPL is managed by the nearby California Institute of Technology (CALTECH) for NASA.

JPL has offered an 8 week internship programme for three students of B.Tech. in each branch viz, Aerospace Engineering, Avionics and Physical Sciences/Engineering Physics who

are in their third year. Students receive a generous stipend to cover their entire expenses. The expenditure towards airfare, medical insurance coverage, VISA fees and SEVIS fees were met by IIST.

The following students participated in this programme during the period from 01.06.2016 - 30.07.2016

Avinash Chandra
(Aerospace Engineering)

Jiljo K Moncy
(Avionics)

Netra S Pillai
(Physical Sciences)

Mitacs Globalink Research Internship

Shri Gaurav Kumar, Department of Avionics attended a fully funded summer research internship in the University of Manitoba, Canada organised by the Mitacs Globalink Foundation, Canada, 11.05.2016 to 29.07.2016.

The Mitacs Globalink Research Internship is a competitive initiative for international undergraduates from Brazil, China, France, India, Mexico, Saudi Arabia, Tunisia and Vietnam. From May to September of each year, top-ranked applicants participate in a 12-week research internship under the supervision of Canadian university faculty members in a variety of academic disciplines, from science, engineering and mathematics to the humanities and social sciences. Over 45 universities across Canada are hosting Mitacs Globalink Research interns in the summer of 2016. The entire expenditure towards air fare, accommodation, living stipend, medical insurance, student registration fees is met by Mitacs Globalink Reseach Foundation.

Other Internships

- **Sri Raj Biswas**, Final year student of B. Tech. Physical Sciences was awarded 2016 Visitng Undergraduate Research Programme (VURP) by CALTECH which included 10 week research work from 23rd May to 29th July 2016.

He also attended a research internship at Molonglo Observatory Synthesis Telescope (MOST), sponsored by Swinburne University of Technology, Australia from 7th January 2017 to 30th April 2017.

- **Shri. Kaustubh Kandi Anand**, Final year student of Avionics attended an Academic Development Programme in Small satellite Design and Instrumentation for Earth Observations at National Central University in Taipei, Taiwan from 20.07.2016 - 22.07.2016.

- **Ms. Swapnil Singh and Ms. Shreeya Natarajan**, final B. Tech (Physical Sciences) students participated in the SPIE Optics and Photonics Conference held from 27.08.2016 – 01.09.2016 at San Diego, USA.

Ph.D

- **Ms. Ruchi Sandilya**, Department of Mathematics presented the paper "A priori finite element error estimates in opitical control" at Brunel University, London, UK, 14.06.2016 to 17.06.2016.

- **Shri Arun Prasad**, Department of Earth and Space Sciences attended the Green Talent International Competition for young research talent initiated by the Federal Ministry of Education and Research, Germany, 01.07.2016 to 30.09.2016.

Internship for M.Tech (Batch: 2016-2017) outside IIST

Sl. No.	Name of the Student	Course	Internship
1	Mithun PV	VLSI and Microsystems	INTEL
2	Muddu Manhar	VLSI and Microsystems	INTEL
3	Abhishel Mishra	RF and Microwave	IISC Bangalore
4	Bhartendu Thakur	Machine Learning and Computing	Continental Automotives
5	Dushyanth SR	Power Electronics	Centum Electronics
6	Chalapathi V	Solid StateTechnology	LEOS
7	Gollangi Yerrannaidu	Optical Engineering	LEOS
8	Pravendra Pratap Singh	Material Science and Technology	VSSC
9	Harish Singh Dhami	Material Science and Technology	LPSC

10	Nasibullah	Machine Learning and Computing	ISI , Kolkata
11	Sumit Kumar Singh	Machine Learning and Computing	IIT, Patna

3.7 Placement

3.7.1 Absorption to DOS / ISRO

B.Tech

Students of 2011 batch who completed the B.Tech. course with the required CGPA were placed at various ISRO centres as Scientist/Engineer 'SC'.

ISAC, Bangalore	33	PRL, Ahmedabad	03
ISTRAC, Bangalore	03	SAC, Ahmedabad	20
LPSC(Valiamala)	04	SCL, Chandigarh	06
LPSC(Bangalore)	03	SDSC, Sriharikota	02
ADRIN	01	VSSC, Thiruvananthapuram	16
IPRC, Mahendragiri	02	**Total**	**101**
NRSC, Hyderabad	08		

Ph.D

Having completed their research work and awarded Ph.D, two research scholars have been absorbed as Scientist/Engineer 'SD' in ISRO Centres.

C K Muthukumaran	LPSC, Valiamala
Rahul G Waghmare	ISAC Bangalore

3.7.2 Placement

B.Tech Batch (2012-2016)

Sl. No.	Name of the Student	Course	Company
1	Aishwary Mishra	B.Tech - Aerospace Engineering	Tata Consultancy Services
2	Prabeetha G	B.Tech-Avionics	Tata Consultancy Services
3	Viraj Suresh T	B.Tech- Avionics	Tata Consultancy Services
4	Aswin Jacob Thomas	B.Tech- Avionics	LM Wind Power Pvt Ltd

5	Yudhistir Jagadeeshan	B.Tech -Aerospace Engineering	Indian Navy
6	Abhishek Khandelwal	B.Tech Aerospace Engineering	Indian Navy
7	Narpendar Sahu	B.Tech- Avionics	Indian Navy
8	Tapinderdeep Singh Sidhu	B.Tech -Avionics	Indian Navy
9	Shubham Diwakar	B.Tech -Avionics	Kottackal Solutions

M.Tech Batch (2014-2016)

Sl. No.	Name of the Student	Course	Company
1	Shreeja Sugathan	M.Tech- Digital Signal Processing	Analog Devices Pvt Ltd
2	Balaji Selvanathan	M.Tech - Digital Signal Processing	Tata Consultancy Services
3	Bharath Kumar Harijan	M.Tech-Structure and Design	Tata Consultancy Services
4	Dweep Jyoti Malakar	M.Tech-Control System	Tata Consultancy Services
5	Pallavi Venugopal	M.Tech-Digital Signal Processing	Tata Consultancy Services
6	Unnikrishana KR	M.Tech-Structure and Design	Tata Consultancy Services
7	Aparna Alak	M.Tech-Machine Learning and Computing	Subex Ltd
8	Ayushi Jain	M.Tech-Digital Signal Processing	Subex Ltd
9	Srivalsan Namboodiri	M.Tech-Geoinformatics	Subex Ltd
10	Vamshi Kumar K	M.Tech-Machine Learning and Computing	Subex Ltd
11	Nikita Sahay	M.Tech-Aerodynamics and Flight Mechanics	LM Wind Power Pvt Ltd
12	Abhilash Chadhar	M.Tech-VLSI and Microsystems	Intel Technologies Pvt Ltd.
13	Merin Mary Meyn	M.Tech-VLSI and Microsystems	Intel Technologies Pvt Ltd.

14	Vandana Rajan	M.Tech-Digital Signal Processing	Mathworks
15	Gayathri G	M.Tech-Digital Signal Processing	Analog Devices Pvt. Ltd.
16	Vaishak	M.Tech-Machine Learning and Computing	Intel Technologies Pvt Ltd.
17	Nimai	M.Tech-Machine Learning and Computing	Oxyent Technologies
18	Tinkesh	M.Tech-RF & Microwave Engineering	Team Indus

3.8 Student Projects

Vyom MK II- Sounding Rocket Project

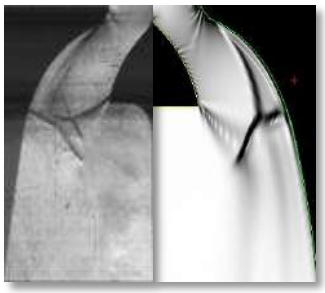
Vyom Mk II, successor of Vyom I, a student designed rocket, is nearing the end of its conceptual design. A multi-disciplinary optimization approach has been followed for designing Vyom Mk II. In the last one year, the team has taken small steps towards automating the grid generation over the rocket which would enable them to incorporate high fidelity CFD in the optimization process to obtain aerodynamics forces and stability coefficients, which are otherwise estimated using engineering methods from aerodynamic codes provided by VSSC.

The team has also analysed feasibility of drag separation with the current design as payload separation would provide them an altitude gain of 20 km, as predicted by the optimization study.

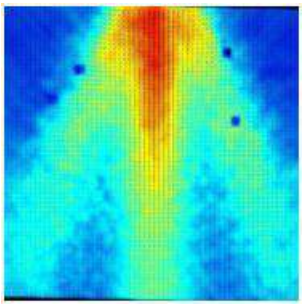
Work is being done on database generation (aerodynamic forces for a parametrized geometry) using CFD, which will be used to enhance the existing engineering methods based codes.

Team has explored the possibility of using a FPGA (field-programmable gate array) integrated circuit and a patch antenna in the design and has deemed them to be feasible and is currently working on their implementation. A scientific payload, Ozonesonde, is being developed by the students to accumulate the data on ozone concentration with altitude.

Team plans to complete the design in the current academic year and move into the manufacturing phase.



Schlieren image of flow through altitude compensating E-D Nozzle



Velocity field of 10 N Swirl Injector in Vernier engine-PS4 stage

Nano satellite Project

IIST nano-satellite mission is an interdisciplinary project taken up by a team of IIST students with mentor-ship provided by ISRO scientists and IIST Faculty members. The mission's objective is to set up a small-satellite standard for the Indian education institutes and for the students to have a hands-on experience on the design, fabrication and realization of small satellites at reasonable cost. The IIST nano-satellite mission began in the year 2008 and is in an advanced stage of development now. During this period it has helped our students in complementing their domain knowledge acquired from the curriculum in various disciplines like computer science, power systems, control theory, communication, PCB design etc.

Encouraged by the progress made under this program a few foreign universities including Caltech University, USA, University of Surrey, UK, University of Colorado, USA and foreign organizations like JPL and a few Indian Space industries have shown keen interest in collaborating with IIST for design and development of small satellites for a range of mission objective that includes technology demonstration and space science experiments.

RESEARCH AND DEVELOPMENT


IIST
VYOM

4| RESEARCH AND DEVELOPMENT

As laid down in the vision of IIST, the institute continues to demonstrate its potential for research using high end technologies and translating these in to ground realities that impact the life of common man. IIST has developed state-of-the art laboratories and research centres of excellence.Research at its highest level calls for constant upgradation of instruments and facilities. IIST continues to constantly upgrade its research facilities and tries to provide the best possible facilities to its faculty members and research scholars. Faculty members are encouraged to do interdisciplinary and collaborative research with other ISRO centres and institutes of national importance. Financial support is provided to faculty and research scholars for attending international / national conferences, seminars and workshops. Fast track projects and seed money provided for new faculty members also helps to enhance the research culture in the institute.

4.1 Department of Aerospace Engineering

Academic	Faculty	25
Technical	Staff	06
Students	Ph.D	34
	M.Tech	39

Research Activities

The major research initiatives from Department of Aerospace Engineering during the report period were in the broad areas of **(a) Thermal and Propulsion (b) Aerodynamics and Flight Mechanics (c) Structures and Design (d) Materials, Manufacturing and Management**. The research highlights under each of these areas are briefly described below.

THERMAL AND PROPULSION

A. Salih does focused research on the development of Equation of States for compressible liquids and simulation of shock phenomena in liquids.

Aravind Vaidyanathan's research during the report period include (a) Performance evaluation of Pintle Injector for variable thrust engine (b) Investigation of supercritical heat transfer of fluoroketone to mimic the expander cycle conditions in Lox-methane engine (c) Transition from transverse to longitudinal mode of oscillations in supersonic cavities and the development of shock train, and (d) studies on subcavity based supersonic cavities to regulate oscillation suppression capabilities in flight/launch vehicles. The studies on Pintle injector is progressing under ISRO-IIST projects

Deepu M's research is in (a) heat transfer enhancement in microchannels, (b) numerical and experimental studies on micro-nozzles and thrustors(c) numerical and experimental studies on thermal ignition of energetic materials, (d) studies of rocket nozzle flow separation and its control and (e) simulation studies on passive enhancement of convective mass transfer. He has been working on the Simulation of Heat Transfer in GOX-GCH4 Pilot Igniter for the future Liquid Oxygen (LOx)/Liquid Methane (LCH4) rocket engine. This project is in collaboration with IPRC Mahendragiri and was initiated through the ASTDC/ IIST. In collaboration with Dr. Rajesh S. of IIST, and Dr. Praveen Nair of the Vikram Sarabhai Space Center, he has also been carrying out a joint IIST-ISRO project on the numerical simulation of secondary Injection to an Expanding Supersonic Cross Flow.

Mahesh S. is involved in the research work on buoyancy induced flame flickering in jet flames and thermoacoustic instability of nonpremixed combustor.

Manu K V's research interests are in the areas of flow instability, vortex dynamics, turbulence and heat transfer. The research methodology are computational or experimental or a combination of the two. During the past one year the work was primarily focused on experimental and numerical study on the stability of stratified flows, study on the evolution of vortex pair under different stratified environments and numerical study on short and longtime stability of thermocline based storage tank.

Pradeep Kumar P along with a post-graduate student carried out a preliminary study on the centrifugal seal for Turbo pumps, a topic which is of interest to ISRO. The experimental work was done at the ISRO-LPSC Valiamala, during the report period. They were able to model and demonstrate the workability for water as the fluid. This work was adjudged as the best research paper in industry in the 42nd National Conference on Fluid Mechanics and Fluid Power. Dr. Pradeep and his doctoral students are also working on a project jointly undertaken with Dr. Aravind Vaidyanathan of IIST to develop a numerical model for cavitating venturi. The objective is to develop a variable area venturi useful for thrust modulation of future throttleable rocket engines. Dr. Pradeep's group, in collaboration with Dr. Seena of IIST, is also working towards the development of reliable electronic/ sensor cooling systems using micro fluidics specifically for space applications.

C. Prathap is working on the experimental investigation of laminar burning velocity of premixed methane oxygen-N_2/CO_2 mixtures using spherically flame method. The purpose of this work was to measure the unstretched laminar burning velocity of premixed methane-oxygen mixtures at ambient conditions and different equivalence ratios with different levels of inert gases like nitrogen and carbon dioxide. Propagating spherical flames setup with high speed shadowgraph imaging system at IIT Delhi was used for this study. His group also involved in the

generation of stationary homogeneous isotropic turbulence inside an acrylic cuboidal shaped chamber using 8 fans. The fans were synchronized and operated at different speeds. Using PIV and LDV rigs at IIST, they measured the quality and quantity of turbulence characteristics inside the vessel. They studied the influence of confinement on the turbulence generated by the fans. His group also worked with swirl combustion to understand the presence of pilot flame (co-axial flow) on the lean blow out limits of an annular swirl burner using laser diagnostics. His group also undertook an experimental and numerical study of stationary flat flames. This joint IIST-ISRO project, done in collaboration with LPSC Valiamala, was to design and fabricate a burner to anchor a planar flame. The planar flame was anchored at near adiabatic condition. The anchored planar flame will be used as a reference flame for the calibration of laser diagnostic rigs at ISRO facilities. This burner will provide information on unstretched laminar burning velocity.

Rajesh Sadanandan was primarily working in the areas of optical and laser diagnostic techniques in propulsion research. (a) Role of Optical and laser diagnostic techniques in cryogenic propulsion research and (b) Experimental investigation of swirl effects on pollutant emission using OH chemiluminescence measurements are typical studies carried out by him during the reported period. Further, he has been working on the development of Ultra Lean Non-Premixed Gaseous Fuel Burner as well as Characterization of a non-premixed, swirl stabilised, methane burner using non-intrusive methods.

Shine S R, works on film cooling applications, cryogenic flows, natural convection flows, biological heat transfer, solar based vapour adsorption systems and CFD studies in tandem airfoil configurations. Development of analytical models for liquid and gaseous film cooling applicable to rocket combustion chambers is the major contribution to the rocket chamber film cooling research. His team has proposed new correlations for (i) local heat transfer coefficients for the case of natural convection flow around cylinder without confinement, and (ii) two phase average heat transfer coefficients for cryogenic chill down flows.Currently, involved in the development of a sorption solar refrigerator with inputs from National Academy of Sciences of Belarus.

AERODYNAMICS AND FLIGHT MECHANICS

Devendra Ghate works on adjoint gradient calculations for computational fluid dynamics. He has extensive experience in the application of automatic differentiation and parallel computing techniques. He is presently investigating optimisation methods for aerospace systems design.

Dhayalan. R 's research work was focused on system identification of unmanned aerial vehicles in small and micro class. The system identification includes the conceptual design, fabrication, state measurements, flight tests and parameter estimation of the aerodynamic models. Further, the usage of proper estimator corresponding to the flight vehicle and flight data is paramount importance. A few

classical methods such as Least Squares and Maximum Likelihood along with data driven methods like Neural and Fuzzy networks have been used for the parameter estimation. The flight dynamics of the corresponding flight vehicles are characterized by modeling the aerodyanmics of the flight vehicles over a wide range of flight regimes.

Manoj T Nair's research interests are in the areas of 1) numerical methods 2) low and high speed flows 3) optimization and 4) scientific computing. During the past one year the work was primarily focused on 1) improvement of Runge-Kutta methods for handling stiff differential equations - this would allow the use of large time steps in integration of differential equations at the same time improving the accuracy of the solution; 2) improvement of accuracy of higher order WENO schemes - this lead to improvement is solution accuracy without considerable increasing the stencil and computing time; 3) separation control on low-speed airfoils using cavity; 4) separation control on low-speed airfoils using self-activating flaps - these two research considerably improves the efficiency of the airfoils used for MAVs; 5) control of supersonic flow past bluff bodies.

R.V. Ramanan made research advancements in the following areas. (a) new iterative patched conic technique for the transfer trajectory design of interplanetary orbiter missions has been developed. (b) Design of Earth return trajectories using the gravity assist from Moon has been generated using a newly developed methodology based on pseudo state technique (c) In order to extend the launch windows of direct interplanetary transfer opportunities, a multiple impulse design has been developed using broken plane concepts and the differential evolution technique.

K Satheesh was involved in studies related to the aerodynamics of a flapping airfoil in low Reynolds number flows. As a part of this, experiments on the flapping airfoil were conducted in the low speed wind tunnel at IIST. The flow over flapping airfoil was also modeled analytically using potential flow techniques. Further, a 2-component force balance capable of measuring unsteady aerodynamic forces on the airfoil was developed as a part of this work.

B R Vinoth works on (a) effect of nozzle inlet conditions on global oscillations of low density jets and its control, (b) development of spatio-temporal instability code to understand and predict the global oscillations in fluid flows, (c) development of non-modal instability code to understand and predict the instabilities in fluid flows, (d) instability analysis of supercritical flow, and (e) effect of contraction and swirl on nozzle performance.

STRUCTURES AND DESIGN

Anup S has been pursuing investigations on the mechanics and physics of biological & bio-inspired composites. Under this, his research group made the following progress during the report period. (a) Using molecular dynamics simulations, the mechanical response of bio-inspired brittle-

brittle nano composites were investigated. The effect of aspect ratio, strain rate, interface strength and scale effects were studied. These results could pave the way for development of advanced composites; (b) A fracture mechanics based studies were carried out with a view to find the stress transfer and subsequently, design a bio-inspired staggered composite. Finite element based techniques were used inorder to perform these studies. (c) The effect of structural arrangement on mechanical properties of CNT composites were also investigated. (d) An analysis to find the critical buckling load of dished shallow shells were carried out. With a view to help designers, the effects of various parameters were investigated under this. This problem is of relevance to space industry including ISRO where some of the components are made of dished shallow shells (e) Experimental stress analyses using micro Raman spectrometer were carried out for model composites. These micromechanics studies would be helpful in designing composites for the Aerospace industry.

Arun C O along with his research students has been working on the development of numerical methods using wavelets. Wavelets are functions that satisfy certain mathematical requirements and are used in representing data or other functions. Wavelet based finite element is one such numerical method wherein, instead of using the traditional polynomial interpolation, scaling and wavelet functions of wavelets are used to form the shape functions. His current research intends to address the limitations of FEM and extend its capability to stochastic framework as well. Mechanical, Aerospace, Marine and Civil Engineering are some the areas of application of this work. Additionally, he is also developing a tool for solution of elastic buckling of columns with random material properties, using element free Galerkin method (EFGM). Arun's research has also been on the application of EFGM for 2D Nonlinear Static Problems, wrinkling of membrane and on the development of a numerical tool based on EFGM to understand the effect of initial damage in buckling and bending. Concurrently, he is also investigating the wrinkling of thin plates subjected to tensile loading. A detailed examination of characteristics of wrinkling of thin plates was done numerically and experimentally. Moreover one his students have carried out a detailed study on capabilities of EFGM in wrinkling and free vibration analysis of pre-stressed thin membranes. Currently he along with his research team is also working on studying effect of random imperfection on buckling of cylindrical structural components and application of mesh-free methods on sloshing of fluids and acoustic simulations.

Bijudas C R is involved in research in the area of structural health monitoring with his post graduate students. Tomography of a cylindrical shell using guided waves is done using arrays of piezoelectric transducers. This work involves experimental study of guided wave propagation in cylinders, analytical investigations for dispersion relations in cylinders and numerical simulation of wave propagation. The results conclude that time reversed guided wave modes can be used for damage detection in cylinders. Another investigation regarding the non-linear interaction of de-bonded piezoelectric transducers is also done.

Here the influence of modal characteristics of the transducers are studied to find the frequencies at which higher non-linear interaction occurs in terms of higher and sub harmonics of Lamb wave. Another current project is the design of the Ka band antenna for NRSC, Hyderabad. The design involves structural, thermal and aero-elastic studies of the antenna in the operating condition. The work is expected to propose new configurations and detailed design to meet the stringent requirements of high frequency signal reception.

Kurien Issac works in the area of optimal design and control of mechanisms and robotic systems. He, along with Sam Noble and Alok Ranjan, has proposed a new design for rocker-bogie like suspension to enhance step climbing performance of rovers. Along with Saurabh Chatterjee, he is exploring algorithms for estimating terrain properties as a rover moves on uneven sandy terrain, and thereby classify terrains for path planning on such terrains. Along with Mohankumar, Dr N Selvaganesan and Dr M Jayakumar, he is exploring methods for fault detection and diagnosis of linear actuators used in space applications. Along with Manoj T K, he has proposed an approach for reducing the time to de-orbit defunct satellites from near-polar low earth orbits using electrodynamic tether. Along with Divesh Soni and Sohan Yadav, he has proposed a new mechanism for the frame of an Astromesh type deployable space antenna, which has some features superior to existing designs.

Praveen Krishna I R's research over the report period involved the aeroelastic analysis of Bending–Torsion wing, where a theoretical formulation for flutter analysis was utilized to develop a working method for determining flutter speed of a typical subsonic linear bending–torsion coupled aircraft wing. His group has also been working on the application of Element Free Galerkin Method (EFGM) in 2D nonlinear static problems. Through this, they were also able to show that EFGM can be used as a numerical tool for solving two dimensional nonlinear static problems in solid mechanics. Praveen's group has also been studying oscillating airfoils in low speed flows. The main aspect of this work was to obtain the forces on pitching airfoil experimentally and validate these results analytically. NACA 0015 and NACA 0024 wings with different aspect ratios were fabricated for the experimental aspect of this study. Praveen's group has also been carrying out aeroelastic analysis of flapping wings. The purpose of this work was to obtain the lift on a plunging wing model, theoretically and experimentally. An experimental setup was designed to find the lift on a 2-D and 3-D wing executing pure plunging motion.

P Raveendranath has been working on efficient and accurate finite element modelling of piezoelectric beam structures. The shortcomings of conventional Euler-Bernoulli beam element and Timoshenko beam finite element formulations when applied to piezoelectric materials have been identified and remedial measures proposed. Following a coupled polynomial interpolation approach, the dependencies of finite element accuracy and efficiency on the material properties of piezoelectric beam formulations have been eliminated. This paved way for versatile piezoelectric

beam finite element formulations based on first order and higher order shear deformation theories. The experience gained in this area is to be incorporated in the development of piezoelectric structural analysis module for FEAST software of VSSC. This activity is being proposed as a IIST-ISRO collaborative project. Dr.Raveendranath's team has also initiated a research work on Coupled numerical simulation of thermal, structural and chemical response of ablative composites.Currently working on modelling of pressure developed by decomposition products during the escape of decomposition gases through porous charred material.

Sam Noble was focused on the research related to suspension mechanisms for wheeled rovers. As a part of this, he has carried out (a) simulation studies on different configurations of wheeled rovers, (b) kinematic analysis and fabrication of variable diameter rover wheel, and (c) design and development of a six axis load cell.

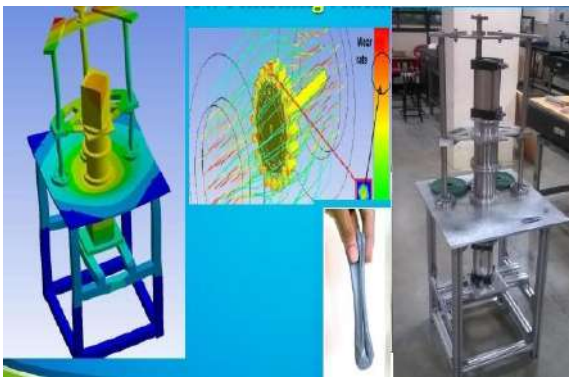
MATERIALS, MANUFACTURING AND MANAGEMENT

P Chakravarthy has been pursuing experimental studies on flux bounded tungsten arc welding, a variation of Activated TIG welding wherein a narrow strip of base metal is coated with activating flux and is exposed to the arc during welding. Bead on plate welds by FBTIG process on commercially pure aluminium plates were performed using silica as flux, under this project. The experiments were aimed to investigate the effect of flux gap and flux powder particle size on the weld penetration and depth to width ratio. Microstructural analysis was also carried out to understand the changes in grain structure in the weld pool and adjacent zones. It was observed that the weld penetration and depth to width ratio increased with the decreasing flux gap. Also, results showed better penetration for activating flux with finer flux powder size. The mechanisms that supported these observations have been demonstrated.

Girish B S has been investigating a number of problems related to air traffic control, and aircraft scheduling. This includes the aircraft landing problem (ALP), which is a well-known NP-hard optimization problem in air traffic control, dealing with runway allocation, sequencing and scheduling of arrival aircrafts at busy airports. This problem has been researched for over two decades and the methodologies proposed in the literature include metaheuristic approaches such as Genetic algorithms, ant colony optimization, etc. Most of the existing approaches in the literature use MILP solvers (like CPLEX) to determine objective value for a fixed landing sequence and runway allocations. In his research work, a schedule generation algorithm was developed to determine the objective value, which was found to be almost 100-200 times faster than that obtained with CPLEX. A hybrid particle swarm optimization (HPSO) algorithm was proposed that effectively and efficiently generates solutions satisfying the constraints in the problem. The HPSO algorithm, which was implemented in a rolling horizon framework and with multi-threaded processing, outperformed all the existing approaches by a big margin in

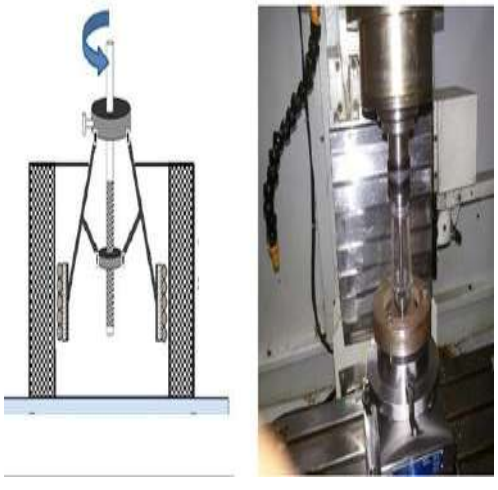
terms of both solution quality and computational time. His group has also been modeling the aircraft sequencing and scheduling problem based on the air traffic control operations at CSI Mumbai international airport. The developed optimization problem considers several real-life parameters and operational constraints of aircrafts sequencing and scheduling, which were obtained from Terminal radar approach control (TRACON) and Air traffic control tower (ATCT) of Mumbai airport. An MILP formulation was developed which was modelled and solved using CPLEX solver. Two metaheuristic algorithms, a GRASP and an ant colony optimization were developed to solve this problem. Girish's group has also generated a simulation model for reducing the the inter-arrival spacings between aircrafts so as to increase the runway throughput defined in terms of number of arrivals and departures per hour. The factors affecting the runway throughput were identified and their influences were quantified in this research.

V.S.Sooraj research is based in Investigations on low pressure abrasive flow finishing of aerospace components. It mainly focuses on the design, development and computational analysis of low pressure elasto-abrasive finishing machine developed at IIST and investigations on its performance characteristics for intricate aerospace components.



- **Design and development of open source multi functional rapid prototyping systems** : Include studies on filament based, powder based and weld based additive fabrication systems

- **Investigations on elasto-abrasive finishing and its applications**: Mainly focused on the design, development and analysis of rotary elasto-abrasive finishing. In addition, concept and mechanics of deployable elasto abrasive finishing is also investigated with detailed theoretical analysis/stochastic grain interaction studies.



➢ **Work done for ISRO missions**

(a) Rapid Prototyping of intricate parts for Wind Tunnel test (For Cryo – GSLV Mk III wind tunnel testing – 1: 50 scale) for Aero Enity, VSSC.

(b) Rapid Prototyping of an enclosure for a secure communication system for RFATD, VSSC.

4.2 Department of Avionics

Academic	Faculty	24
Technical	Staff	03
Students	Ph.D	20
	M.Tech	38

Research Activities

Faculty members associated with the department conducts research in digital signal processing, image processing, virtual reality, control systems, smart sensors, digital communication, communication networking, microwave circuits, antenna design, poer electronics and drives, virtual instrumentation, VLSI signal processing, smart systems, micro-nano electronics, micro-electro mechanical systems, cyber security, robotics, and computer systems. The research activities of each faculty member is described below.

Anindya Dasgupta is currently leading a joint IIST-ISRO effort to study switching topologies and control schemes for isolated DC-DC power converters. During the report period, the Phase I of this project has been completed, which involved the identification of prospective topologies with numerical simulation without considering effect of parametric uncertainties on switching delays.

Anoop C. S. does focused research on design and development of sensor systems for crack detection, estimation of angular position, determination of human vital parameters, etc. New Giant-magnetoresistance (GMR) based sensing arrangements for the detection and characterization of cracks on metallic surfaces was investigated and prototype models were developed. High performance Linearization circuits for Tunneling magneto-resistance based angular position sensors were also designed and developed. Novel sensing schemes for realizing simple and efficient biomedical systems to measure vital parameters like heart rate, respiratory rate, and blood pressure was also designed and implemented. In addition, space-related projects were also worked out during this period. The development of signal conditioners for hydrogen sensors fabricated for IPRC Mahendragiri was pursued. He is also actively involved with the realization of electronic modules associated with Retarding potential analyser (IIST project-proposal for MOM-2 mission).

Basudeb Ghosh is currently working on the design of multiband reflector antennas for satellite data reception. This work, done in collaboration with ISRO-NRSC, is leading towards a modified design of reflector antennas working in the S, X, and Ka

bands, which will be efficient both structurally to combat the extreme weather conditions in Hyderabad, and also performance-wise. In addition Basudeb is also working on the design and analysis of leaky wave antenna, with particular focus on the improvement of open stop band suppression method for such antennas.

Chinmoy Saha's research is in printed microwave circuits and antennas. With collaborators, he has proposed a novel technique of controlling the bandwidth of cylindrical ring dielectric resonator (CRDR) antenna. His recently proposed techniques of designing frequency notched ultrawideband antenna have been further implemented on various planar radiators. This technique doesn't impact the impedance and radiation characteristics of the antenna excepting the desired notch frequency and applicable on various microstrip/CPW fed printed antennas. The findings are being used for new generation ultra compact UWB antennas. His group has recently proposed a mechanically tunable frequency-notched and/or narrow band antenna using this concept. This is a completely new concept of reconfigurable antenna design as antennas can provide various complementary antenna functionality (UWB/Frequency Notched UWB/Narrow band) evolved from a single radiator by combinatorial actuation of various resonators and switches. Such antennas have the potential for applications in software defined radio (SDR) and cognitive radio (CR) environment. Along with these, his group has also shown a new technique to enhance mutual isolation between multiple antennas in MIMO environment. This technique is versatile and can be applied on various antenna geometries. He is leading two IIST-ISRO collaborative project on the design and implementation of a compact widebad microstrip patch antenna and design of tri-band feed systems for remote sensing satellites. He is currently also working on photoconductive antennas for THz applications.

Chris Prema's work is in wideband spectrum sensing for cognitive radios to utilize the radio frequency spectrum efficiently. Recently she implemented a low complexity multistage polyphase filter bank (MPFB) for the detection, estimation of center frequency and spectral edges of multiple users for cognitive radio (CR) applications. In this work, a mathematical expression for calculating the center frequency and spectral edges of multiple users were derived. Adaptive thresholding technique for wideband spectrum sensing using filter banks is also in progress. In order, to overcome the noise uncertainty in energy detection techniques covariance based methods are also studied for wideband spectrum sensing.

Deepak Mishra heads the Virtual Reality and Image Processing Lab (VRIP lab) and has been working in the areas of image and signal processing, machine learning tools & techniques, and virtual reality. The members of the lab are presently working on signal tracking approaches for phase estimation, deep learning and machine learning applications, computer vision tracking for surveillance applications, and compressive holography. Recent work in the report period includes development of deep learning architectures for watermarking applications, image fusion,

and tracking of objects in a sequence of videos, content based retrieval and copy detection. The lab has also recently proposed a robust integrated tracker which got short listed in the VOT 2016 challenge as one of the best trackers. The lab also works on bio-inspired computing and on various problems related to computational neuroscience & neuro informatics. The VRIP lab is currently involved in a IIST-ISRO joint project for developing a virtual reality model for disaster simulation, primarily flood water inundation based on satellite images and Bhuvan maps. Work is also actively underway in another IIST-ISRO joint project that uses object-based change detection techniques for identifying landslide scars, and hotspots by monitoring land use.

Gorti R K S S Manyam has developed signal tracking approaches based on adaptive filters for phase estimation from Digital Holographic Interferometry data, which enables 3D extraction at microscopic level from highly noisy and rapidly varying fringes. His research has also produced a novel framework for unstained Leukemia cell segmentation and classification from imaging flow cytometry data. This framework eventually results in a cost effective mass cancer screening. He is currently working on the development and application of active learning, transfer learning and deep learning techniques. He has also developed Convolutional Neural Networks (CNN) based generic satellite image segmentation and is currently developing rotational invariant CNNs. He has recently proposed a robust integrated tracker which is short listed in VOT 2016 challenge as one of the best trackers. In addition, he is leading several ISRO-IIST joint projects on (1) object based high resolution image analysis for land slide classification, an ongoing effort with NRSC, (2) vibration data analysis technique for finding patterns, features that help for automatic classification of normal and faulty satellite structures, in conjunction with the VSSC, (3) a virtual reality model for disaster simulation and a (4) gate based approach for online simultaneous tracking of satellites, in collaboration with SDSC SHAR.

Harsha Simha's research is in the areas of nonlinear dynamical systems and control. Autonomous rendezvous and docking is a key technology for many complex space missions. It requires complicated and precise transnational and rotational maneuvers whose dynamics are coupled. Conventional control methodologies which neglects this coupling between transnational and rotational dynamics are unsuitable for precise control. Harsha's research is to model the coupled attitude and transnational dynamics in the framework of geometric mechanics, where his group is coming up with control algorithms to achieve precise and fast maneuvers. He is leading an ongoing joint IIST-ISRO effort for the simulation and development of attitude determination and control systems (ADCS) and sensor technologies for docking of quad-copters which can later be used for developing and testing of ADCS for docking of autonomous spacecrafts in space.

Lakshminarayanan R's interests are in the development of various signal processing algorithms. In the

report period, he has developed new algorithms for tracking and estimation of time varying sparse signals, with particular focus on the development of recovery algorithms with reduced complexity for practical applications, an area that has not been addressed adequately by researchers. He has also been working in collaboration with ISRO for the (1) development of turbo encoder and decoders for ISRO space missions and (2) development of tracking algorithms for multi object tracking radar developed by SHAR.

B. S. Manoj's interests include Computer Networks, Wireless Networks, Wireless Sensor Networks, Next Generation Internet, Ad hoc wireless networks, Wireless Mesh Networks, Software Defined Networks, Complex Networks and Cyber Security. Two research labs viz., Systems and Networking (SysNet) Lab and the Cyber Security (CySec) Lab have been developed to cover these research areas. His research group has been pursuing four major projects using these laboratory facilities, namely (a) an IIST-ISRO project on the development of an integrated enterprise network security, whose primary goal is to create solutions for detecting and providing enterprise network security from Highly Sophisticated Cyber Malwares, botnets and future threats by using a combination of techniques that span machine learning, signal processing, information theory, deep packet inspection, data and traffic finger printing and network data traffic analysis; (b) an Indo-US collaborative research on Pervasive Computing for Disaster Response whose objective is to support improved information flow in evolving disaster situations through distributed sensing, processing and dissemination capabilities; (c) an IIST-funded fasttrack project titled "IIST MeshNet: A Programmable Hybrid Wireless Mesh Network Testbed," that developed a multihop wireless mesh network in IIST campus; and (d) an ITRA funded collaborative project named MICRONet (Mobile Infrastructure for Coastal Region Offshore Communications & Networks) that aims at studying the characteristics of wireless propagation over sea for long-range communications in order to develop a wireless mesh network to cover a distance of 50-100 Km from sea shore. The purpose of such a network is to provide a communication system that can greatly benefit the fishermen community in India in general and in particular in Kerala.

Palash Kumar Basu's research are in the development of nano technology based gas sensors and biosensors. The availability of gas sensors suitable for space applications is very limited. In this context, Palash's group is trying to investigate low weight, high performance nanostructure gas sensor array on flexible substrate at room temperature where each element of the array will be functionalized by required nano materials (metal Oxide with catalyst) to enhance the performance of the sensor. The group is working actively with IPRC to develop the suitable H_2 sensor for leak detection and they have demonstrated superior performance as compared to the available sensor in the market. The validation and signal processing is going on with IPRC. The group is also working on THz detectors. A high sensitivity, low power (~1μW to 10 μW), room

temperature, antenna coupled, THz (0.8 THz) detector has been developed by means of field effect transistor (FETs) fabricated on epitaxial-grown graphene on silicon carbide. Palash is also the principal investigator on a joint IIST-ISRO project for the design and fabrication of grapheme based RF transistor for eventual space applications. Concurrently he is also leading another effort for the development of high performance hydcarbon sensors to reduce or avoid hazardous events which could hinder the implementation of hydrocarbon fuel. Similarly Palash's group also involves to develop a pathological protocol for early detection of cancer. Nanoscale vesicles that originate from tumor cells and which can be found circulating in the blood have been discovered to contain a wealth of proteomic and genetic information to monitor cancer progression, metastasis, and drug efficacy. However, the use of exosomes and micro/nano vesicles as biomarkers to improve patient care has been limited by their small size (30 nm– 1 μm) and the extensive long time sample preparation required for their isolation and measurement. Similarly an extensive research is necessary to characterize the nano vesicles for cancer prognostic. The aim of the investigation is to develop a nano material based Electrochemical exosome sensor for cancer prognostic with improvement in sensitivity, reduction in cost of platform compared to today's available techniques and analysis time less than 3h.

H.Priyadarshnam's research interests are in the design, modeling and development of control systems. His research group is currently developing a tactile sensor for an underactuated robotic arm designed by the Vikram Sarabhai Space Center. The project involves modification of the existing design, fabrication of new components, and the development of a fail-safe control algorithm for an under-actuated robotic hand. He is also heading two IIST-ISRO projects, which involves the (1) development of reaction wheel hardware and interface system for small satellites, and (2) the design and development of standards for various subsystems of small-satellites in the Indian context and to carry out scientific experiments in space at regular intervals.

Rajeevan Puthen Purayil works in the areas of power electronics such as power converters and PWM techniques, control of electric drives, and renewable energy. He is involved in the development of new topologies of multilevel power converters and pulse width modulation techniques with specific emphasis on applications in the areas of drives, power quality improvement and renewable energy. He is also working on new schemes for control of current source inverter fed induction motor drives with open-end stator windings. Another ongoing research is the development of control schemes for multiphase drives with number of phases more than three, for space applications. Multiphase AC drives are potential candidates for space applications due to their inherent advantages compared to the standard three-phase drives such as the enhanced fault tolerance, higher power density, higher efficiency, higher torque density, reduced torque pulsations etc. In the field of renewable energy, he is involved in the development of dual converter based systems for maximum

power point tracking and control of power flow in stand-alone as well as grid connected solar photovoltaic energy sources.

Rajesh Joseph Abraham's research group looks into the mitigation of issues in Smart Grids with renewables integration. Depletion of fossil fuels and growing concern about environment has resulted in integrating more and more renewable energy sources into the smart grid. Further, two way communications between the energy supplier and the customer and smart meters have brought in economic aspects in power generation and distribution which needs further investigation. The intermittent nature of renewables pose further threats as far as stability is concerned. The group is actively investigating different aspects of smart grids such as frequency stabilisation using energy storage devices, design of stabilisers for voltage stability, optimal placement of distributed generation etc. One doctoral student in this group is about to graduate and another is pursuing doctoral studies.

Sam K. Zachariah's research has been on the design of autonomously walking humanoid robots. A CAD model of humanoid having similar mass distribution and geometric dimensions of a human counterpart has been generated. A novel walking control algorithm for planar biped over sloped terrain has also been formulated and validated on physics based simulation test bed. The algorithm, named *hybrid-state driven autonomous control* (HyDAC), has been extended for ascending and descending stairs with random dimensions and surface slopes. The stability and robustness aspects of HyDAC has been proved mathematically and demonstrated based on simulation model. The proposed algorithm is far superior to current biped control schemes reported in the literature. The future work concentrates on extension of HyDAC to 3D humanoids capable to walk over uneven terrain as in a planetary surface.

Sanjeev Kumar Mishra has been working on Microstrip Antennas and Circuits. The area of printed microwave circuits and antennas has attracted the attention of antenna researchers over last two decades. Recent surge in wireless communication demands new antennas which will satisfy the requirements for these services. Considering this latest trend and requirements designed and development of various new microstrip antennas has been conceived.

Seena V's research contributions focus mainly on the development of ultra-sensitive Micro Electro Mechanical Systems (MEMS) platforms with novel electromechanical techniques for integrated transduction. The miniature microsystems have been demonstrated to have huge potential for the development of various engineering and scientific applications ranging from low cost micro sensors in the field of environmental monitoring, health care and homeland security, gas sensors for space and terrestrial applications to inertial systems such as MEMS Accelerometers. Most of the recent devices were designed and characterized at Micro/Nanoelectronics and MEMS facilities at IIST and fabricated at CEN, IIT Bombay through her research

projects under Indian Nanoelectronics User's program (INUP), sponsored by DieTY. These include polymer MEMS nanomechanical sensor, Polymer MEMS accelerometers, MEMS energy harvester etc. realized with novel device architecture and MEMS fabrication techniques. She has been receiving SERB Women Excellence Award grant for carrying out research in Polymer MEMS. Her research group is active in developing ultra-sensitive MEMS accelerometer for space applications through ISRO/IIST project. Work towards patenting the design and fabrication of an advanced non-planar quad beam symmetrical piezoresistive MEMS accelerometers for low cross axis sensitivity is in progress. She has also contributed towards development of novel CMOS-MEMS architectures for inertial sensors and IR detectors.The recent work is towards strain engineering of Transition Metal Dichalcogenides (TMDCs e.g., MoS2) for nanoelectronics and development of MEMS Sensor platforms with embedded MoS2 thin film transistor (TFT) for active electromechanical transduction.

N. Selvaganesan has been working on fractional control design, the objective of which is to investigate the limit cycle performance of Fractional Order Controllers (FOC). He has also been investigating artificial intelligence based techniques for the prompt detection and diagnosis of faults in industrial systems, which is essential to minimize the production losses, increase the safety of the operator and the equipment. In this effort, he has generated an artificial intelligence based fault detection and control for a 6/4 Switched Reluctance Motor, Permanent Magnet Synchronous Generator, de-aerator in thermal plant and heat exchanger systems. He is also leading an IIST-ISRO project on the design and development of brushless DC motor. This project focuses on the design and simulation of L110 EGC quadruplux torque motor which is used for PSLV/GSLV rockets. Additionally, he is also the principal investigator on another IIST-ISRO project on the modeling and controller design for micro actuators. Under this, the mathematical modeling of piezo proportional diaphragm valve was studied and verified through simulation.

J Sheeba Rani's research is on developing high performance hardware algorithms and architectures for signal/image processing applications. Her group has developed novel pipelined parallel architecture in FPGA for non rigid body motion estimation. At present the focus is on developing cloud motion estimation and tracking algorithm and improving the performance by introducing hardware accelerators for highly computationally intensive task which will be reducing the time of climate prediction, weather forecast during natural calamities such as cyclone/flood. She is also working on hardware algorithms for compressive sensing based reconstruction algorithms. The group also works on developing ASIC based designs such as sigma delta modulator ADC, instrumentation amplifier and FLASH ADC. The fabrication is done in collaboration with SCL Chandigarh.

Sooraj Ravindran's research is on developing optoelectronic and photonic devices for communication, computing, sensing, energy harvesting and lighting.

Currently he is working on developing energy efficient optical switches, modulators and logic gates having micro-ring resonator/directional coupler configurations especially looking at their integration prospects on Photonic Integrated Circuits (PICs), development of high-efficiency multi-junction solar cells and investigation of slow light propagation in microring resonator structures. The focus is also on understanding the evolution of chirping in microring resonator modulators which uses carrier injection and electro-absorption as the modulating mechanism and developing microring resonator based gyroscopes for navigational applications. He is leading an effort to design active and passive optical waveguides for high-speed optical interconnects for use in launch vehicles so as to replace the conventional copper cables and thereby enable high-speed data transmission.

R. Sudharshan Kaarthik research focus was on Power Electronics and drives. The research work included work on reducing switch count for a seventeen-level converter for induction motor drive applications. This resulted in a high-performance system with enhanced reliability. Furthermore, the work extended to generation of dodecagonal voltage space vector structures with switched averaged capacitive filters. He is also currently working on decoupled control of permanent magnet actuators. With this scheme, methods to control two electric motors with a single power source and a single inverter will be explored. This will involve several research aspects such as modeling and analysis of multi-phase machines and modulation techniques for the driving inverter. The outcome would be reduced device count and possibility of fault tolerance and low voltage operation for the decoupled drive system. Furthermore, he is involved in a payload design and fabrication - Retarding potential analyser (RPA) for the observation of Martian Ionosphere for the MOM-2 mission. His focus would be to design and fabricate the data acquisition, reference generation and communication sections of the payload.

Vanidevi M is interested in the development of signal processing techniques. In cellular networks, the massive MIMO architecture proposed for 5G communication consists of a base station equipped with a very large number of antennas serving multiple single-antenna users simultaneously. The increase in the antenna at the base station exploits the additional spatial degrees of freedom to multiplex data streams for several users on the same time-frequency resource, to maximize the beamforming gain by focusing the radiated energy towards the intended receivers and to minimize the intra-/inter-cell interference by using detection and precoding algorithms. Therefore, her research focuses on the development of the signal processing, detection and estimation technique in the receiver. It includes uplink/downlink channel estimation problem (in both TDD and FDD mode), uplink detection and downlink precoding schemes

Vineeth B. S.'s research activities are related to building optimized protocols and algorithms for communication and senor networks for improved communication, estimation and detection performance. Analytical tools and simulation software to

aid in this purpose were developed during the report period. Low complexity threshold control policies for active sensors for fast and energy efficient detection of changes in sensor networks have also been realized in the recent past. He has also developed analytical algorithms to optimally add links to a communication network to minimize the average path length of networks. In the reported period Vineeth was the PI for a project to develop a multiple target tracking and trajectory prediction algorithms to be used in multi-object tracking radar for SDSC-SHAR. Towards this, a software simulator for simulating the detection data obtained by the radar as well as a software prototype of the multi-target tracking system was developed in the report period.

4.3 Department of Chemistry

Academic	Faculty	09
Students	Ph.D	22
	M.Tech	12

Research Activities

Research activities of the department include **nanomaterials, materials for energy applications, sensors, polymeric materials, biomaterials, functional materials, composites and high temperature materials.**

Gomathi N's research group works on the synthesis of graphene nanostructures through chemical routes and their surface modification through plasma functionalization and hybridization with metal nanoparticles. The group is also working on the application of various surface modified graphene nanostructures obtained through novel surface modification techniques, on biosensor applications with various analytes such as glucose, ascorbic acid, dopamine, uric acid, nitrite and cancer biomarkers. The group also focuses on surface modification of carbon nanotube by plasma treatment and studying the application of plasma functionalized CNT in nanocomposite with cyanate ester matrix to make use of the composite material in satellite structural applications. With the promising result of enhanced dispersion of plasma functionalized CNT in cyanate ester matrix, the group further focuses on optimizing the weight percentage of plasma functionalized CNT in the matrix and further characterization and testing for studying enhancement in its mechanical and thermal properties.

Jobin Cyriac and his team is interested in developing chemical sensor devices for environmental monitoring, pesticide screening, decease detection, etc. To realize this, they understand and develop chemical principles and materials.The methods adopted towards this goal include fluorescence based methods, surface enhanced Raman spectroscopy (SERS) and mass spectrometry. The group recently demonstrated easy and effective detection

of various molecules of societal importance using fluorescent quantum dots. SERS based sensors were developed in a flexible substrate platform for the effective screening of pesticides.

Kuruvilla Joseph's research include (a) the development of new *structural epoxy nanocomposites* with high toughness as well as mechanical strength suitable for space applications, (b) the development of *polyimide nanocomposites* for space applications where they could show improved transparency, flexibility and electrical conductivity with electrostatic charge mitigating properties, (c) the development of High Performance in-situ conducting Microfibrillar Composites which are found to have good conductivity and mechanical properties than the basic MFCs. In addition, the group has also developed recently gold nanoparticle based colorimetric sensor for naked eye detection of cholesterol in human blood, fructose in semen samples and E.Coli bacteria in UTI patients. Followed by the colorimetric sensor they have also developed a fluorescence sensor for Alzheimer's disease using bovine serum albumin (BSA) protected atomically precise clusters of gold. Recently, a blood creatinine sensor using protein protected gold quantum clusters was also developed by his research group.

Mahesh S works on functional materials. Recently his group reported a simple and cost effective method for the synthesis of graphene quantum dots (GQDs) from easily available bioresource-Honey. Interestingly these fluorescent GQDs can be used as a security ink for currency counterfeit. Development of functional materials from plant/crop based feed stocks is another area of interest for his group. Photoswithable molecule has been developed from Cardanol, a byproduct of cashew. The molecule can undergo self-assembly leading to the formation of nanospheres and these can transforms to microspheres upon light exposure. This is an example of light induced size variation at nanoscale.

Mary Gladis's research interests are also in developing materials for energy applications. The lithium-sulphur (Li-S) batteries have been considered as the most promising next generation Li batteries for high energy density applications to satisfy the high-energy demandsof electric vehicles (EVs) and sustainable energy-storage systems. Sulphur has several drawbacks such as poor conductivity, large volumetric expansion upon lithiation and dissolution of the intermediate polysulfides during charge-discharge processes. Strategies adopted by her group to address the above challenges are(i) using low cost, high surface area mesoporous carbon matrix from biomass to trap sulphur and to reduce the shuttling of polysulphides during cycling (ii) combining sulphur with conducting substrates like mesoporous carbon, polymer material and CNTs to improve the electrical conductivity of cathode material and to ensure active utilization of the material and (iii) employing hetero atoms doped porous carbon to trap the polysulphides to improve the rate capability.

Nirmala Rachel James's research is primarily in the development of polymeric

materials for medical application. Recently, her group could successful use polyelectrolyte complex based on polysaccharides for enhancing the solubility of curcumin leading to the efficient drug delivery. Polymer-drug conjugate and nanogels have also been developed in her lab for drug delivery applications. The group also works on nanofiber composites. Polyurethane nanofibers generated using electrospinning was used for preparation of composites with resorcinol-formaldehyde resin. The composite showed improved thermal and mechanical properties. The feasibility of using crystalline polymers to functionalize carbon nanotube (CNT) via CNT-induced polymer crystallization was also investigated in the recent past. Modified CNT without sacrificing the beneficial properties of CNT was then used as precursors to form electrospun composite nanofibrous mat.The group has also strted working on Polymeric light emitting diodes.

Prabhakaran K is interested in development of light weight high temperature materials of low thermal conductivity for thermal protection applications. His lab is engaged in developing novel processing methods for preparation of carbon and ceramic foams to achieve this goal. As far as possible we try to replace the fossil fuel based chemicals with natural renewable materials of plant origin as precursors/processing additives for the preparation of carbon and ceramic foams for environmental friendliness and sustainability. The lab is also working on the development of novel carbon based sorbents of high CO_2 adsorption capacity from bio-mass for CO_2. The materials will be a candidate for CO2 removal from manned crew cabins in space shuttles and submarines.

Sandhya K Y's research is focused on the development of (nano) functional materials for various applications such as electrochemical storage, sensing, adsorption, photocatalysis and adsorption. It includes Selection or designing of materials, synthesis of nanomaterials or nanostructures or composites, testing the materials performance for the applications.

Renewable energy is the need of the hour. Energy harvest from renewable sources and its intermittent nature and geographical constraints calls for advanced energy storage with higher capacity. Therefore we are working on: electrode materials with higher capacity for lithium-ion batteries, photoharvesting materials, visible light photocatalytic materials, electrodes for electrochemical sensing of analytes. Further areas of interest are functional nanomaterials for CO_2 adsorption, pollutant removal by adsorption, etc.

Sreejalekshmi K G's research group - Organic Molecules and Functional Materials (OM&FM) group, works in the design and development of functional organic materials. The exploration of chemical space around 1,3-thiazole core for the development of theranostic agents is one of the prime focus of research in Organic Chemistry. Synthesis of novel class of molecules in 4-hydrazinothiazole family has already been established by her group and currently the utility of N-rich heterocycles in a fragment based anticancer drug discovery was completed as part of a funded project. The

molecular docking in various biomarker proteins with a focus on kinase proteins and prediction of drug likeness is being carried out in her lab to assist small molecule drug design. Yet another research area actively pursued by the group is in the development of multicore heterocycles, exemplified by the design and synthesis of 5-(thiophen-2-yl)-1,3-thiazole core. Using density functional theory the charge carrier mobility in the systems were earlier studied and a facile and versatile [4+1] ring synthesis route was established. The thienylthiazole core accommodated tunable handles at C2 and C4 and photophysical properties evaluation proved them to be the smallest solid state red emitting molecules with positive solvatochromism, large Stokes shift and aggregation-induced emission (AIE) behaviour. The approach was further extended to design and develop a furanylthiazole core and the property evaluations are being pursued.

4.4 Department of Earth & Space Sciences

Academic	Faculty	13
Students	PhD	18
	M.Tech./ MS	31

Research Activities

The department has on-going research in such diverse disciplines as **astronomy and astrophysics, atmospheric science, geology and planetary sciences, and remote sensing.**

Ambili K M is working in the field of planetary atmosphere and ionosphere, specifically on the theoretical modelling of equatorial and low latitude region of Earth's ionosphere. Her work makes use of space borne and ground based radio and optical instruments, such as Incoherent Scatter radar, GPS Satellites, Ionosondes, Magnetometer and multi-wavelength day glow photometer. During the annual report period, her work with collaborators was mainly focused on the following : (a) development of a photochemical model for the ionospheres of Venus and Mars (b) morphological features of the plasma irregularities estimated using geostationary satellites, (c) variabilities in the total electron content across Indian sub-continent during solar flare/ geomagnetic storm events, (d) development of a quasi-two dimensional First Principle Ionospheric Model for the terrestrial equatorial/low latitude region (e) study on the effects of ionospheric variabilities on the performance of IRNSS (f) development of retarding potential analyzer for the planetary ionospheric studies

Anand Narayanan's interests are in modeling the physical conditions of diffuse gas in the extended halos surrounding galaxies and the intergalactic medium. In the report period, his group, using data from the Hubble Space Telescope,

reported the detection of a large reservoir of dark baryons near to a concentration of galaxies in a far away location of the universe. This work is relevant in the context of global efforts to map the distribution of ordinary matter in the universe over its last 10 billion year history. Presently, he is pursuing work along similar lines through a larger spectroscopic survey of distant quasars.

Anandmayee Tej's research primarily focuses on high-mass star formation and their interplay with the surrounding interstellar medium. Her work is observational based where the national facilities like the Giant Meterwave Radio Telescope, Himalayan Chandra Telescope and Mount Abu Infrared Telescope are extensively used. Her research group is currently involved in detailed study of Infrared Bubbles which are the observational manifestation of the radiative and mechanical feedback of massive stars. The group is also trying to understand the nature of Extended Green Objects which are signposts of the early phases of massive star formation.

A.Chandrasekar's research is on improving the model forecast by adding time dimension in the traditional variational data assimilation system, which is generally known as four dimensional variational data assimilation system. Recently, the group is involved in quantifying the impact of assimilation of radiance as well as conventional observations from satellites in improving the weather forecasts over Indian subcontinent.

L.Gnanappazham's interests are in the application of remote sensing and GIS technologies in the management of natural resources, with special focus on coastal zones and mangroves. In the report period, her group carried out Modeling the Vegetation Health using MODerate resolution Imaging Spectrometer (MODIS) using time series analysis of vegetation and temperature indices for Southern India and replicated for Mangrove forest cover of Krishna delta using better resolution Landsat data to monitor and understand the interseasonal variations of mangrove health over a period of 10 years. The estuarine hydrodynamics of Mumbai mangroves also studied using open software showing that tidal elevation around the mangrove forest has increased from 1.6m to 2.4m during 1990 to 2017. There was another study to identify the potential sites of establishing solar power plants in 7 districts of Karnataka using Remote sensing and GIS tools.

Urban modeling is yet another research on GIS based Cellular automata and Artificial Neural Network Modeling. This study is currently being taken up for modeling the urban sprawl of Chennai metropolitan city using temporal remote sensing data and spatial parameters which will be the key factors determining the urban growth such as transportation, industrial development, population growth, migration, income, and land value. The urban growth of Sriperumbudur Taluk which is adjacent to Chennai with tremendous development in Automobile sector was modeled as a precursor to the major study.

M. Govindan Kutty's interests are in developing data

assimilation system that improves the estimate of initial conditions for weather models. In this report period, his group has successfully tested the impact of flow-evolving error covariance in variational data assimilation system, which is found to be beneficial in improving the track forecast of tropical cyclones formed over Bay of Bengal.

Jagadheep's research interests are in observational studies of early phases of high mass star formation. In the report period, his group worked on studying the massive young stellar objects associated with 6.7 GHz methanol masers. This involves constructing spectral energy distributions of the methanol maser sources from submillimeter (870 micron wavelength) to mid-infrared (24 micron wavelength). The group has also been working on spectral line modelling of young high-mass star forming sources using data from the James Clerk Maxwell Telescope (JCMT) in Hawaii (USA).

Jagadheep is also part of an international collaboration carrying out a large survey of the plane of the Milky Way at radio wavelengths with the aim of obtaining a global picture of star formation in our galaxy. In order to exploit the data products from this survey, he has proposed to form a partner group in collaboration with the Max Planck Institute for Radio Astronomy with funding from the Max Planck Society. The proposal for formation of the group has been accepted by the Max Planck Society and is expected to commence by the end of 2017.

Rajesh V J's research includes deep crustal processes during the evolution of Archaean Nilgiri block, southern India.

Funding Source: Ministry of Earth Sciences (MoES)

Role: Co-PI in collaboration with Centre for Earth Sciences, Indian Institute of Science, Bangalore.

Earth's crust which consist of continents and oceanic basins is a part of a complex system that has evolved over the last ~4600 million years (Ma). The evolution of planet Earth took place through a series of interactions involving the core, mantle, crust and atmosphere. However, only limited remnants of the early crust remain because of the extensive reworking. Consequently, in order to understand the crustal evolution of the early Earth in general and the formation, growth and evolution of continents in specific, it is crucial to investigate these early continental crust relicts from the standpoint of both their formation and subsequent modification during later continental crust accretion. This study includes understanding the evolution of Nilgiri Block (~2500 Ma), southern India using petrological, geochronology and rock magnetic tools. This study would provide a complete picture of evolution of the Nilgiri Block and thereby gain greater insight into tectonic events during the formation and evolution of an Archean crust.

Study of Moon and Mars analogues: Investigations on orthopyroxene-olivine-spinel (OOS) group of minerals and cumulate rocks in India based on remote sensing, mineralogical and geochemical methods

Funding Source: Indian Space Research Organization (ISRO)
Role: PI in collaboration with Space Application Centre, Ahmedabad.

The mineralogy and mineral composition of planetary samples contain a rich record of the thermal and chemical evolution of the planetary body. These processes produce distinct signatures in the mineral assemblages and compositions produced across a range of depths and across the body's surface. While the record can be complex, the composition and mineralogy of planetary samples represent one of the most powerful tools available for unravelling the geologic history of a planetary body. The uppermost mantle of the Earth, the Mars and the Moon consists of only four major minerals, namely, olivine, clinopyroxene, orthopyroxene and spinel (chromite/chromian spinel). During the early stages of evolution of a terrestrial planet, energetic impacts, radioactivity and core formation creates one or more whole or partial silicate mantle magma oceans. Understanding their mineralogy and chemistry is significant in providing clues to the planetary evolution. The spectral reflectance property of minerals comprising mantle cumulates in compositional space is therefore important to examine in conjunction with compositional and structural information in order to derive systematic and quantifiable spectral-compositional relationships. Such relationships could allow the presence, abundance, and composition of these minerals to be determined from optical remote sensing data. This would enable petrogenetic conditions to be assessed for inaccessible targets such as the Moon, Mars, and the asteroids and aid terrestrial geological exploration and mapping based on optical remote sensing of such targets.

Geological and spectral studies of terrestrial analogue rocks: Implications for Mars exploration Funding Source: Indian Institute of Space Science and Technology (IIST) Role: PI in collaboration with Dr. Gnanappazham, IIST

Planetary analog research is an important topic in planetary geoscience both in terms of planetary origin and evolution and in the preparation and result interpretation of robotic exploration to support future manned missions. Overall the past decade, much attention has been drawn to potential research on terrestrial analogue sites for Mars and Moon on Earth. The analogue sites on Earth provide us with resources and data that can be used as ground truth for satellites and other training purposes. For example, Mars may have been, in some ways, similar to ancient Earth, and that is what makes it an intriguing planet. To understand the processes on or the evolution of one solar system object, frequently the Earth's surface and objects (like rocks and minerals) are to be compared and studied. Several landforms/terrains which show similarities with Martian landforms will be studied in terms of mineralogy and morphology to get a better understanding of Martian geological processes.

The geology lab, headed by **Rajesh V J**, has been actively pursuing several research problems in Earth and planetary geology. Over the report period, his research group has been trying to understand the evolution of Nilgiri Block (~2500 Ma), of southern India, using petrological, geochronology and rock

magnetic tools. This work, when completed, would provide a complete picture of evolution of the Nilgiri Block and thereby gain greater insight into tectonic events during the formation and evolution of an Archean crust. More broadly, such investigations are crucial to forge a better understanding of the crustal evolution of the early Earth in general and the formation, growth and evolution of continents. Additionally, Rajesh's group is also leading the effort on a project in collaboration with ISRO-Space Applications Center, Ahmadabad, to study the orthopyroxene-olivine-spinel (OOS) group of minerals and cumulate rocks in India based on remote sensing, mineralogical and geochemical methods. This work is meant to enable the petrogenetic conditions to be assessed for inaccessible targets such as the Moon, Mars, and the asteroids along with aiding terrestrial geological exploration and mapping based on optical remote sensing of such targets. Concurrently, in collaboration with L Gnanappazham of the remote sensing group of IIST, Rajesh has been pursuing geological and spectral studies of landforms/terrains on Earth which show similarities with Martian landforms to get a better understanding of Martian geological processes.

Rama Rao Nidamanuri's research is on hyperspectral remote sensing, which is an advanced broad spectrum space technology tool for detection, identification, and quantification of surface and sub-surface materials. The research carried out during report period have mostly been aimed at developing novel algorithms, methodological frameworks, and implementation modules for the processing and analysis of hyperspectral images for several applications of interest. In addition, a new direction in the research on hyperspectral imaging, fusion and integration of hyperspectral imaging with high performance laser scanning, has also been undertaken in order to widen the application base of present and future hyperspectral satellite missions. Several undergraduate and post-graduate theses works were carried out under this. Rama Rao's group and collaborators have also been active in national scientific infrastructure development in the hyperspectral remote sensing by the Department of Science and Technology, Government of India, a Central Facility on Hyperspectral Remote Sensing is being set up in IIST. This facility will cater to the laboratory needs of interested faculty and students across universities/ colleges in south India.

Ramiya A. M.'s research is in the area of LiDAR Remote Sensing of earth surface features with particular emphasis on 3D semantic labeling of LiDAR point cloud. The current thrusts of her work are in 3D point cloud segmentation, 3D feature extraction and labelling, and multisensor fusion (especially with hyperspectral and multispectral data). The research is motivated by practical utility of LiDAR technology for earth resource management particularly focusing on 3D smart city modeling, urban forests, and structural parameters estimation from vegetation point cloud.

Resmi Lekshmi's research interest is primarily in the field of High Energy Astrophysics, focusing mostly on the physics of Gamma Ray Bursts and Blazars. She investigates the

structure and evolution of Gamma Ray Burst jets through theoretical predictions of GRB afterglows and interpretations of multi-wavelength afterglow data. Since the last couple of years she has started to focus more on the properties of short duration Gamma Ray Bursts, thought to be originating from merger of binary compact objects.

Samir Mandal's major research interests are accretion physics around compact objects, radiation hydrodynamics, particle acceleration across shocks, analysis of X-ray data from different space missions including AstroSat. Recently, his group has been working towards a better understanding of the behaviours of the outbursting sources (compact sources show sudden enhanced X-ray activity) by analyzing the X-ray timing and spectral data.

Sarita Vig's research interests include investigation of early stages of massive star formation using tracers such as HII regions, that result from the direct interaction of these infant stars with the surrounding interstellar medium. The group's work during the report period relates to probing HII region complexes in extensive detail including detection of non-thermal emission that are traditionally believed to be largely thermal in nature. The work plays a role in improving our understanding of the emission mechanisms in HII regions as well as in augmenting the current insight regarding the formation of HII regions. The body of work relies on data obtained from the Giant Metrewave Radio Telescope (GMRT), India apart from various scientific missions and surveys.

In addition, the astronomy & astrophysics group has also been pursuing the following joint collaborative efforts.

The Square Kilometre Array (SKA) is the next generation radio telescope of extremely high sensitivity (50 times better than that of the current biggest radio telescope) and angular resolution. The astronomy group of the Department of Earth & Space Science of IIST joined the SKA-India consortium in October 2015 as a full member. This is expected to improve the visibility of IIST since it can act as a regional nodal centre for scientific users of this upcoming global facility. The SKA project is managed by an international consortium of 11 member countries. India is a full member of this international consortium. The SKA-India consortium has been created to oversee and coordinate activities related to the SKA project by the Indian scientific community.

The astronomy group of the department also has members in the Training & Outreach Team (TOT) of the ASTROSAT mission. The TOT is responsible for the educational and public outreach activities associated with this multi-wavelength astronomy mission, which is ASTROSAT. The team is responsible for conducting workshops across the country for promoting the scientific user base for high energy astronomy data. At an equally important level, the TOT is planning to have programs promoting scientific literacy among school children and the public through wide range of educational outreach activities. During the report period, the IIST members of the TOT were actively involved in the scripting and discussions of the documentary that was

brought out by DECU-ISRO. IIST also played a key role in the design and production of educational posters, for public distribution, describing the scientific instruments on ASTROSAT and their broad science goals.

4.5 Department of Humanities

Academic	Faculty	05
Students	Ph.D	11

Research Activities

Research activities of the department are in the areas of sociology, economics, management, digital humanities, visual communication, and gender studies.

English

Babitha Justin with the help of a state-of-the-art audio visual lab of the department has been thinking of ways to harness the power of new technologies for the enhancement and dissemination of knowledge. She has started a consortium for the production of Open Course Ware, based on the core competencies at IIST and ISRO, which will eventually bring out video lectures online for information sharing. The work on this is in progress. Her research also draws on the hierarchy of visuals and text, the rhetorical, contextual situations in which visuals and texts co-mingle, film studies, disability studies and travel writing.

Gigy J. Alex's interests are in cultural studies and science fiction. In the changing sensibilities of gender perceptions and gender ideologies, transgender studies have emerged as an interdisciplinary of this genre. Her ongoing research is an attempt to look at the identity contestations of transgenders and how they are perceived and analysed in Malayalam cinema. There is also another study, in progress, on gender and religion, with special reference to folk lore and kali worship in South Travancore.

Sociology

Lekshmi V Nair's research in sociology mainly focused on Gender studies, Gerontology and Science, Technology & Society. In gender studies, the life of women in different professions, the entry and empowerment of coastal women in Self Help Groups in Kerala and the nature and type of violence towards women in Kerala were studied. Studies in gerontology were based on institutionalization and the life of elderly living in the different old age homes of Kerala, especially the people living in the different institutions for more than 10 years. Studies were also undertaken to know the causes and consequences of the longer lives of the elderly women. In the area of science, technology and society, collaborative studies were done focussing mainly on the different aspects of space technology such as the impact of tele education and telemedicine mobile van and also to assess the penetration of space technology into the social and economic life of the households of India.

Economics

Shaijumon C. S.'s research in the field of economics is focussed on development economics and space economics. The specific research areas are technology, innovation, diffusion and economic development, various issues of Indian economy, economic vulnerability due to various economic impacts including climate, natural shocks, social changes etc. He has also undertaken work on agriculture issues, infrastructure, governance and regional economics. His doctoral student is currently working on understanding the impacts of technology diffusion in marine sector as well as the effects of climate change vulnerability in agriculture sector. In the area of space economics, research is on-going to analyze the cost-benefits analysis of the Indian space program, quantification of Indian space economy, understanding the space technology penetration among the households of India, study on Village Resource Centres, Telemedicine impact study, space technology and inclusive growth of India.

In addition, Shaijumon C. S. and Lekshmi V. Nair are currently pursuing ISRO-IIST joint project that looks at space technology and it's mediation into the socio- economic space of households of India. The study, with data being gathered from five states of South India, will look into the diffusion of new space based technology and its impact on the socio-economic wellbeing of households. An understanding of the factors gleaned from this study is anticipated to be useful both for the social scientists studying the determinants of socio-economic sustainability of the household, and for ISRO, who are the creators and producers of such technologies.

Management

V Ravi's Research work in management is focused on supply chain management, reverse logistics and new product development. In supply chain management, resilient supply chain, green and sustainable supply chains is the focus. In resilient supply chain, research on strategies for mitigating various risks in supply chain, its organization and management was studied. In sustainable supply chain, researches on economic, environmental and social aspects to sustainability have been carried out. In reverse logistics issues related to product recovery options as refurbishing, remanufacturing, recycling and quantitative modelling of various parameters have been done. Research has also been conducted for efficient management of electronic (e-waste). In new product development (NPD) studies have been conducted to gain a broad insight about the various issues related to NPD in R & D context.

4.6 Department of Mathematics

Academic	Faculty	11
Students	Ph.D	13
	M.Tech	09

Research Activities

The research activities in the department are spread over a range of disciplines. During the report period, research activities included

Anil Kumar C V's research includes nonlinear analysis and modeling of naturally occurring series from Ionospheric and Magnetospheric data. He has investigated the chaotic dynamics of the time series of Total Electron Content (TEC) in detail. He is also working on Dynamics and Rheology of Periodically forced suspensions. His other area of research interest is in nonlinear dynamics and suspensions. His theoretical and numerical work in these topics will provide insights to develop smart fluids for applications in future projects of ISRO. Additionally he is also involved in the the analysis and modeling of naturally occurring series from Ionospheric and Magnetospheric data. His group investigated the chaotic dynamics of the time series of Total Electron Content (TEC). The analysis based on the calculation of the invariant characteristics such as Lyapunov exponent, Correlation dimension, etc. and of the surrogate data test established the existence of a low dimensional deterministic chaotic system in all cases. Both the dynamics are efficiently modeled to an approximate functional relation in symbolic form using an evolutionary program, which can be used for prediction. This idea may be extended to any system such as earth quake etc. having time series, and hence some information can be obtained, if otherwise impossible.

Deepak T G's research focuses on Modelling and analysis of some queuing problems related to wireless networks. Also, he is working on statistical inference on some probability distributions that are closely related to the phase-type class of distributions. He is involved in a joint Indo-Russian project titled "Elaboration of the Mathematical models, methods, algorithms and computer tools for quality of service evaluation of broadband wireless networks, multimedia information transmission along main transport systems".

Kaushik Mukherjee's research is on developing and analyzing parameter-uniform numerical methods for singularly perturbed parabolic convection-diffusion problems value problems

E Natarajan's research is focused on developing new stabilization methods for the convection dominated reaction diffusion problem over polygonal and polyhedral meshes.

E Natarajan and Sarvesh Kumar are heading a joint project with the Vikram Sarabhai Space Center SMSD team for developing modules for FEAST Software (Finite Element Analysis of Structures).

Prosenjit Das works on topics of Affine Fibrations, Affine Forms, Epimorphism problem, Cancellation problem, Locally Nilpotent Derivations and allied areas. Presently he is collaboratively working with Dr. Neena Gupta of the ISI, Kolkata on the project "Embedding of plane over DVR of characteristic zero"; and with Dr.

Swapnil A. Lokhande, IIIT Vadodara on the project "Study of Locally Nilpotent Derivations on Affine Fibrations".

Dr Raju K George does focussed research on mathematical theory of Control, Orbital Dynamics and soft computing techniques. The problems of fundamental interest in control theory are the one like controllability problems, observability problems, stability problems and optimal control problems etc. We deal with control systems described by nonlinear differential equations both ordinary differential equations and partial differential equations. These problems can be investigated by using the tools of functional analysis, namely, the theory of linear and nonlinear operators. In the analysis we invoke the tools from Monotone operator theory and Lipschitz continuous operator theory. In controllability problem, we characterize conditions for controllability of nonlinear and linearized systems. The Steering controllers are obtained by algorithms established through Banach contraction principle and other iterative schemes. The theory can be applied for finding steering controllers for artificial satellites and launching vehicles. We also employ tools from Artificial Neural Networks and fuzzy logic to obtain steering controller for special systems having fuzzy components.

N Sabu's research is in the broad areas of Mathematical Elasticity.Lower dimensional models of plates and shells are preferred to three dimensional models when the thickness of the plates or shells is very small. One reason for preferring lower dimensional theories is their simpler mathematical structure which permits one to obtain richer variety of results. The other, is these theories are more amenable for numerical computations. Most of the lower dimensional theories rely on a priori assumptions of a mechanical or geometrical nature. Further it is not evident which is the model most to a particular case in hand. Thus before approximating the exact solution of a given lower dimensional model we should first know whether it is close enough to the exact solution of the three dimensional model it is intended to approximate. Thus one is lead to the question of justifying a lower dimensional model starting from the three dimensional model.

K Sakthivel's current research project focuses on ergodic properties of infinite dimensional systems subject tostochastic forces such as Gaussian and Levy type andalso works on the inverse problem of reconstructing physical parameters in higher order parabolic type differential equations using the available measurements of Dirichlet or Neumann type boundary data of the domain. He is involved in a joint project with S.S. Sritharan, Air Force Institute of Technology, Ohio, USA on "Ergodic Properties of Stochastic Fluid Dynamic Models". He is also working on a joint project with A. Hasanov, Izmir University, Turkey on "Parameter Estimation Problems of Partial Differential Equations.

Sarvesh Kumar's research is on development of new discontinuous finite volume schemes (with emphasis on theoretical and computational aspects)

for the approximation of certain fluid flow problems such as: coupled flow-transport problems, immiscible displacement problems, Stoke's equations, nonlinear hyperbolic conservation laws. His research also includes Development and analysis of discontinuous finite volume methods for the approximation of distributed optimal control problems governed by certain partial differential equations subject to pointwise control constraints. He has been collaborating with Dr. Ricardo Ruiz-Bair, Mathematical Institute, University of Oxford, and Prof. Raimund Burger, University the Concepcion, Chile in the area of computational partial differential equations, in particular, on Stokes, Sedimentation-consolidation processes and Poroelasticity equations. In collaboration with Dr. Deepak Mishra of IIST, Sarvesh Kumar has been working on the development and analysis of image fusion techniques for satellite images. Concurrently, he is also involved in a short term NPDE-TCA project that looks into Discontinuous finite volume methods for optimal control problems governed by fluid flow equations.

K S S Moosath's research focuses on Geometric structures of the deformed exponential family and also the dually flat geometry of the deformed exponential family and F-escort probability distributions. Another topic of research was the momentum maps on symplectic manifolds. He has also been working on the geometry of statistical manifold on finite sets. This ongoing work is in collaboration with Dr. Harsha who is a Post-Doctoral Fellow in the Department of Mathematics at IIT Mumbai.

S. Sumitra's research focuses on development of theoretical frame work for Machine Learning algorithms and its application to various domains.

4.7 Department of Physics

Academic	Faculty	13
Scientific	Staff	01
Students	PhD	23
	M.Tech	20

Research Activities

The research activities in the department are spread over a range of disciplines of theoretical and experimental physics. The portions below highlight some of the work that overlaps with the report period.

Apoorva Nagar works in the area of non-equilibrium Statistical Physics and Biological Physics. A major portion of his research focuses on studying steady states in one dimensional dynamical models where non trivial phase structure emerges from relatively simple dynamical rules. Such models are not merely a theoretical tool for exploring nonequilibrium systems but also find applications in various disciplines including Biology. Protein production by

mRNA-Ribosome complexes and the collective motion of ants are two examples from life systems where such models are being applied.

The adaptive optics with capability to measure and subsequently correct the wavefront aberrations forms an indispensable part of any form of optical imaging. Wavefront sensing or and correlation measurements can pave the wave for image correction and image processing for extracting the vital information.

Dinesh N. Naik works on optical imaging in Space Optics, at Applied and Adaptive Optics Laboratory of Department of Physics, IIST, He is working on innovative techniques for optical sensingwith applicationsin optical metrology dedicated to astronomy and remote sensing; an example being spectrally resolved incoherent holography having capability to measure the spatio-temporal coherence function of the field to reconstruct a 3-dimensional object as well as its spectral distribution.

Jayanthi S. is pursuing research in NMR, in particular solid state NMR, which has extended applicability in many fields. Nuclear Magnetic Resonance (NMR) is one of the most powerful ways where the quantum properties of a system are measured Several challenges associated in retrieving dynamic parameters of the system utilizing standard dynamic Floquet theory for computational affability has been achieved. Experimental and theoretical investigations are also being presently corroborated with molecular modelling obtained through molecular dynamic simulations. SERB-DST has funded project, collaborating institute is NCL – Pune to understand atomic level dynamics in functionalized materials.

Collaborators: NCL, Pune TCIS – Hyderabad
IISc – Bangalore
Weizmann Institute of Science
Technion Institute of Technology

K. B. Jinesh. heads the Electronic Materials and Device group. The lab has established a marked progress in research on advanced memory options for post-Flash data storage, high-mobility thin film transistors (TFT's) for display and logic applications and thin film solar cells for space applications. The current focus of this group is in understanding charge transport in graphene-based devices. Recently, the technology of gate-controllable resistive memory (ReRAM) devices using graphene as the channel layer was developed at IIST. In collaboration with NIIST (Trivandrum), the first memory devices using perovskite nanoparticles with tunable programming voltages and organic-inorganic hybrid ReRAM devices were also realized. In addition, the influence of vitrification of polymer active media on the organic ReRAM cells were investigated and the results were published during this annual report period. The group is at present involved in various projects with different ISRO centers for the development of space-qualified ReRAM cells, protective coatings to prevent tribological or plasma erosions, and solar cells for future space missions.

Kuntala Bhattacharjee is pursuing studies of two dimensional (2D) layered

materials like various transition metal dichalcogenides (TMDC), stanene - a 2D allotrope of tin (Sn) etc. on clean semiconductor, metal substrates. Investigations of different growth processes of various self-assembled low dimensional structures and studying surface properties like local electronic density of states (LDOS), band mapping, various defects and dislocations on the surfaces, understanding towards the local electronic properties are underway.

S. Murugesh's research mostly involves non-linear dynamics and their applications to condensed matter systems. With students, he has constructed explicit spin configurations for the breather solution of a one-dimensional Heisenberg ferromagnetic spin system. This corresponds to the breather soliton solution of the gauge equivalent nonlinear Schroedinger equation.

C. S. Narayanmurthy, through the Applied and Adaptive optics lab of the institute, has been developing techniques of high resolution optical systems for earth observations. The presence of stray light in imaging optical systems reduces the image contrast and hence the image quality. To avoid stray light interfering with the image resolution in telescopes, the adaptive optics lab is developing a new baffle design method. Another area that the lab is working on is in developing an electro optical module (EOM) using Shack Hartmann Wave. The lab has already completed the testing of optical system in an integrated electro optical module (EOM). Measurements were conducted using MLA (Micro Lens let Array) using both spherical and plane wave fronts for obtaining optimum results. The applied and adaptive optics lab is also exploring techniques for vibration analysis is time average digital holographic interferometry, where the test object is holographically recorded with a single exposure and using a exposure time longer than compared with the period of vibration one can obtain vibrational fringes for evaluation. The lab has developed methods to detect aerospace structures using time average digital holography with low and high frequencies.

Naveen Surendran works in the area of quantum many-body physics. His research is mainly focused on the study of systems with topological order. Due to topological protection, excitations in such systems are robust against decoherence and are considered the most promising candidates to physically realize quantum gates. With students and other collaborators, he has been studying solvable models with topological order in three dimensions (3D), a much less explored area in comparison to two dimensions. In particular, they have classified the excitations and studied their properties in a 3D generalization of the well-known Kitaev model.

Rakesh Kumar Singh's research interests are in optical metrology, non-diagnostic and in-situ/in-vivo imaging through homogeneous and inhomogenous media, Computational Optics, Coherence-Polarization Optics, Singular Optics, and Diffraction Optics. Through the applied and adaptive optics lab, his group has been developing new and effective techniques to control various physical properties of light

such as polarization, coherence, complex amplitude for applications in optical metrology, imaging and diffraction control. At IIST, the group has successfully demonstrated several new results in the area of physical optics, optical imaging, metrology and coherence theory. In the physical optics, their very recent works are in the creation of singularity in partially coherent light, synthesis of coherence comb structures, controlled synthesis of coherence and polarization of the light, ghost diffraction for singularity in low coherent light, development of an experimental technique to determine statistical properties of light. In the applied domain, their recent contributions are new method to recover complex coherence function from single shot intensity measurement, quantitative phase contrast imaging through the random scattering medium, imaging of 3D complex valued objects from laser speckles, 3D deformation measurement by self referencing holography, polarization imaging in free space and in random scattering medium, complex field imaging by combining speckle interferometry with computational optics, development of new Jones matrix imaging system for the birefringence measurement etc.

Solomon Ivan, works in the area of quantum information theory and quantum optics by the notion of nonclasicality breaking which was introduced for the first time. A mathematical classification of all the single-mode bosonic Gaussian noisy channels was established. The connection to degardation to entanglement of correlated photons on passage through such a channel was brought out by this work. This research is highly relevant in quantum communication through a noisy channel such as atmospheric turbulence for instance. Solomon's group also carried out an experiment in collaboration with the Raman Research Institute, Bangalore, involving the development of a novel method to control `classical light' to achieve a desired photon statistic. New incoherent states of `classical light' were theoretically proposed and then experimentally demonstrated in this work. The work has implications towards generating exotic states of `nonclassical light'. In another experimental work, the profile of a light beam as it propagates through atmospheric turbulence like conditions was investigated, with several quantities of physical interest measured and presented. New and highly significant findings in free space communication in a turbulent atmosphere were also published during the report period. This latter work is much relevant for ISRO's current interests in free space optical communication, and adaptive optics. The group also published very recently the fundamental role of spatial coherence of a light field in the context of phase estimation from transverse intensity measurements. The work has implications for commercially available wavefront sensing devices which encorporate such algorithms, such as those routinely used in SAC Ahmedabad for ISRO applications. In a more recent work, an algorithm to extract phase in its unwrapped form from an interferogram having perturbed straight line fringes was proposed and studied. The work is applicable for surface metrology and surface profiling of reflectors, which is relevant to the routine work carried out at ISRO's LEOS center in Bangalore.

Sourin Mukhopadhyay's research focuses on the realm ofstrongly correlated electronic quantum matter and visualization of these electronic structures, different phases and their emergent behavior both in *real space* and *momentum space*. Using spectroscopic imaging scanning tunneling microscopy (SI-STM) and other transport spectroscopic experiments he tries to explore the quantum realm of electronic matter, identify the underlying interactions leading to their unique phases at the atomic scale.Throughout, the focus is on development of innovative techniques and approaches to each problem.

Sudheesh Chethil's interests are also in the area of quantum optics and quantum information. His work has brought out several important applications of optical tomograms in quantum dynamics and entanglement. The manifestations of revivals and fractional revivals of quantum states have been shown directly in the optical tomogram of the time evolved quantum states, which in turn can help experimentalists avoid the errors that can accumulate during the reconstruction process of quantum states. The investigations on the effect of decoherence on the optical tomograms of states at the instants of fractional revivals can be used to find out how much the decoherence models really capture the effects of environmental interactions in an actual experimental setting.

Umesh R. Khadane heads the Atomic and Molecular physics lab, The group has been studying indirect ionization and related structural effect on large molecules like PAHs. An electron-ion coincidence setup was designed and fabricated at IIST for this purpose. The lab has also been providing support, for several years now, to the ongoing LPSC-ISRO program in electric propulsion systems. Within the period of this report, one new facility was added to this collaboration and five new sets of diagnostic probes were developed and delivered to LPSC. Out of these, three probes, namely RPA, Faraday Probe and Langmuir probe have already been tested and are in regular use at IVTF, LPSC, Bangalore for the test of 75 mN Hall effect thrusters. These probes allow one to precisely measure several vital plasma properties; they can perform beam intensity measurements accurately close to the thruster without disturbing the plasma, and they can measure the velocity and obtain the full energy spectrum of the ions.

4.8 Advanced Space Technology Development Cell (ASTDC)

In the last one year, ASTDC, in collaboration with Dean R&D and the project review committee has reviewed all the thirty-six ongoing ISRO-IIST projects as well as ten new projects. The review has brought out the progress made as well as the challenges faced by the principal investigators. The challenges were mainly in obtaining sufficient funding as well as recruitment of project personnel for carrying out the work. These were mitigated to some extent by projection of a more robust budget requirement for BE2018-19 as well as

fast tracking recruitment of project personnel. ASTDC participated in the recruitment process and ensured the availability of some project personnel. A second round of recruitment is in progress.

Currently there are forty-six projects in collaboration with ISRO centres which are in progress in IIST. These projects are in collaboration with SCL. SAC, NRSC, ISAC, VSSC, IISU, LPSC and IPRC. Of the projects of importance to the space programme, the following nine have made good progress and are very relevant for ISRO.

They are:

1. **NRSC project: Design and development of a Ka band antenna system** to be used for Cartosat 3 data reception. The design of an integrated tri-band (S/X/Ka) monopulse autotracking feed for satellite data reception was completed and a joint IIST-NRSC review was conducted. In addition, the modelling of the main and sub-reflectors, as well deformation of the reflectors due to environmental effects was also completed. Further work is being taken up to support development and fabrication of the antenna system.

2. **IPRC project: Design and Development of High Performance Hydrogen Sensor** Characterisation of the newly developed sensor was carried out in IIST and subsequently in IPRC and the response was found to be on par or better than commercially available systems. Packaging of the sensor and the supporting electronics has been initiated.

3. **SCL project: Design and development of two ASICS**.
   The preliminary designs of ASICS for the programmable gain difference amplifier and 14 Bit, 1MSPS SAR ADC have been completed. Several reviews of these projects in collaboration with SCL were carried out. The remaining work leading to final design and fabrication of the ASICs in SCL is in progress. This has been a very important learning process towards building competence in ASIC design capability in IIST.

4. **VSSC project: Intrinsically conducting polyimide composites with CNT or graphene with good optical properties**. Several more samples were fabricated and tested and showed desirable properties. More samples need to be fabricated and qualification exercise will be initiated.

5. **VSSC project: Flexible Wiping Substrate for SERS detection of explosives**
   This project has achieved its objectives and the next phase of prototype development is in progress.

6. **IPRC project: Development of Novel N2O4 scrubber system**

The objective of this project was to develop an improved method of scrubbing of N2O4 and the results achieved show improvement over the existing system. Work leading to an operational system is being taken up.

7. **VSSC project: Development of carbon foam – CMC sandwich composites**
   The objective of this project is to develop refractory materials for thermal protection of exposed surfaces of re-entry vehicles. Prototype development and testing show encouraging results. The process has to be scaled to larger dimensions and further work on qualification of the process is in progress.

8. **LPSC project: Comprehensive stationary plasma thruster diagnostics instrumentation**
   The electric propulsion project being carried out in LPSC was supported by providing plasma diagnostics instrumentation including Retarding Potential Analysers, Langmuir probes and Faraday probes. Five types of probes were designed, built and tested at IIST and installed at HET test facilities in LPSC Valiamala as well as in LPSC Bangalore. Three probes, Faraday probe, Retarding Potential Analyser probe and Langmuir probe are already installed and are in regular use at IVTF, LPSC Bangalore. The other two probes, E X B probe and parallel plate analyser probe were completed and installed.
   After completion of this project, IIST is a partner for the High Thrust Electric propulsion system (HET) project. The responsibility of IIST, with Dr. Umesh Kadhane as Deputy Project Director, is to design and develop the thruster diagnostic system.
   ASTDC is participating in HET project as a member of the Technical Advisory Committee (TAC).

9. **IISU project: Surface engineering techniques for improving the life performance of ball bearings in ISRO spacecraft mechanisms.**
   This project aims to design and develop specific coatings for the balls in the bearing assembly which will reduce friction and enhance the life of bearings. An important part of this project is in-house design and development of an Atomic Layer Deposition (ALD) System, which is required for the coatings. Procurement of a commercial ALD costs several crore rupees, while in-house development is expected to be less tha n half a crore rupees.

In addition to the ISRO-IIST projects, ASTDC has been actively involved in the following student satellite and planetary payload development.

1. **Student satellite projects:** The IIST Nanosatellite project is being designed and developed by the student under the guidance of faculty. ASTDC has enabled interaction with subject experts in VSSC, ISAC, SAC as well as industry for fabrication of electronic cards. Several lectures on systems reliability, pcb fabrication, testing and EMI/EMC aspects were arranged.

2. In addition, ASTDC is responsible for coordination and guidance of two IIST student satellite projects with international collaboration. These are **AAReST student satellite project** in collaboration with JPL/Caltech and University of Surrey and **INSPIRE student satellite project** in collaboration with University of Colorado and National Central University of Taiwan. An important contribution was arranging regular reviews, providing technical support and guidance to the team.

3. **Design and development of Retarding Potential Analyser for Mars Orbiter Mission-2 and proposal for Venus mission.**
   ASTDC has worked closely with faculty and students in encouraging proposals for the two planetary missions. Five payloads were proposed for MOM-2 and after several rounds of presentations to the ADCOS committee, one payload, the RPA was awarded to IIST. This is the first time that IIST is participating in science missions of ISRO with a payload. The RPA instrument proposal for the Venus mission has undergone the first ADCOS committee review. Regular meetings of the payload and science teams have been arranged to facilitate timely progress of the project.

New Venture

Collaboration with Sree Chitra Tirunal Institute of Medical Sciences and Technology

Discussions are underway for technical collaboration with the Bio-Medical Technology Wing of the Sree Chitra Tirunal Institute of Medical Sciences and Technology, Trivandrum. The proposed collaboration will involve photonics design and development for various biomedical instruments.

4.9 Centres of Excellence

Advanced Propulsion and Laser Diagnostics (APLD)

(Department of Aerospace Engineering)

The setting up the Advanced Propulsion and Laser Diagnostics (APLD) is aimed at the establishment of a centre of excellence that will serve as (i) centre for conducting academic research in IIST which would assist ISRO activities, (ii) national facility for performing advanced research and (iii) national technological development centre for aerospace organizations. The current objective is to perform propulsion research studies through laser diagnostic techniques. The short term scope and objective of setting up the laboratory is to primarily focus on applying 10 Hz and 1 MHz laser diagnostic techniques to basic propulsion facilities while the long term goal is to apply it to real scale engines that are most relevant to ISRO's technological development.

As part of the ongoing research activities in academic year 2016-17, the following major studies were carried out:

a. Pintle Injector Characterization for Throttleabe engines that could be used for lunar and Mars landing missions and also for stage recovery missions.
b. Supercritical heat transfer characterization that mimicks the flow heat transfer in LOx-Methane Expander Cycle Engines
c. Kerosene-Quantum dot nanofluid fuel for reduced ignition delay that can play vital role in ISRO's Scramjet mission with hydrocarbon based fuel
d. Annular liquid film visualization for characterizing film cooling in thrust chambers; can lead to improvement in existing ISPs
e. Development of IIST-Rocket Propulsion Code (IIST-RPC) for Thrust chamber performance analysis which is validated against the established codes of NASA CEA and RPA.
f. Preliminary design of microthruster for AARest mission
g. Extensive studies on Supersonic cavity flow field for noise suppression

The research activities carried out in the APLD lab contributed to three peer reviewed journal, two international conference and three national conference publications.

Virtual Reality Lab

(Department of Avionics)

Computer Vision and Virtual Reality Lab (CVVR lab) carries out research in the area of image and signal processing, computer vision using machine learning tools & techniques, and Virtual reality applications. The lab is equipped with state of the art computing facility and imaging equipments for computer vision and virtual reality research. The research work that this lab focuses on are Artificial Intelligence application in signal processing, deep learning and machine learning applications, computer vision tracking for surveillance applications, compressive holography. Recent work includes proposing deep leaning for object recognition and tracking, video summarization, image fusion, and tracking objects in a sequence of videos, content based retrieval and copy detection. Recently proposed a robust integrated tracker which is short listed in VOT 2017 challenge as one of the best trackers and results will be published in ICCV conference 2017. Currently, two ISRO-IIST and one IIST research project are under progress. The lab also works on bio-inspired computing and on various problems related to computational neuroscience & neuroinformatics. One Mtech Project and one Btech project that carried out at this lab was shortlisted for presentation at INAE best project award 2017.

Center of Advance Research in Nanoscience and Technology

(Department of Chemistry)

For facilitating research in Nanoscience and Technology and to address challenges in Space Science and Technology and related areas the department has established a centre of Advanced Research in Nanoscience and Technology. The Department is in the process of bringing all the facilities required to conduct advanced research in Nanoscience and allied fields. Currently, facilities such as Atomic Force Microscope, Particle size Analyzer, Glove

Box, Electrospinning Machine, Contact angle Goniometer, HPLC, Planetary Ball Mill and Surface Area Analyser, ESI mass spectrometer etc. are available in centre. The Department plans to add X-ray Diffractometer and Scanning electron microscope to the facilities shortly.

4.10 Advanced Research Facility in Atmosphere Science

Climate Observatory

(Department of Earth and Space Sciences)

The **Climate observatory** at Ponmudi continues to provide important micro-meteorological measurements such as air temperature, pressure, turbulence, relative humidity, soil moisture, soil temperature and radiation. An Automatic Weather Station (AWS) facility was recently installed in the climate observatory at Ponmudi hills (1081 meter asl; 8^0 45' 26"N, 77^0 06' 50"E). The AWS instruments include Fast response sensors and slow response sensors to make measurements on continuous basis. Fast response sensors include sonic anemometer, CO_2 and H_2O vapor analyser for the intensive measurements of eddy covariance flux which will help to understand the carbon exchange between hilly ecosystem and the atmosphere in climate change perspective.

4.11 Projects

Sl No	Name of the Programmes/Activities/Schemes/Projects	Principal Investigator/Co-Investigator
1	Studies on crack propagation in composites by micro Raman spectroscopy, starting in 2016 July (IIST/ISRO project)	**Dr. Anup S.** **Dr. Bijudas C. R.** Dr. Ramesh Narayanan Sudarsana Rao
2	Laser Sheet Droplet Sizing for Spray Studies (ISRO-IIST R&D project)	**Dr. Aravind V** Dr John Tharakan (LPSC)
3	Design and Analysis of a new Tri-band ground station antenna system for NRSC Hyderabad.	**Dr. Bijudas Das C R**
4	Studies on Crack propagation in composites by Micro Raman spectroscopy (IIST-ISRO project)	**Dr. Bijudas Das C R**
5	Assessment of machining characteristics of ablative materials (ongoing)	**Dr. Chakravarthy P**
6	Studies on Secondary Injection to an Expanding Supersonic Cross Flow	**Dr. Rajesh Sadanandan** **Dr. Deepu M**

7	Development of experimental rover and investigation of mobility and approaches for local and global motion planning on uneven terrain	**Dr. K Kurien Issac** Gaurav Sharma (ISAC), Shamrao (ISAC), Abhishek Kumar (ISAC)
8	Latent and Sensible heat thermal storage system for medium and high temperature CSP applications (IMPRINT India)	**Dr. K. V. Manu** Prof. Saptarshi Basu, (IISc Bangalore)
9	ISRO-IIST Approved on April01,2016 Duration : 2years Performance characterisation and development of numerical model for cavitatingventuri	**Dr. Pradeep Kumar P** **Dr. Aravind.V** Dr. Nandakumar, (Group Director, LPSC)
10	Experimental and numerical study of stationary flat flames	**Dr. C.Prathap** Dr. Nandakumar, (LPSC Valiamala)
11	Experimental investigation of laminar burning velocity of premixed Isrosene/air/oxygen mixtures using freely expanding spherical flames	**Dr. C.Prathap** Dr. Nandakumar, (LPSC Valiamala)
12	Mixing Enhancement in Supersonic Combustors Using Pylon-Cavity Flameholder	**Dr. Rajesh Sadanandan**
13	Studies on Secondary Injection to an Expanding Supersonic Cross Flow	**Dr. Rajesh Sadanandan** **Dr. Deepu M**
14	Structural reliability of thin cylindrical and spherical shells used for Aerospace Structures	**Dr. Arun C.O.** **Dr. P.Raveendranath** B.S.Raju(VSSC)
15	IIST-LPSC Project-Influence of compressibility and stream wise pressure gradient on film cooling performance	**Dr. Shine S R** J. C. Pisharadi
16	IIST-LPSC Project- Investigation of wavy microchannel flow with nanofluids	**Dr. Shine S R** Dr. Deepak kumar Agarwal
17	Modelling and controller design for micro actuators	**Dr. N.Selvaganesan** D.Venkittaraman / Raji George / Rajesh Ravi (LPSC)
18	Design and development of brushless DC motor	**Dr. N.Selvaganesan** M. N. Namboothiripad and Pradeep Kumar (VSSC)

19	Optimal Scheduling and Routing of Packets over Delay Tolerant Hierarchical Interplanetary networks	**Dr. B. S. Manoj,** **Dr. Vineeth B. S** (IIST project)
20	Research and Development of an Integrated Enterprise Network Security System (IIST-ISRO collaboration)	**Dr. B. S. Manoj** (IIST-ISRO project)
21	Indo-US collaborative Research on Pervasive Computing for Disaster Response	**Dr. B. S. Manoj** India side PI, IIST, DIT and NSF Caltech, Pasadena, CA and University of California Irvine, Irvine, CA
22	MICRONet – Mobile Infrastructure for Coastal Region Offshore Communications & Networks	**Dr. B. S. Manoj** IIST, Antrix Corporation (ISRO), Amrita University, and Indian Institute of Information Technology and Management -Kerala, India
23	IIST MeshNet: A Programmable Hybrid Wireless Mesh Network Testbed	**Dr. B. S. Manoj**
24	Design of Autonomous walking control of Humanoid Robot.	**Sam K Zachariah /** **Dr. Kurian Issac**
25	Development and Analysis of Image Fusion Techniques for Satellite Images	**Dr. Deepak Mishra** **Dr. Sarvesh Kumar**
26	Object Based High Resolution Image Analysis for the Land Slide and Land Use Land Cover Classification'	**Dr. Deepak Mishra** Dr. Tapas Martha (NRSC) **Dr. Rama Rao**
27	Developing of Virtual reality model for disaster simulation	**Dr. Deepak Mishra**
28	Flash ADC Design- IIST-SCL collaboration Project	**Dr. Sheeba Rani J** Dr. H.S.Jatana (SCL Chandigarh)
29	ASIC Design-SAR ADC- IIST-SCL Collaboration Project	**Dr. Sheeba Rani J** Dr. H.S.Jatana (SCL Chandigarh) Mohammed Aseem (SCL Chandigarh)

30	Triband (S/X/Ka) Monopulse Auto Tracking Feed for LEO satellites ISRO-IIST Project	**Dr. Basudeb Ghosh** **Dr. Chinmoy Saha** T Naga Sekhar G Baig and Sandip Sankar Roy (NRSC)
31	Design and Implementation of a Compact Wideband Microstrip Patch Antenna. ISRO-IIST Project	**Dr. Chinmoy Saha** K K Mukundan
32	Design and Development of High Performance Hydrogen Sensor for IPRC, Mahendragiri	**Dr. Palash Kumar Basu**
33	SERB Extra Mural Research Funding	**Dr. Seena V**
34	IIST/ISRO Project scheme Development of MEMS Accelerometer with Ultra-Sensitive Transductions for Space Applications	**Dr. Seena V**
35	Novel Integrated Electromechanical Transduction for Nanomechanical Sensors	**Dr. Seena V**
36	Development of Parylene MEMS piezoresistive accelerometer **Cost of fabrication at Nanofabrication facility, CEN IIT B is sponsored by Meity, Govt of India*	**Dr. Seena V**
37	Design and Development of Hydrogen Sensor and Signal conditioners	**Dr. Anoop C.S**
38	Design and Analysis of passive and active optical waveguides for optical interconnects	**Dr. Sooraj R**
39	Decoupled Control Scheme for Dual Permanent Magnet Machine Actuators	**Dr. R. Sudharshan Kaarthik**
40	Real time algorithms for track estimation for Multiobject Tracking Radar (IIST-ISRO project)	**Dr.Vineeth B. S** Sai Gorthi
41	Development of carbon foam-CMC Sandwich Composites	**Dr.K. Prabhakaran** Dr. Deepa (VSSC) Dr. R. Sreeja (VSSC)
42	Ceramic Foams by Emulsion Casting	**Dr.K. Prabhakaran** Dr. P.V. Prabhakaran and Dr. R. Sreeja (VSSC)

43	Superionic conductor as electrolytes for all solid-state-lithium sulfur batteries	**Dr. J. Mary Gladis** Dr. Manuel Stephane (CSIR-CECRI)
44	N-doped mesoporous carbon - sulphur composite based cathode materials for advanced lithium-sulfur batteries	**Dr. J. Mary Gladis** Dr. S.A. Ilangovan (VSSC) Dr. C. Gouri (VSSC) S Sujatha (VSSC)
45	Plasma functionalized CNT-polymer nanocomposites for satellite structural applications	**Dr. Gomathi N** **Dr. Kuruvilla Joseph** Dr. C.Gouri, VSSC
46	Study of Silicon-polymer nanofibers as anode material for Lithium batteries	**Dr. K. Y.Sandhya** **Dr. Nirmala Rachel James**, S. A. Illangovan (ISRO), S. Sujatha (ISRO)
47	Flexible Wiping Substrate for SERS Detection of Explosives/Pesticides (IIST-ISRO Project)	**Dr. Jobin Cyriac** Benny K. George S. Bhuvaneswary, VSSC
48	Switchable Functional Supramolecular Networks on Surfaces	**Dr. Mahesh S** (DST-Inspire)
49	Design and Synthesis of Magnetically Responsive self-assembled polymer Composites (DST nanomission)	**Dr. Mahesh S**
50	N-containing heterocycles as aurora kinase inhibitors – computational design and synthesis	**Dr.K.G. Sreejalekshmi**
51	Intrinsically Conducting Polymide composites with CNT or Graphene having Electrostatics Charge Mitigating Characteristics for Space Application	**Dr. Kuruvilla Joseph** Dr.Muralikrishnan Dr. R.S. Rajeev
52	Development of novel N2O4 scrubber system	**Dr. Kuruvilla Joseph**
53	Nav|C-GAGANUtilization Programmeat Space ApplicationsCentre, ISRO Ahmedabad Project title: A study on the effects of ionospheric variabilities on the usability of IRNSS/GAGAN using observations and models	**Dr. Ambili K M** **Dr. Priyadarshanam**

54	Martian Orbiter Mission II of ISRO Project: Development of Advanced retarding potential analyzer for the martian ionospheric studies (ARIS)	**Dr. Ambili K. M** **Dr. Anoop C S** **Dr. Rajeevan P. P.** **Dr. R. Sudharshan Kaarthik**
55	Radio Mapping of IR Dust Bubbles	**Dr. Anandmayee Tej**
56	Improving the operational forecast of SASE using 4DVAR Data Assimilation Scheme	**Dr. Govindan Kutty**
57	Geological and Spectral studies of Terrestrial Analogue Rocks: Implications for the exploration of Mars, 2015 – 2017, IIST, Trivandrum	**Dr. Gnanapazham**
58	Geological and spectral studies of terrestrial analogue rocks: Implications for Mars exploration (IIST Project- ongoing)	**Dr. Rajesh V J**
59	Deep crustal processes during the evolution of archaeanNilgiri block, southern India (MoES Project- ongoing)	**Dr. Rajesh V J**
60	Study of Moon and Mars analogues: Investigations on orthopyroxene-olivine-spinel (OOS) group of minerals and cumulate rocks in India based on remote sensing, mineralogical and geochemical methods.(SAC-ISRO Project- ongoing)	**Dr. Rajesh V J**
61	Spectral characterization and morphology of olivine-pyroxene-spinel bearing lithologies on Moon; implications for lunar endogenic processes (ISRO Chandrayaan-I AO Project- ongoing)	**Dr. Rajesh V J**
52	A comprehensive study on crustal dichotomy and extensional tectonics in and aroung Valles Marineris, Mars (ISRO MOM-I AO Project- ongoing)	**Dr. Rajesh V J**
63	Integrating air and space borne spectroscopy and laser scanning to assess structural and functional characteristics of crops and field margin vegetation (DBT Funded)	**Dr. Ramiya A M**
64	Physics of radio bright gamma ray burst afterglows	**Dr.Resmi Lekshmi** Kuntal Misra, ARIES, Nainital

65	Radio Continuum mapping of ionized emission associated with infrared bubbles.	**Dr. Sarita Vig**
66	'Space Technology: Its penetration into the Socio Economic Space of the Households of India Phase I- South India'- IIST- ISRO Project	**Dr.Lekshmi V Nair** **Dr. Shaijumon C.S.**
67	Assesment of the contributions made by IIST Alumni in the ISRO Programmes	**Dr. V Ravi** **Dr. Gigy J Alex**
68	Indo-Russian project titled "Elaboration of the Mathematical models, methods, algorithms and computer tools for quality of service evaluation of broadband wireless networks, multimedia information transmission along main transport systems".	**Dr. Deepak T G**
69	Algebraic multigrid for sparse linear solvers	**Dr. Natarajan. E**
70	Algebraic multigrid method for solving sparse linaer system	**Dr. Sarvesh Kumar**
71	Development and Analysis of Image Fusion Techniques for Satellite Images	**Dr. Sarvesh Kumar**
72	Study of dynamics induced by very small amounts of water molecules through deuterium MAS solid state NMR and molecular Dynamic Simulations (SERB-DST EMR Project)	**Dr. S. Jayanthi** T.G. Ajithkumar
73	Generation of analysis of light source with unconventional correlation structures (Extramural Scheme- Science and Engineering Research Board (SERB)/DST-India)	**Rakesh Kumar Singh**
74	Laser speckle for small deformation measurement (ISRO-IIST Project (SAC Ahmedabad))	**Rakesh Kumar Singh** Sachin Kumar Daksh (SAC)

4.12 Intellectual Property Rights

Institute's policy is to protect its intellectual property, and contribute to the country's industrial growth by facilitating commercial exploitation of such property through transferring technology and licensing its patents. Such activities started formally within IIST by 2014, and are being coordinated by Dean IPR & Continuing Education.

In the year 2016-17 IIST filed 2 patent applications. Since its inception in 2007, the institute has filed 12 applications for patents. Some industries have expressed interest in some of our technologies.

Patents Applied

- **Kuruvilla Joseph**, Meegle S Mathew, "Novel biosensor for the detection of creatinine", Indian Patent File No. 201741000489.
- **Dr. Rakesh Kumar Singh**, Ms. Annie Varghese, "Novel A new self referencing digital lensless holography arrangement using Sagnac interferometer and decollimated beam", Indian Patent File No. 201741010417.

4.13 Awards and Recognitions

IIST faculty members made significant contributions in the areas of teaching and research. They won several awards and honours.

Name	Department	Award / Recognition
ASI Award		
Chandrasekar A	Earth & Space Sciences	Astronautical Society of India (ASI) award in the area of 'Space Science and Applications'
2016 ASCE Outstanding Reviewer		
Aravind Vaidyanathan	Aerospace Engineering	Journal of Aerospace Engineering (American Society of Civil Engineers)
Young Scientist Award		
Seena V	Avionics	2016 Kerala State Young Scientist Award, Kerala State Council for Science, Technology & Environment (KSCSTE), Govt. of Kerala.
Ambili K. M.	Earth and Space Sciences	Young Scientist award, URSI APRASC, Seoul, South Korea, August 2016
Vice-Chairman of IEEE Anetnnas and Propagation Society IEEE Kerala Chapter Chair		
Chinmoy Saha	Avionics	Nominated for 2017.
Best Oral Presentation Award		
Mohankumar.L, Anandapadmanabhan.E.N, **Chakravarthy P**	Aerospace Engineering	"Advanced Manufacturing Processes for Aerospace Ablative Composites", National Aerospace Manufacturing Seminar.

Best Paper Award		
Kakanuru Sumithra **Deepak Mishra**	Avionics	"Integrated Algorithm for Tracking Using KCF and TLD and its Extensive Evaluation", INAE Best Project Award
Latheef A Shaik , J.Y. Siddiqui **Chinmoy Saha**	Avionics	"Coplanar Wave guide Fed Tapered Slot Antenna with Multifunctional Characteristics" , URSI (International Union of Radio Science) RCRS Conference organized by NARL, DOS, Government of India during March 1-4, 2017.
Jyothi AKB, **Chinmoy Saha** **Basudeb Ghosh.**	Avionics	"Think-Nano Symposium ", JN Tata Auditorium, IISC Bangalore, India during March 31st - April 1st 2016.
Neema P.M., **Jobin Cyriac**	Chemistry	"One Pot Synthesis of Highly Luminescent MoS2 Quantum Dots Interspersed in Nanosheets" International Union of Materials Research Society - ICYRAM Conference-December 2016 IISc Bangalore
Springer Best Student Paper Award		
Rahul Singh, Abhishek Chakraborty **B. S. Manoj**	Avionics	For the paper titled "Graph Fourier Transform Based on Directed Laplacian" at the 11th International Conference on Signal Processing and Communications (SPCOM) 2016, IISc Bangalore, June 2016.
Best Poster Award		
C. LalithaLekshmi, Kizhisseri Devi Renuka, K. Joseph **Mahesh S**	Chemistry	"Sustainable Materials: Simple & Cost-effective synthesis of GQDs from Honey" in 29th Kerala Science Congress at Marthoma College,Thiruvalla, January 28-30, 2017
Pralay Raj **Ambili K. M**	Earth and Space Sciences	Kerala Science Congress, January 2017 "Morphological features of ionospheric variabilities estimated using geostationary satellites"
Sam Uthup, **V.J. Rajesh**, Satadru Bhattacharya	Earth & Space Sciences	Third Prize "Spectral and chemical features of anorthosite complexes in southern India: implications for lunar highland anorthosite evolution", 2016 International Association for Gondwana Research Annual convention

4.14 Research Publications

4.14. 1 Journal Papers

DEPARTMENT OF AEROSPACE ENGINEERING

- Tripathi, S. M**., Anup S**., Muthukumar, R, (2016). "Effect of geometrical parameters on mode shape and critical buckling load of dished shells under external pressure". *Thin Walled Structures*, Vol. 106, pp. 218-227.

- S Mathiazhagan, **S Anup.,** (2016). "Mechanical behaviour of bio-inspired brittle-matrix nanocomposites under different strain rates using molecular dynamics". *Molecular Simulation* ,Vol. 42 (18), pp. 1490-1501.

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- S Mathiazhagan, **S Anup.,** (2016). "Influence of platelet aspect ratio on the mechanical behavior of bio-inspired nanocomposites using molecular dynamics", *Journal of the Mechanical Behavior of Biomedical Materials*, pp.21-40.

- Sahu, R., & **Anup. S.**, (2016). Molecular dynamics study of toughening mechanisms in nano-composites as a function of structural arrangement of reinforcements", *Materials & Design*,Vol 100, pp. 132-140.

- Malhotra A., and **Vaidyanathan, A.**,(2016). "Aft Wall Offset Effects on Open Cavities in Confined Supersonic Flow", *Experimental Thermal and Fluid Science*, Vol. 74, pp. 411-428.

- Kannayain, K., Banda, M. V.K., and **Vaidyanathan, A.**, (2016). "Planar Sauter Mean Diameter Measurements in Liquid Centered Swirl Coaxial Injector using Laser Induced Fluorescence, Mie Scattering and laser diffraction techniques", *Acta Astronautica*, Vol. 123, pp.257-270.

- Muthukuamaran, C.K., and **Vaidyanathan, A.,** (2016). "Initial instability of round liquid jet at subcritical and supercritical environments", *Physics of Fluids*, Vol.28 (7), pp. 074104.

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- Mohan Kumar.L, Usha.K.M, Anandapadmanabhan. E.N, and **Chakravarthy.P**, "Effect of fibre orientation on the properties and functional performance of ablative materials for solid rocket motors" Accepted for publication in *Transactions of the Indian Institute of Metals*, (2017).

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- **M. Deepu**, M.P. Dhrishit, S. Shyji, (2017). "Numerical simulation of high speed reacting shear layers using AUSM+-up scheme-based unstructured finite volume method solver", *International Journal of Modeling, Simulation, and Scientific Computing*, 1750020.

- S. Shyji, **M. Deepu**, N. A. Kumar, T.Jayachandra (2017). "Numerical Studies on Thrust Augmentation in High Area Ratio Rocket Nozzles by Secondary Injection", *Journal of Applied Fluid Mechanics*, Vol. 10, No. 6.

- G. P. Aravind, K. M. M Rafi, **M. Deepu**, (2017). "Numerical study on passive convective mass transfer enhancement", *Journal of Physics: Conference Series* Vol. 822, No 1, pp. 12064.

- Subrahmanyam Saderla, **Dhayalan**, **R**, Ajoy Kanti Ghosh, (2016), "Longitudinal parameter estimation from real flight data of unmanned cropped delta flat plate configuration", *International Journal of Intelligent Unmanned Systems*, Vol. 4 Iss 1, pp. 2 – 22.

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- Saderla. S, **Dhayalan. R,** Ghosh. AK, (2017). "Non-linear aerodynamic modelling of unmanned cropped delta configuration from experimental data", *The Aeronautical Journal*, Cambridge University Press, Vol. 121, pp. 320-340.

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- Tinaikar, A., Advaith, S., Chetia, U. K., **Manu. K. V**., Basu, S. (2016). "Spatio-temporal disruption of thermocline by successive laminar vortex pairs in a single tank thermal energy storage". *Applied Thermal Engineering*, Vol.109, pp. 924-935.

- Hatte, S., Mira-Hernandez, C., Advaith, S., Tinaikar, A., Chetia, U. K., **Manu, K. V**., & Basu, S. (2016). "Short and long-term sensitivity of lab-scale thermocline based thermal storage to flow disturbances". *Applied Thermal Engineering*, Vol. 109, pp. 936-948.

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- Dharmendra Singh Yadav, A. Chakraborty, and **B. S. Manoj**., (2016). "A Multi-Backup Path Protection scheme for survivability in Elastic Optical Networks," *Elsevier Optical Fiber Technology*, Vol. 30, pp. 167-175.

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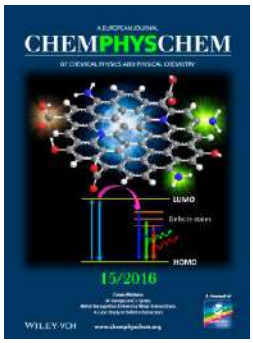

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- Shiju S. S., Asif Salim, **Sumitra S**., Formulation of Two Stage Multiple Kernel Learning using Regression Framework. Accepted for oral presentation in the Seventh International Conference on Pattern Recognition and Machine Intelligence (PReMI), December 05-08, 2017, and for publication in the Conference proceedings of PReMI2017. (LNCS Volume no. 10597).

- **K S Subrahamanian Moosath**, K.V. Harsha, "Mismatched Estimation in an Exponential Family", *E-Proceedings of International Conference on Information Geometry and Its Applications-IV, June 12-17, Liblice.*

- K.V. Harsha, **K S Subrahamanian Moosath**,"Estimation in a Deformed Exponential Family", *E-Proceedings of International Conference on Information Geometry and Its Applications-IV, June 12-17, Liblice.*

- Mahesh T V, **K S Subrahamanian Moosath**, "Information Geometry - Geometry of Exponential Family", *International Conference on Differential Geometry, Algebra and Analysis, Nov 15-17, Jamia Millia Islamia (Central University), New Delhi*

4.14.3 Books / Book Chapter

- **V.S. Sooraj, V. Radhakrishnan.**, "Elasto-Abrasive Finishing", 6th Chapter in the proposed book Nano-finishing Science and Technology: Basic and Advanced Finishing and Polishing Processes, Taylor and Francis (CRC): 2016.

- **Anindya Dasgupta**, Parthasarathi Sensarma, "Design and control of matrix converters for regulated 3-phase power supply and voltage sag mitigation for linear loads", *Springer Series on Energy Systems in Electrical Engineering, ISBN - 978-981-10-3831-0.*

- P. Singh, A. Chakraborty, and **B. S. Manoj**, "Complex Network Entropy," Chapter in the book titled *Soft Computing Applications in Sensor Networks*", edited by Prof. Sankar K. Pal and Prof. Sudip Misra, September 27, 2016 by Chapman and Hall/CRC Press ,USA.

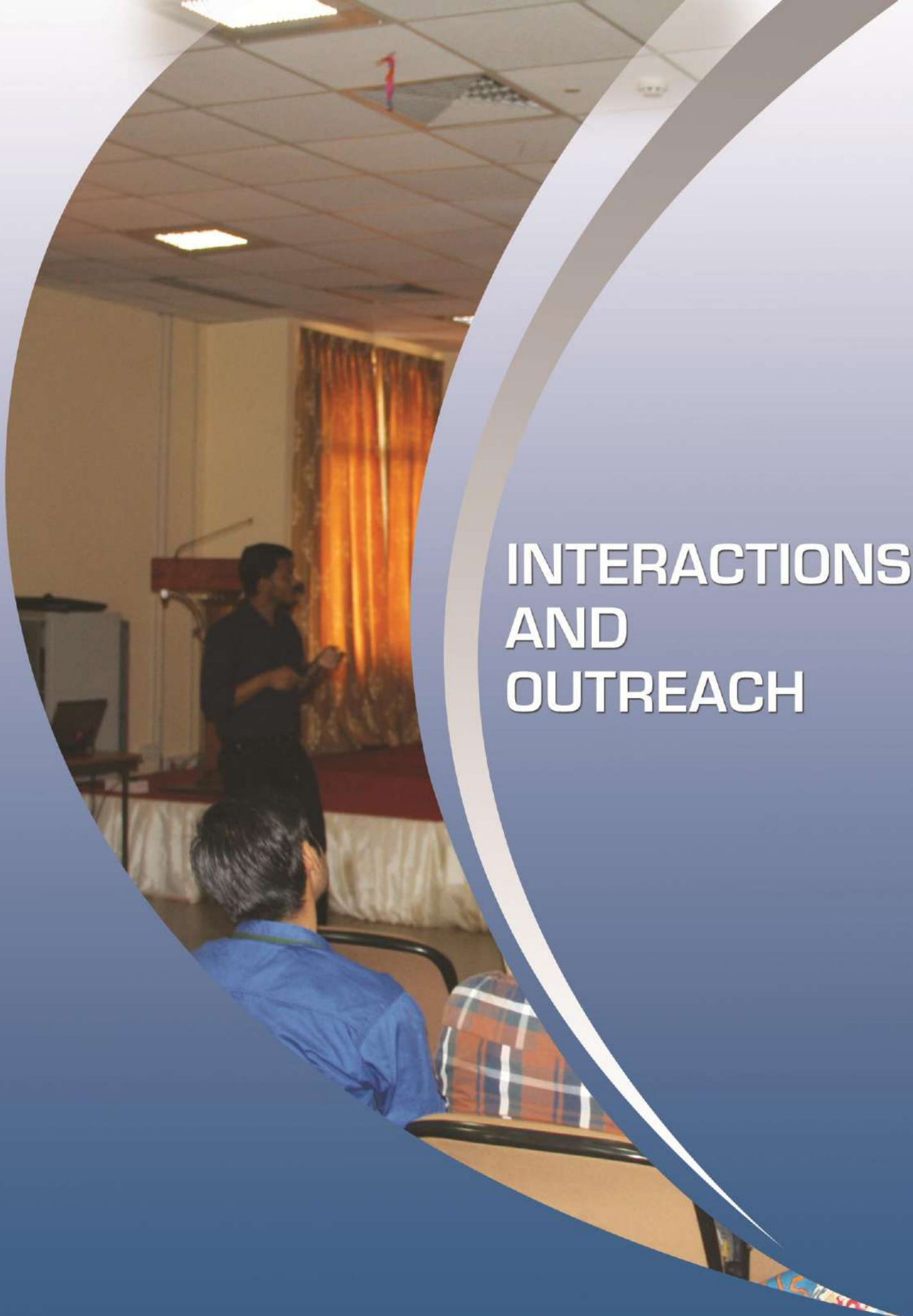
- Sukirna Roy and **B. S. Manoj**, "IoT Enablers and their Security and Privacy Issues", Chapter in the book titled *Internet of Things (IoT) in 5G Mobile Technologies,* edited by Constandinos X. Mavromoustakis, George Mastorakis, and Jordi Mongay Batalla, Springer-Verlag, pp 449-482, April 21, 2016.

- Smart Electroactive Polymers and Composite Materials, T.P.D. Rajan and **J. Mary Gladis,** Chapter in the book of "Biomedical Applications of Polymeric Materials and Composites", edited by Raju Francis, D. Sakthi Kumar, Wiley, 2016 (ISBN: 978-3-527-33836-8, 384 pages).

- **Babitha Justin.** *From Canon to Trauma: Essays in Literature*. Bodhi Tree Books and Publications, Trivandrum (2016).

- **Shaijumon C S.,** (2017). "Institutions, Innovation and Agricultural Development: Role of ISRO", in the book Globalisation and India's Innovation Systems: A Creative Destruction? edited by Girish Kumar R, Mahatma Gandhi University Press, Kottayam pp 136-141.

- **Babitha Justin.** "The Presence of Period." In the Footsteps of Survival (ed. Jyothi KG) Thrissur: Mayflower Publishers, 2016. Pp. 121-26. ISBN 978-93-85894-1.



INTERACTIONS AND OUTREACH

5| INTERACTIONS AND OUTREACH

5.1 Conference / Workshop attended by Faculty Members

- **S Anup,** Co-Chaired, International conference on Aerospace and Mechanical Engineering, TKM College of Engineering, Kollam (Technical session on Engineering Design) December 16, 2016.

- **S Anup,** Chaired a session in NCET 2016, Government Engineering College, Barton Hill, Thiruvananthapuram, August 20, 2016.

- **C. Prathap**., "Investigation of burning velocities using freely expanding flame method", 4th P.J.Paul Memorial Combustion Researcher's meet, High Energy Materials Research Lab, Pune. Febraury 17-18, 2017.

- **C. Prathap**, "One day workshop on NCCRD facilities" at IITM, Chennai, August 19, 2016.

- **Shine.S.R.**, "Advances in Computational Heat Transfer, CHT-17, Napoli, Italy 6th International and 43rd National Conference on Fluid Mechanics and Fluid Power", Allahabad, India ICCMS2016, IIT Bombay, June 2016.

- **V S Sooraj**, International Conference AIMTDR 2016, Pune, December 2016.

- **Deepak Mishra** attended Tenth Indian Conference on Computer Vision, Graphics and Image Processing at IIT Guwahati 2016.

- **B. S. Manoj** served as Member, Panel Discussion on "Current Technology Status & Future Needs for Effective Disaster Mangement," International Workshop on Sensors and Small Satellite Technology for Disaster Management (SSTDM 2016), Amritapuri, Kollam, August 17 -19 , 2016.

- **B. S. Manoj** attended International Workshop on Sensors and Small Satellite Technology for Disaster Management (SSTDM 2016), Amritapuri, Kollam, August 17 -19, 2016.

- **B. S. Manoj** attended ITRA-Mobile Evaluation Workshop, IIT Hyderabad, July 20-22, 2016.

- **J.Sheeba Rani**, Attended and presented paper in the TENCON 2016 Conference organized by IEEE Section Singapore, November 22-25, 2016.

- **Chinmoy Saha** attended and presented papers in IEEE AP-S Symposium in San Diego, California, USA during July 09-14, 2017.
- **Chinmoy Saha** attended and delivered invited talk in IEEE Indian Antenna Week (IAW) 2017, DIAT, Pune, Maharashtra, India during June 05-09, 2017.
- **Chinmoy Saha** attended and delivered invited talk in the International Conference of Young Researchers on Advanced Materials, at IISC Bangalore, India during December 11-15, 2016.
- **Chinmoy Saha** attended and delivered invited talk in IEEE Indian Antenna Week (IAW) 2016, Madurai, Tamil Nadu, India during June 06-10'2016.V.Seena, 8th International Conference on Advancements in Polymeric Materials (APM2017), IISc Bangalore February 11-13, 2017.
- **V.Seena**, 29thKerala Science Congress, January 28-30 2017.
- **V.Seena**, Miniaturization of Launch Vehicle Electronics, Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram, November 2-4, 2016.
- **V.Seena**, NCEES 2017, March 22-24, 2017.
- **V.Seena**, MEMS Resonators, GIAN Course 'MEMS Resonators', IIT Bombay June 27-3 July 2016.
- **Rajesh Joseph Abraham**, International Conference and Exhibition on Smart Grids and Smart Cities, New Delhi, March 05-09, 2017.
- **M. Vanidevi**, "Short Course in 5G Multi-User MIMO and massive MIMO Systems" at M. S.Ramaiah Institute of Technology, Bengalore, June 14 - 16, 2017.
- **K. Y. Sandhya**, R. Aswathi and Arya Nair, J. S. An International Summer School on *Electrochemical Energy Storage and Conversion*: Materials, Processes and Applications, organised by ECS India section, Yercaud Hills, Salem, Tamil Nadu, August 20- 23, 2016.
- **S.Mahesh**.,C.LalithaLekshmi, Kizhisseri Devi Renuka, K.Joseph "Simple and Cost effective Synthesis of GQD from honey and its application as stable security ink" at IISER Thiruvananthapuram, March 9-12, 2016.
- **S.Mahesh**., Kizhisseri Devi Renuka.,C.LalithaLekshmi, K.Josep h "Cost effective Synthesis of Graphene Quantum Dot from Bioresource Material (Honey)" at CSIR-CECRI Karaikudi, May 26-28, 2016.
- **S.Mahesh**., C.LalithaLekshmi, Kizhisseri Devi Renuka, K.Joseph "Honey: Production of Energy Related Materials-GQD & its Applications" at Sree SankaraCollege,Kalady, November 14-16, 2016.
- **S.Mahesh**., Kizhisseri Devi Renuka.,C.LalithaLekshmi, K.Joseph "Sustainable Electronic Materials:Reversible Phototuning of Conductance in a Non-Covalent assembly of

MWCNT and Bioresource Derived Photochromic Molecule at IISc Bangalore, December 11-16, 2016.

- **S.Mahesh**.,C.LalithaLekshmi, Kizhisseri Devi Renuka, K.Joseph "Sustainable Materials: Simple & Cost-effective synthesis of GQDs from Honey" at Marthoma College, Thiruvalla, January 28-30, 2017.

- **Chinmoy Saha**, Steering Commitee Member in Shannon Centennial Workshop on Communication and Information Theory held at Trivandrum, Kerala, India during December 13-14, 2016.

- **B. S. Manoj** served as Member, Technical Program Committee, IEEE Globecom 2016, Washington, DC, USA, December 4-8, 2016.

- **B. S. Manoj** served as Member, Steering Committee, Shannon Centennial Workshop on Communications and Information Theory, CDAC, Thiruvananthapuram, Kerala, December 13 - 14, 2016.

- **B. S. Manoj** served as Member, Technical Program Committee, IEEE ANTS 2016, Bangalore, November 6-9, 2016.

- **B. S. Manoj** served as Member, Technical Program Committee, IEEE Conference on Network Function Virtualization and Software Defined Networks 2016 (IEEE NFV-SDN 2016), Palo Alto, California, USA, November 7-9, 2016.

- **B. S. Manoj** served as Member, Technical Program Committee, IEEE International Symposium on Technology and Society (IEEE ISTAS 2016), Trivandrum, October 21-22, 2016.

- **B. S. Manoj** served as Member, Technical Program Committee, ICUMT 2016, , Lisbon, Portugal, October18-20, 2016.

- **B. S. Manoj** served as Member, Technical Program Committee, ICACCI 2016, Jaipur, September 21-24, 2016.

- **Rajesh Joseph Abraham**, Organized a Control Systems Engineering and Design workshop ,IIST, Trivandrum, June 06-09, 2017.

- **Vineeth B. S**, Co-Chair, Shannon Centennial Workshop on Communications and Information Theory 2016.

- **Vineeth B. S**, Co-Organizer Trivandrum School on Communications, Coding, and Networking - 2017.

- **K G Sreejalekshmi**, International Conference on Drug Design, JNU-New Delhi, India, April 7-9, 2017.

- **K G Sreejalekshmi**, Macro-2017- International Conference on Polymer Science and Technology, Thiruvananthapuram, Kerala, January 8-11, 2017.

- **K G Sreejalekshmi**, 21st International Conference on Organic Synthesis (ICOS 21), IIT Mumbai, December 11-16, 2016.

- **K G Sreejalekshmi**, National Conference on Recent Trends in Material Science & Technology (NCMST- 2016), J Indian Institute of Space Science and Technology, Thiruvananthapuram, Kerala, July 12-14, 2016.

- **K. M. Ambili**, R. K. Choudhary, Anil Bhardwaj , URSI APRASC, Seoul, South Korea, August 21-26, 2016.
- K.M. Ambili, "Planetary ionospheric studies using observations and models", INSPIRE Annual Meet, Goa Univerisity, January 29, 2017.
- Pralay Raj, **K M Ambili** ,"Morphological features of ionospheric variabilities estimated using geostationary satellites", 29thKearala Science Congress, Mar Thoma College, Thiruvalla, 28-30 January 2017.
- Sneha Susan Babu, **K M Ambili**, "Characteristics of dayside Venus ionosphere: A modelling approach", URSI RCRS, Tirupati, March 14, 2017.
- Pralay Raj, **K M Ambili** ,"Characterisitcs features of the amplitude and phase scintillations over equatorial and off-equatorial regions", URSI RCRS, Tirupati, March1-4 2017.

- **Anandmayee Tej**, attended the Astronomical Society of India Annual Meeting at Jaipur in March 2017.

- **Rajesh V.J**., 13th International conference on Gondwana to Asia, Trivandrum, November 18-22, 2016.

- **Rajesh V.J**., International conference on Geology: Emerging methods and applications (GEM-2017), Christ College Irinjalakkuda, Kerala, February 6-8, 2017.

- **Rajesh V.J**., National Seminar on modern frontiers in Earth Sciences. University College, Thiruvananthapuram, March 16-17, 2017.

- **Rajesh V.J**., National seminar on the current trends in Earth System Sciences, Department of Geology, University of Kerala, Thiruvananthapuram, March 22-23, 2017.
- **Ramiya, Anandakumar** M.,ISRS –ISG National Symposium at IIRS Dehradun December 7-9,2016.

- **Resmi Lekshmi**, "Astronomical Society of India meeting, Univ. of Kashmir, Srinagar, May 2016.
- **S. Mandal**, "Jet Triggering Mechanisms in Black Hole Sources" at Tata Institute of Fundamental Research, Mumbai, India, January 20 - 23, 2016.
- **S. Mandal**, "The 34th meeting of Astronomical Society of India" at University of Kashmir, Srinagar, India, May 10-13, 2016.
- **S. Vig**. TMT-MICHI Workshop, TIFR Balloon Facility, Hyderabad, October 18, 2016.
- **S. Vig**. 35th Astronomical Society of India Meeting, B. M. Birla Auditorium, Jaipur, March 6 – 10, 2017.
- **Gigy J Alex**, "Translation Workshop on Malayalam Dalit Writing." UGC SAP and Institute of English, University of Kerala, 2016.
- **Shaijumon C S**, "Education Conclave", Hotel Crown Plaza Cochin, DC Media & DC Books, June 17 , 2016.
- **Shaijumon C S**, attended the lecture on "Significance of Official Language Hindi and its fundamental aspects" by Dr. Prakash, Director of Translation studies, University of Kerala, at IIST, September 21 , 2016.
- **Kaushik Mukherjee**, "Uniformly convergent Improved Hybrid Numerical Scheme for Singularly Perturbed Problems with Interior Layers", in the 10th International Conference of IMBIC on Mathematical Sciences for Advancement of Science and Technology (MSAST 2016), held at Kolkata, WB, December 21-23, 2016.
- **Kaushik Mukherjee** and Avinash Chandra, "A robust hybrid numerical scheme for a system of singularly perturbed convection-diffusion boundary-value problems", in the International Conference on Advances in Scientific Computing (ICASC 2016), held at IIT Madras, Chennai, November 28-30, 2016.
- **Prosenjit Das**, Symposium on "Polynomial rings projective modules and related topics", ISI, Kolkata, November 07-09, 2016.
- **Sarvesh Kumar**, International Conference on "Recent advances in PDE: Theory Computations and Applications, , IIT Bombay, June08-10, 2017.
- **Sarvesh Kumar** International Conference on "Mathematical analysis and its applications", , IIT Roorkee, Roorkee, November 28 to December 02, 2016.
- **Sarvesh Kumar** International Conference on "Recent advances in theoretical and computational partial differential equations with applications", Panjab University, Chandigarh. December 05-09, 2016.

- **Raju K George**, Keynote speech in the International Conference on Differential Equations and applications, Bharathiar University, Coimbatore, March 15, 2017.

- **Apoorva Nagar**, Statphys 26, Lyon, France. Gupta (2016). Poster:" Diffusion with stochastic resetting at power law times". July 18-22, 2016

- **K S Subrahamanian Moosath,** Harsha K V, "Mismatched Estimation in an Exponential Family", International Conference on Information Geometry and Its Applications- IV, Liblice, Czech Republic.. June 12-17, 2016

- **K S Subrahamanian Moosath**, National Seminar on Analysis and Algebra, University College, Trivandrum, February 2, 2017.

- **K S Subrahamanian Moosath**, National Conference on Current Scenario in the Applications of Mathematical Sciences, Vellalar College for Women (Autonomous), Erode, February 9, 2017.

5.2 Invited Lectures delivered by Faculty Members

- **Dadhwal, V.K.**: Invited Lecture "Remote Sensing of Earth : Applications to Sustainability, Climate Change & Disaster Management", ISRO Structured Training Program : Challenges in Space Science and Exploration, Space Physics Laboratory, VSSC, Trivandrum, March 13,2017.

- **Dadhwal, V.K.**: Keynote Lecture "Recent results on Crop Monitoring and Modeling with EO Inputs", XIII Agricultural Science Congress, at Univ. Agric. Sciences, Bangalore, February 22, 2017.

- **Dadhwal, V.K.** : Invited Lecture "EO for forest biomass mapping in India: Lessons for MRV and REDD+", Centre for Science & Environment Workshop on REDD+ in India, India Habitat Centre, New Delhi February 7, 2017.

- **Dadhwal, V.K.** : Chief Guest & Technical Lecture "Imaging from Space : Realizing Myriad Applications", Berchmann's Award Function, at St Berchmann College, Kottayam, January 30 ,2017,

- **Dadhwal, V.K.** : Invited Lecture "Lessons, challenges & innovations: Indian Case studies EO data research to use", GEOSPATIAL WORLD FORUM 2017, , Hyderabad, January 24 2017.

- **Dadhwal, V.K.** : Chief Guest & Keynote Lecture "Geospatial Technology Trends & Applications Scenario in India", National Conference on Geospatial Technology at LBS Institute of Technology, Thiruvananthapuram, January 12, 2017.

- **Dadhwal, V.K.** : Keynote Lecture "Space Inputs for Carbon & Climate Studies in Mountain Regions", ISRS & ISG Annual Convention & National Symposium Recent Advances in Remote Sensing and GIS with Special Emphasis on Mountain Ecosystems, Indian Institute of Remote Sensing (IIRS), Dehradun December 8, 2016.

- **Dadhwal, V.K.** : Todarmal Lecture at 36th Indian National Cartographic Association International Congress, "Geospatial enabling of e-Governance in India", Shantiniketan University, W Bengal, November 9, 2016.

- **Dadhwal, V.K.** : Invited Lecture "Remote Sensing and Geospatial Applications" at ISRO Induction Training Program, VSSC, Thiruvananthapuram, October 27, 2016.

- **Dadhwal, V.K.** : CSIR Foundation Day Lecture "Space-based Earth Observations for societal applications : Indian Case studies on Inter-disciplinary Research", at National Institute Interdisciplinary Science & Technology (NIIST), Thiruvananthapuram; September 27, 2016.

- **S. Anup**, "Molecular Dynamics for Material Failure", at College of Engineering Trivandrum, November 29, 2016.

- **S. Anup**, "Bio-inspired Composites: Current Research Trends" at, Government Engineering college Bartonhill, Thiruvananthapuram, April 05, 2016.

- **Chakravarthy P,** "Fasteners for aerospace industry" at Aerospace fasteners colloquium, Society of aerospace manufacturing engineering, February 20, 2017.

- **Chakravarthy P**, "Flux bounded TIG welding" at the Indian society for non-destructive testing, March 16, 2017.

- **Chakravarthy P,** "Materials for space", at UKF College of engineering and technology, Kollam, May 12, 2017.

- **B S Girish**, "Scheduling of Aircraft landings at busy airports" at DC School of management and technology, Trivandrum, Kerala, on October 28, 2016.

- **C. Prathap**, "Introduction to Combustion, flame and its applications", at the MEPCO Schlenk College of Engineering, Sivakasi, December 16-17, 2016.

- **Rajesh Sadanandan,** "Optical and laser diagnostic techniques for scramjet propulstion", Air Breathing Propulsion Seminar, VSSC, June 19, 2017.

- **Raveendranath P.** "On the development of piezoelectric finite element module in FEAST" at Vikram Sarabhai Space Centre, December 19, 2016.

- **Shine.S.R**.,"Invited speaker for Thermal STP" for ISRO Engineers September 17, 2016.
- **Shine.S.R**.,"Energy Conservation: Solution to energy generation and global warming",Training programme on resource persons at Energy Management Centre, Kerala June 25, 2016.
- **Shine.S.R**.,"Title of the talk-Thermodynamic power cycles for advanced rocket engines", National conference on Advanced technologies in Mechanical Engineering Science, BJINATCON 2016.
- **Shine.S.R**., "Liquid rocket engine cycles", Quality Improvement Programme , College of Engineering, Adoor, March 23, 2016.
- **B. S. Manoj** "Pervasive Computing for Disaster Response: Challenges and Opportunities for Nano satellites," at International Workshop on Sensors and Small Satellite Technology for Disaster Management (SSTDM 2016), Amritapuri, Kollam, August 17-19, 2016.
- **B. S. Manoj** "Complex Networks" at Rajadhani Institute of Engineering and Technology, Attingal, Trivandrum, India on July 18, 2016.
- **Deepak Mishra**, "Introduction to Deep learning and its application" TEQIP-II sponsored one-week Short Term Course / Faculty Development Program (FDP) on "Communication Networks: A Research Perspective" during at HBTI Kanpur, February 27, 2017 to March 04, .2017.
- **Deepak Mishra**, "Machine Learning application Satellite Data Processing". College of Engg. Perumon, July 15, 2016.
- **Rajesh Joseph Abraham**, "Load Following with TCSC in Deregulated Power Systems" during 2nd UK-India Bilateral Workshop on Sustainable Energy and Smart Grids,Leeds, UK, July 14-15, 2016.
- **J. Sheeba Rani,** "High Speed Digital Design" College of Engg Perummon, Kerala July 2016.
- **V. Seena**, "Design and Fabrication of Ultra-Sensitive Polymer Microsystems", 8th International Conference on Advancements in Polymeric Materials (APM2017), IISc Bangalore February 11-13, 2017.
- **V.Seena** "Design and Fabrication of Ultra-Sensitive Polymer Microsystems", 8th International Conference on Advancements in Polymeric Materials (APM2017), IIScBangalore February 11-13, 2017.

- **V.Seena,** 'MEMS& Nanomechanical Sensor Systems', Kerala State Scientist Awardee Session 29th Kerala Science Congress January 30, 2017.

- **V. Seena,** "Sensors and MEMS Technology", Miniaturization of Launch Vehicle Electronics, Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram November 2-4, 2016.

- **V. Seena,** "MEMS and Nanoelectronics Sensor Systems: Homeland Security to Space Applications", NCEES 2017, March 22-24, 2017.

- **V. Seena,** 'Silicon and Non-Silicon based Microsystems: Design and Development' , Prabandh 2017 .

- **Chinmoy Saha,** "Photo Conductive Antennas (PCA) for MM Wave and THz Applications: Challenges, Design and Realization", in IEEE Indian Antenna Week organized by IEEE AP/AP-MTT, IEEE AP-Society at DIAT Pune, India during June 5-9, 2017.

- **Chinmoy Saha,** "Metamaterial Inspired Multifunctional Antennas", AAFM 2017 (Workshop for Advanced Antenna, Frequency Selective Surface and Metamaterials) organized by ECE Department, Government Women Engineering College, Ajmer, Rajasthan, on March 25, 2017.

- **Chinmoy Saha,** "Engineered Electromagnetic Materials: Applications in Modern Printed Circuits and Antennas", in the International Conference of Young Researchers on Advanced Materials, IISC Bangalore. December 11-15, 2016.

- **Chinmoy Saha,** "Multifunctional Printed Antennas for Modern Wireless Applications", in the MHRD Short Term Course on Towards 5G: The Key Enabling Technologies organized by National Institute of Technology, Patna December 05-14, 2016.

- **Chinmoy Saha,** "Next Generation Antenna Requirements in THz Technology for Space Applications: An Overview, Challenges and a Recent Effort**"**, in the MHRD Short Term Course on Towards 5G: The Key Enabling Technologies organized by National Institute of Technology, Patna during December 05-14, 2016.

- **Chinmoy Saha,** "Electromagnetics Teaching and Learning: Impact of Simulators", in Government Women Engineering College, Ajmer, Rajasthan, on September 03, 2016.

- **Chinmoy Saha,** "Filtenna: Concept , Design and Realization", in Malaviya National Institute of Technology, Jaipur, Rajasthan, on September 02, 2016.

- **Chinmoy Saha,** "Recent Requirements and Challenges in Printed Antenna Design", in TEQUIP sponsored National Workshop on Antenna and Microwave Devices: Design, Fabrication and Measurements in Government Women Engineering College, Ajmer, Rajasthan, during August 29-September 03, 2016.

- **Chinmoy Saha,** "Microstrip and Printed Antenna Research :Early Developments and Recent Trends ", in National Institute of Technology, Trichy, Tamil Nadu on July 26, 2016.

- **Chinmoy Saha,** "An Overview of Satellite Systems and Antennas", in K Ramakrishnan Collge of Engineering, Trichy, Tamil Nadu on July 26, 2016.

- **Chinmoy Saha,** "Recent Trends and Techniques in Frequency Notched Ultra Wide-Band Antennas", in IEEE Indian Antenna Week organized by IEEE AP/AP-MTT Chapter Madras and Kolkata Chapter, IEEE AP-Society at Madurai, Tamil Nadu, India during June 6-10, 2016.

- **Chinmoy Saha,** "Microstrip and Printed Antenna Research: Early Development and Recent Trends", in workshop *Compact Microstrip Antenna: Design and Simulation* , organized by VIT University, Vellore, Chennai, India on April 16, 2016.

- **Chinmoy Saha,** "Microwave Filter Design: Basics to State of the Art Techniques", in summer school organized by UGC Network Resources Centre, University of Calcutta, during April 7-8, 2016.

- **Anoop C. S.**, "Non-Invasive and Reliable Sensing Techniques for Health Monitoring" at the Dept. of Electronics Engineering, Rajadhani Institute of Engineering and Technology, Trivandrum, September 01, 2016.

- **Anoop C. S.**, "Magnetic Sensors and Electronic Instrumentation" at the Faculty Development Programme (sponsored by TEQIP Phase II) at College of Engineering, Chengannur, September 06, 2016.

- **Vineeth B. S.**, "Introduction to queueing theory", at the Government College of Engineering, Wayanad, March 2017.

- **Vineeth B. S.**, "Approximate Bayesian Inference and Markov Chain Monte Carlo", at the Lourde Matha College of Science and Technology, Trivandrum, January 2017.

- **Vineeth B. S.**, "Introduction to Markov Chains and Queueing Models", at the Trivandrum School on Communications, Coding, and Networking, January 2017.

- **Vineeth B. S.**, "Optimization in Wireless Communication Systems", at the College of Engineering, Perumon, April 2016.

- **N.Selvaganesan** "Shaping Limit Cycle Performance ofFractional-Order Controllers for PlantsContaining Relay Nonlinearity" Three Day National Workshop on Fractional Order Modeling in Engineering (FOME - 2016) at GayatriVidyaParishad College of Engineering (A), Visakhapatnam, October 26-28, 2016.

- **N.Selvaganesan,** "Eliminating the limit cycle oscillation for digitally controlled DC-DC converter", TEQIP II sponsored workshop at NIT, Trichy, August 29, 2016.

- **N.Selvaganesan**, "Control System Design For Space Transportation Systems" Muthayammal Engineering College, Rasipuram, December 23, 2016.

- **Mary Gladis J,** "Advances in Microscopic Techniques for Material Characterisation" International Seminar on'State-of-the art of Instrumental Techniques in Compound Analysis-SITCA' 2016 *at the Christian College Kattakada, Thiruvananthapuram,* July 20, 2016.

- **Gomathi N.**, "Surface engineering of carbon nanomaterials" on TEQIP sponsored workshop on "Current Research Scenarios in Energy, Environmental and Chemical Engineering" at NIT, Trichy, Tamil Nadu, January 30 – February 4, 2017.

- **Nirmala Rachel James,** "Gum Arabic : applications in tissue engineering and drug delivery", APM 2017, 8th 'International Conference on Advancements in Polymeric Materials' organized by Advanced Research School for Technology and Product Simulation, IISc, Bangalore, February 13, 2017.

- **Jobin Cyriac,** "Surface enhanced Raman spectroscopy: Concept and Applications" National Seminar on Recent Advances in Materials Science, Mahatma Gandhi University, Kottayam, November 19, 2016.

- **Jobin Cyriac,** "Surface enhanced Raman spectroscopy as a Chemical Fingerprinting Metho" National Seminar, Govt. College Kottayam, January 10, 2017.

- **Jobin Cyriac,** "Analytical Applications of Raman Spectroscopy" National Seminar, St. Xavier's College, Palayamkottai February 23, 2017.

- **K.G.Sreejalekshmi,** "Chemical sensors for environmental applications" NVMACC-2017 at Department of Chemistry, Government College, Chittur on January 13, 2017.

- **K.G.Sreejalekshmi,** "Colorimetric sensors for anon detection" National Seminar on Green Chemistry for Environmental Sustainability organised by Department of Chemistry, Bharata Mata College, Trikkakkara on February 08, 2017.

- **K.G.Sreejalekshmi,** "Dendrimers for theranostic applications" Plenary Lecture International Conference on Nanotechnology (ICON 2017) organised by Nesamony Memorial Christian College, Marthandam during February 15- 16, 2017.

- **K.G.Sreejalekshmi,** "Molecular materials based on heterocycle hybrids for theranostic applications" National Seminar on Recent Advances and Applications in Chemistry (CHEMINO 2017) organised by Department of Chemistry, AnnaiVelankanni College, Tholayavattom on February 10, 2017.

- **K.G. Sreejalekshmi, "**Multi-objective optimisation problems in Materials ScienceandEngineering-A Chemist's Role",Research Colloquium by Department of Applied Science, College of Engineering Kidangoor, March 30, 2017.

- **Kuruvilla Joseph**,Plenary talk at the Programme for motivating innovation in Science at National Institute for Interdisciplinary Science and Technology & Department of Science & Technology on April 26, 2016.

- **Kuruvilla Joseph,** Plenary talk at IIST@Schools Programme, at Chakkittapara, Kozhikode on June 20, 2016.

- **Kuruvilla Joseph,** Plenary lecture at the International Conference on Functional Materials at Centre for Scientific and Applied Research, PSN College of Engineering and Technology, Tirunelveli on September 10, 2016.

- **Kuruvilla Joseph,** Plenary lecture at the National Conference on Biopolymers & Green Composites (BPCG 2016 - 4th in Series) at Centre for Biopolymer Science and Technology (CBPST-CIPET), Kochi on September 29, 2016.

- **Kuruvilla Joseph,** Expert Mentor at the India –UK joint workshop on 'Nano-Biomaterials for Water Purification at M.G University, Kottayam on December 12–16, 2016.

- **Kuruvilla Joseph,** Expert Mentor at Department of Science & Technology (DST) INSPIRE Internship Science Camp at Sree Narayana College, Kannur on December 29, 2016.

- **Kuruvilla Joseph,** Invited talk at International Conference on Polymer Science and Technology [MACRO 2017] on January 8 –11, 2017.

- **Kuruvilla Joseph,** Plenary talk at the National Conference on Nanomedicine Current Scenerio and Future opportunities at SN College, Chengannur on February 17, 2017.

- **Kuruvilla Joseph,** Plenary talk at the National Conference on Recent trends in Biomaterials (BIOMEET 2017) at Bishop Moore College, Mavelikara on February 17, 2017.

- **Kuruvilla Joseph,** Plenary lecture at the 6th National Seminar on advances on Materials Science 2017 (NSAMS 2017) at Manonmaniam Sundarnar University, Tirunelveli on March 2, 2017.

- **Kuruvilla Joseph,** Plenary lecture at the National Conference on Recent Advances in the Applications of Macromolecular Materials (RAAMM - 2017) at Gandhigram Rural Institute, Dindigul, Tamil Nadu on March 2, 2017.

- **Kuruvilla Joseph,** Plenary talk at the 5th National Conference on Advanced Functional Materials and Applicatins (NCAFMA-2017) at Kalasalingam University, Tamil Nadu on March 30, 2017.

- **Ambili K M.**, "Ozone and climate: Restored by a world united" at the Govt. BE.d College, Nedumangad, Kerala, September 16, 2015.

- **Anandmayee Tej**, Science Day Lecture at Heera College of Engineering Technological, Trivandrum, February 27, 2017.

- **Anandmayee Tej,** Invited Speaker at International Conference on Cosmology and Applied AstroScience, Ethiraj College, Chennai, February 8-10, 2017.

- **Jagadheep D.**, "Introduction to Radio Astronomy" at the Pulsar Observing for Students (POS) workshop conducted at the Radio Astronomy Centre, Ooty, July 2016.

- **Jagadheep D.**, "Fourier Transforms" at the Pulsar Observing for Students (POS) workshop conducted at the Radio Astronomy Centre, Ooty, July 2016.

- **Jagadheep D.**, "6.7 GHz Methanol Masers and High-Mass Star Formation", colloquium at the Radio Astronomy Centre, Ooty, July 2016.

- **Gnanappazham L.,** "Introduction to Remote sensing and GIS and Research Perspectives" during Prathibha's Student Programme for Excellence in Experimental Design, Kerala State Council for Science, Technology & Engineering sponsored Science Enrichment Programme conducted at IIST, May 26, 2016.

- **Gnanappazham L.**, "Creative Strategies for Generating Innovative Agricultural Technologies" National Technology Day 2016, CTCRI, Thiruvananthapuram, May 11, 2016.

- **Rajesh V.J.**, "Chromianspinels as Petrogenetic and Tectonic Indicators of the ultramafic rocks in southern India" at the 13th International conference on Gondwana to Asia, Trivandrum, November 18-22, 2016.

- **Rajesh V.J.,** "Spinel-bearing anorthosites in Southern India as probable terrestrial analogues to lunar highland crust" International conference on Geology: emerging methods and applications (GEM-2017), Christ College Irinjalakkuda, Kerala, February 6-8, 2017.

- **Rajesh V.J.**, "Lunar Highland anorthosites and terrestrial analogues" at National Seminar on modern frontiers in Earth Sciences. University College, Thiruvananthapuram, March 16-17, 2017.

- **Rajesh V.J.,** "Petrogenetic and tectonic discrimination of chromianspinels, olivines and pyroxenes in ultramafic rocks in Attappadi valley, Bhavani suture zone, South India" 4th UGC-SAP DRS II National seminar on the current trends in Earth System Sciences, March 22-23, 2017.

- **Ramiya, A. M.,**"LiDAR image processing." at the National seminar on Techniques and Applications of Hyperspectral Image analysis" organized by the Department Electronics and Communication Engineering, Amrita School of Engineering on April 19-20,2016.

- **Ramiya, A. M.,** "Applications of image processing techniques in satellite images" at the Recent Trends in Medical and Satellite Image Processing Techniques" organized by the College of Engineering, Perumonon July 11, 2016.

- **Ramiya, A. M.,** "Remote Sensing: An overview." at the National workshop on Geomatics" organized by the Marian Engineering College jointly with Indian Society of Remote Sensing on July 17, 2017.

- **Resmi, L**, "Radio Counterparts to Double Compact Object Mergers", Science with uGMRT, National Center for Radio Astrophysics Pune, June 15-17, 2016.

- **Resmi, L.**, "Gamma Ray Bursts : Progress & Prospects", IUCAA sponsored regional conference on Research in Astronomy: Opportunities and Challenges - III, Calicut University, July 19,2016.

- **Resmi, L.,** "Women in Science", International day of women & girls in science by Breakthrough Science Society, TVM chapter, Trivandrum, February 11, 2017.

- **Resmi, L.,** "Women in Science", International Women's day, IIST, March 8, 2017.

- **Resmi, L.,** "Redshift Distribution of Short Duration Gamma Ray Bursts", Joint ICTS/SAMSI program on Time series analysis of synoptic surveys and GW astronomy, ICTS, Bangalore March 20-23, 2017.

- **S. Vig**. TMT-MICHI Workshop, TIFR Balloon Facility, Hyderabad, October 18, 2016.

- **S. Vig**. 35th Astronomical Society of India Meeting, B. M. Birla Auditorium, Jaipur, March 6 – 10, 2017.

- **Babitha Justin** as the Chief Guest on Women's Day ,UST Global, Technopark Trivandrum, March 15, 2017.

- **Babitha Justin,** Inaugural Lecture for Lécole Fest, Lecole Chempaka School, July 1, 2017.

- **Babitha Justin,** Inaugural Lecture for HAC Nanthencode Art Festival. August 1 , 2017

- **Lekshmi V Nair**, Chaired a session in the One day International Seminar on Living and Woking in the Digital Age: Intercontinental Insights organized by World Science Project, Lousiana State University, June 25, 2016.

- **Lekshmi V Nair**, "PRA Methods"at Loyola College of Social Sciences, October 1-3, 2016.

- **Lekshmi V Nair**. "Responsible Ageing" at the 3 Day National Seminar on "Successful Ageing" Dept of Sociology, University of Kerala, March 15-17, 2017.

- **Shaijumon C S.** Chaired the session on "Innovations: Selected Issues", in the 'International Seminar on Globalization and India's Innovations systems: A creative destruction' KN Raj Study centre, MG University, February 4-6, 2017.

- **Shaijumon C S**, "International Organizations and Institutions", SCMS School of Business, Cochin, May 12, 2016.

- **Shaijumon C S,** "Brexit and its implications on Indian Economy", Invited lecture at YMCA Discussion Forum, Trivandrum July 29, 2016.

- **Shaijumon C S,** "Methodology of Economics for Engineering Students", Invited lecture for the faculty from all engineering colleges of Kerala at APJ Abdulkalam Technical University of Kerala, August 12, 2016.

- **Shaijumon C S**, "Role of Model United Nations in shaping the personality of students", Keynote address at Christ Nagar International School Model United Nations, August 23 , 2016.

- **Shaijumon C S**, "International Financial Crisis and Indian Economy", at the KN Raj Study Center for Planning and Centre-State Financial Relations, MG University, Kottayam, October 26, 2016.

- **Shaijumon C S**, "Structure and ways of mobilizing non-tax revenue after the introduction of GST", at the meeting of Kerala State Planning Board working group on 13th Five year Plan of Kerala, November 15, 2016.

- **Shaijumon C S**, "Course and career opportunities", at the meeting of IIST@Schools, Thalasserry, Kannur November 26, 2016.

- **Shaijumon C S**, "Demonetization and its impacts on Real Estate sector of India", Keynote address at the Seminar on Demonetization by State Bank of India & Artech Builders, Pattom Royal, Trivandrum, December 17 2016.

- **Shaijumon C S**, "Demonetization and its impacts", lead lecture for IIST staff, January 12, 2017.

- **Shaijumon C S**, "National Budget 2017-18: Is it an answer to the problems of Demonetisation", Department of Economics, Fatima Matha National College, Kollam, February 9, 2017.

- **Shaijumon C S**, "International Financial Institutions and Trade Blocks", Lecture at SCMS College of Business, Cochin, February 23, 2017.

- **Shaijumon C S**, "International and Domestic Economic Policy Changes and its Impacts on Indian Economy", Walk with Scholar program, Department of Economics, Government Women's College, Thiruvananthapuram, March 6, 2017.

- **Shaijumon C S**, "National Budget in the light of Demonetization", Lecture at Department of Economics, NSS College, Nilamel, March 21, 2017.

- **V Ravi.,** "Supply Chain Management" at DC School of Management and Technology,Trivandrum, November 4, 2016.

- Invited Lecture by Dr. Meena T Pillai (Director, Centre for Cultural Studies, University of Kerala) as part of Visual Communication Course for seventh semester students – October 7, 2016 (organized by **Babitha Justin**).

- Invited Lecture on Photography by Dr. Seema Krishnakumar (Assistant Professor, DJ College of Design, Coimbatore) as part of Visual Communication Course for seventh semester students –October 8, 2016 (organized by **Babitha Justin**).

- Invited Talk by Dr. Manoj A S , ICT Academy of Kerala, for B Tech Avionics 2015 Batch Students as part of the course paper "Introduction to Social Science and Ethics' on 6th and October 7, 2016 (organized by **Lekshmi V Nair**).

- Prof. N C Narayanan, "Engagements Between Technology and Development", Public Lecture in IIST, June 13, 2016. (organized by **Shaijumon C S**).

- Prof. J Prabhash, "Role of UN in the Changing World", IIST Model United Nations, April 9, 2016.(organized by **Shaijumon C S**).

- **Deepak T G.**, "Random Processes" at the College of Engineering, Cherthala, Kerala, April 26, 2016.

- **Deepak T G.**, "Dynamic Programming" at the Model Engineering College, Ernakulam, Kerala, April 27, 2016.

- **Deepak T G.**, "Network Analysis" at the Indian Naval Academy ,Ezhimala, Kerala, September 23, 2016.

- **Deepak T G.**, "Stochastic Processes and Its Applications in Engineering" at the College of Engineering ,Adoor, Kerala, January 20, 2017.

- **Deepak T G.**, "Probability Theory and Its Applications" at the College of Engineering ,Kidangoor, Kerala, March 23, 2017.

- **Deepak T G.**, "Fourier Transforms and Integrals" at the College of Engineering ,Perumon, Kerala, March 25, 2017.

- **E. Natarajan** , "Finite element methods" at NGP College of Arts and Science, Coimbatore during December 2016.

- **E. Natarajan** , "Finite element methods" at NIT Trichy, January 2017.

- **Sakthivel K.,** "Control and Inverse Problems of Differential Equations", National Conference on Differential Equations and its Applications, P.K.R. Arts college for Women, Gobi, January 6, 2017.

- **Sakthivel K.,** "Optimal Control of Stochastic Navier-Stokes Equations Forced by Levy Noise," National Conference on Recent Advances in Theoretical and Computational Methods for PDEs at Dr.N.G.P. Arts and Science College, Coimbatore, January 7, 2017.

- **Sakthivel K.,** Control and Inverse Problems of Differential Equations, National Conference on Differential Equations and its Applications at P.K.R. Arts college for Women, Gobi, January 6, 2017.

- **Sakthivel K.,**"On the Dynamic Programming Approach for the Optimal Control of StochasticNavier-Stokes Equations" National Conference on Computational and Theoretical PDEs at NIT Goa, October 5-7, 2016.

- **Sakthivel K.,** "Six Lectures on Existence, Uniqueness and Regularity of Solutions for Partial Differential Equations," National Workshop on Advanced Analysis and Differential Equations at Periyar University, Salem, June 9-17, 2016.

- **Sakthivel K.,** "Five Lectures on Functional Analysis, Young Talent Nurture Program (YTN-2016)," Indian Institute of Space Science and Technology (IIST), Trivandrum, May 24 - June 06, 2016.

- **Sakthivel K.,**"Calculus of Variations and Optimal Control Theory," National Conference on Recent Developments in Differential Equations and their Applications at PSGRKrishnammal College for Women, Coimbatore, March 4-5, 2016.

- **Sakthivel K.,**"Determination of a Coefficient in KdV Equation by Optimization Method", 19th Ramanujan Symposium on Recent Trends in Nonlinear Partial and Fractional Differential Equations at University of Madras, Chennai, March 3, 2016.

- **Kaushik Mukherjee**, "Introduction to MATLAB", Pratibha Summer Training Programme sponsored by KSCSTE (Kerala State Council for Science, Technology and Environment), held at IIST, Trivandrum, May 23-27, 2016.

- **Kaushik Mukherjee**, "Second-order ODE", NPDE-TCA (National Programme on Differential Equations- Theory Computation and Application) sponsored undergraduate level training programme, held at IIST, Trivandrum, May 18-June 7, 2016.

- **Kaushik Mukherjee**, "Second-order PDE" in "Young talent Nurture" (YTN-2016) programme, held at IIST, Trivandrum, May 24-June 06, 2016.

- **N Sabu**, " Some problems in Mathematics", St. Jude's College Thoothoor, Kanyakumari District, Tamil Nadu, February 2017.

- **Prosenjit Das**, "Rank of locally nilpotent derivations on affine fibration" in the symposium "Polynomial rings projective modules and related topics", ISI, Kolkata 07-09 November, 2016.

- **Sarvesh Kumar**, Two lectures on "Linear Algebra" in 3-day & FDP on "Recent trends in Signal Processing",College of Engineering, Cherthala, March 1-3, 2017.

- **Sarvesh Kumar** Invited talk on " Interpolated virtual element methods for semilinear elliptic problems", in the International conference on "Recent advances in theoretical and

computational partial differential equations with applications", Panjab University, Chandigarh, 05-09, December, 2016.

- **Sarvesh Kumar** Ten lectures in lecture series on "Numerical techniques and programming in MATLAB, at Purvanchal University, July 22-28, 2016.
- **Sarvesh Kumar** Three lectures in "Workshop on high performance scientific computing" IISER Trivandrum, June 9-10, 2016.
- **Sarvesh Kumar** Six lectures on "Numerical solution of ODEs" in NPDE-TCA's under graduate programme, IIST Trivandrum, May 18-June 07, 2016.
- **Sarvesh Kumar** Three lectures in "Workshop on high performance scientific computing" IISER Trivandrum, 09-10 June, 2016.
- **Sarvesh Kumar** Four lectures in YTN-2016, IIST, during May 24-June 06, 2016.
- **Sarvesh Kumar** Six lectures in "Computational Techniques for differential equations" SVNIT Surat, 02-06 May, 2016.
- **Sarvesh Kumar** Two lectures in faculty training programme on "Differential Equations and its applications" College of Engineering Karunagapally, Kerala, February 25, 2016.
- **Sumithra S**, Kernel Methods: Talk delivered in the "National Seminar on Machine Intelligence, Organized by Department of Computer Science, University of Kerala, on March 28, 2017.
- **Sumithra S** Classification Algorithms: Talk delivered in the TEQIP II Sponsored Faculty Development Programme on "Recent Trends in Signal Processing", Organized by Department of Electronics and Communication Engineering, College of Engineering, Cherthala on March 3, 2017.
- **Sumithra S** Support Vector Machines: Talk delivered in the TEQIP II Sponsored Research Colloquium on "Recent Advances in Soft Computing", Organized by Department of Computer Science & Engineering and Information Technology, College of Engineering, Kidangoor on February 27, 2017.
- **Sumithra S** Introduction to Data Mining: Talk delivered in the TEQIP II Sponsored Faculty Development Programme on "Mathematics for Engineers", Organized by Department of Applied Science, College of Engineering, Adoor on January 20, 2017.
- **Sumithra S** Pattern Recognition & Machine Learning Methods for Image Processing : Talk delivered in the Faculty Training Programme on "Tools and Techniques In Image Processing", Organized by Department of Computer Engineering, College of Engineering, Chengannur on January 18, 2017.

- **Sumithra S** Mathematics of Kernel Methods: Talk delivered in the Short Term Training Programme in "Mathematical Models in Data Mining", Organized by Department of Computer Science, Amrita School of Engineering, Amritapuri Campus June 9, 2016.

- **Sumithra S,** Optimization Techniques in Machine Learning: Talk delivered in the TEQIP II Sponsored Faculty Development Programme on "Contemporary Developments in Optimization Techniques and its Applications", Organized by Department of Computer Application and Department of Electrical & Electronics Engineering, TKM College of Engineering, Kollam, May 20, 2016.

- **Sumithra S,** Mathematics of Kernel Methods: Talk delivered in the Short Term Training Programme in "Mathematical Models in Data Mining", Organized by Division of Applied Sciences & Humanities, School of Engineering, Cochin University of Science and Technology, April 04 , 2016.

- **Sumithra S,** Linear Algebra Applications in Computer Vision: Talk delivered in the Workshop on "Computer Vision: Techniques & Applications", Organized by Department of Computer Science & Engineering, College of Engineering, Karunagappally, March 17, 2016.

- **Raju K George**, "Finite-Dimensional Control Problem", IISER, TVM, May 19-20, 2016.
- **Raju K George**, "Research and Innovations in Science", Engineering & Technology (ICRISET-2017), BVM Engineering College, Gujarat, February 17, 2017.
- **Raju K George**, Resource person to deliver an expert talk, Parul Institute of Engineering & technology, Gujarat, May 16 -19, 2017.
- **K S S Moosath.**, "Calculus" at the Pattom K V, Trivandrum, Kerala, May 19, 2016.
- **K S S Moosath.**, "On Various Geometries" at the SPEED programme, IIST, Trivandrum, Kerala, May 27, 2016.
- **K S S Moosath.**, "On Numbers" at the IIST @ School at Chakkittapara, Calicut , Kerala, June 16, 2016.
- **K S S Moosath.**, "Linear Algebra and Control Theory" at the KSOM, Calicut, Kerala, October 20-23, 2016.
- **K S S Moosath.**, "On Geometry" at the IIST @ School at Thalassery, Kannur, Kerala, November 26, 2016.
- **K S S Moosath.**, "Euclidean and Non-Euclidean Geometries" at the Ishan Vikas Programme, IISER Trivandrum, December 5, 2016.

- **K S S Moosath.**, "Information Geometry" at the Govt. College for Women, Trivandrum, Kerala, December 7, 2016.

- **K S S Moosath.**, "Statistical Manifolds" at the Kongunadu Arts and Science College, Coimbatore, Tamilnadu, December 23, 2016.

- **K S S Moosath.**, "**Geometry of our Living Space**" at the DST Inspire Internship S N College, Kannur, December 29, 2016.

- **K S S Moosath.**, "On Information Geometry" at the Amrita Vishwa Vidyapeetham, Amritapuri Campus, Kerala, January 6, 2017.

- **K S S Moosath.**, "On Statistical Manifolds" at the University College, Trivandrum, Kerala, February 2, 2017.

- **K S S Moosath.**, "Information Geometry" at the Vellalar College for Women (Autonomous), Erode, February 9, 2017.

5. 3 Publications in General magazines

- **Chandrasekar,** "An Encounter" short story published in Surabhi magazine, IIST Journal on Arts and Literature, Vol. 7, No. 2, December 2016, pp7-8.

- **Nikhil Eyeroor,** "Is it time to adapt to BYOD." Teacher Plus. July 2016, pp 22-23.

- **Nikhil Eyeroor,** "De- Mystifying Hypnosis." Extra Reader.December 2016, pp 18-21.

- **Resmi, L**., "The mysterious radio bursts", Physics News, March, 2017.

- **Shaijumon C S.** "Demonetisation in India - Will it stop black money", Mathrubhumi GK& Current Affairs, Mathrubhumi Publishers, December 2016, pp 4-9.

- **Shaijumon C S.** "Foreign Direct Investment", Mathrubhumi GK&Current Affairs, Mathrubhumi Publishers, August 2016, pp36-38.

- **Shaijumon C S.,** "Towards and Evergreen Revolution, Mathrubhumi Year Book Plus 2017, (Chandran P V ed. pp. 432-443), Mathrubhumi Printing and Publication, Kozhikode, December 2016.

5.4. Continuing Education

IIST reaches out beyond its own students, and disseminate knowledge and skills to working professionals, to other students, and to the public at large. Such out-reach programmes, in addition to directly helping professionals and students of other institutions by exposing them

to modern trends and to good facilities, contribute (a) by bringing working professionals and their real life problems and needs to IIST, thereby enabling faculty to become familiar with industry sectors related to their areas, and (b) by helping individuals to be better informed and capable of taking better decisions in individual matters and in matters affecting society at large. Outreach programmes are in the form of (a) short term courses which introduce basics or address state of the art developments in certain areas, (b) workshops which aim to develop important skills in using analytical and experimental tools, (c) symposia and conferences which expose students to experts from within and outside IIST, (d) internship programmes for students from other institutions, etc. Continuing education activities in IIST are coordinated by Dean IPR & Continuing Education. In the year 2016-17 IIST conducted 15 short term programmes for industrial professionals and college teachers and students. In the past, from 2007-08 to 2015-16, IIST conducted around 37 such short term programmes. In the year 2016-17 about 20 external students underwent internships in IIST.

Short Term Courses/Workshops organized in the financial year 2016-2017

Sl No.	Short Term Courses/Workshops	Date	Department	Faculty
1	Short term Course on Automatic Control Systems Engineering with MATLAB/SIMULINK	17-20 May, 2016	Avionics	Dr. Rajesh Joseph Abraham
2	Introduction to Space Technology- A short term course for Defense technical officers	18-31 May, 2016	Aerospace	Dr. R. V. Ramanan
3	Young Talent Nurture-2016	24th May - 6th June, 2016	Maths	Dr. Kaushik Mukherjee Dr. Sarvesh Kumar
4	A course on Nonlinear Control System Design (NCSD) (for Post Graduates, Faculties and Scientists/Engineers)	20-24 June,2016	Avionics	Dr. Harsha Simha M. S. Dr. Priyadarshnam Dr. N. Selvaganesan
5	Workshop on Film Studies	21-24 June, 2016	Humanities	Dr. Gigi J Alex Dr Babitha Justin
6	Conduction of Modern Optical Engineering Workshop at IIST	27 June - 02 July, 2016	Physics	Dr. C. S. Narayanamurthy
7	Geoconnect 2016- Research Orientation in Remote Sensing & GIS for Natural Resources and Environmental Management	4-8 July, 2016	Earth and Space Sciences	Dr. Rama Rao Nidamanuri Ms. A. M. Ramiya
8	NCMST 2016	12-14 July, 2016	Chemistry	Dr. Nirmala Rachel James

9	A Hands-on introduction to OpenFOAM	9-10 September, 2016	Aerospace	Dr. Manoj T. Nair Dr. Devendra Ghate
10	National meeting on Star & Planet formation	5-7 December, 2016	Earth and Space Sciences	Dr. Sarita Vig
11	Astronomy & Astrophysics Winter School	7-16 December, 2016	Earth and Space Sciences	Dr. Resmi L.
12	National Workshop on "Control system design-Fractional controller & its applications" (CSA-FCA)	14-16 December, 2016	Avionics	Dr. N. Selvaganesan
13	Automatic Control System Engineering and Design	27-30 December, 2016	Avionics	Dr. Rajesh Joseph Abraham
14	3 day Workshop on Design Optimization & Introduction to MDO followed by 2 Day meeting of the special interest group of MDO	18-20 January, 2017 (DoMDO workshop) 21-22 January ,2017 (SIG-MDO meeting)	Aerospace	Dr. Devendra Prakash Ghate
15	2017 Trivandrum School on Communications, Coding and Networking.	27& 30 January, 2017 (at GECBH) 28 and 29 January, 2017 (at IIST)	Avionics	Dr. Vineet B. S.

5.5. IIST-SPIE Student Chapter

Society of Photo-Optical Instrumentation Engineers (SPIE) is an Americal not-for profit professional society for optics and photonics technology. It organizes technical conferences, continuing education programs for researchers and developers in the light-based fields and also publishes several journals such as Biomedical Optics, Optical Engineering etc. We have a SPIE student chapter in the IIST campus with 34 active members. Purpose of this chapter is create awareness about optics by arranging lectures, inviting speakers, outreach programs, lab tours etc. Following activities were carried out in the IIST campus or arranged in the neighboring campuses with support of SPIE-IIST student chapter.

Date	Event	Activity
29 July, 2016	Outreach program	Members visited Kollam Govt. School To teach basic optics.
17 August, 2016	Visiting lecture by Dr. N. Apurv Chaitanya from PRL Ahmedabad.	Topic of the talk: NonlinearInteraction of Structured Optical Beams.
14 September, 2016	Study tour / lab visit	School students have visited our lab Facility.
14 October, 2016	Guest lecture by Prof. Steen Grüner Hanson, Denmark Technical University	Topic of the talk: Speckles – How To Analyze, Utilize And Commercialize.
16 November, 2016	Study tour / lab visit	School students have visited our lab Facility.
10 December, 2016	Outreach program	Members visited harvest mission School, Pongode, Trivandrum to Teach Basic Optics.
21 December, 2016	Study tour / lab visit	School students have visited to our Lab facility.
10 January, 2017	Visiting lecture by Dr. Alok kumar Singh, University of Stuttgart, Germany.	Topic of the talk: 3d imaging with Scattering medium.
01 February, 2017	Workshop – 'Seeing the Unseen by Light'	A talk delivered by Dr. Rakesh Kumar Singh, Associate Professor, IIST and workshop on the same.A meeting was conducted with all the Present members of SPIE IIST Chapter for the selection of chapter Officers.
10 March, 2017	Outreach Program	Talk delivered by dr. Rakesh KumarSingh in Krishnammal Women's College, Coimbatore.
3 & 4 March, 2017	World of illusions - exhibition	An exhibition was conducted on 3rd and 4th of march in the aegis of Indian Institute Of Space Science andTechnology in which several Experiments based on basic and Advanced concepts of light were exhibited.
4 March, 2017	Holography workshop	Demonstrations and holography Workshop was conducted in the Adaptive optics lab and students Could make their own holograms.

5.6. Outreach Programmes of IIST faculty

Faculty members also involve in many outreach programmes.
Dr. Anand Narayan and was involved in the following activities.

- Presentation on Astronomy at Nedumangadu Government Girls High School on October 6, 2016 as part of the World Space Week Celebration
- Presentation on the "Endless Worlds Beyond Earth" at the Government LP School Pathanamthita on Novermber 14, 2016.
- Presentation on the "13 Billion Year Old Light" at the Priyadarshini Planetarium, Thiruvananthapuram on August 4, 2016
- Panelist during the live interaction with school children on World Space Week at Kanakakunnu Palace Hall organized by the Vikram Sarabhai Space Center, October 1, 2016

Dr. Rajesh V J was involved in the following activities.

- Delivered a lecture on "Origin and evolution of our Moon" at the IIST@Schools program, Chakkittaparai, Calicut, Kerala, Juner 20-22, 2016.
- Delivered a lecture on"A passage through the origin and evolution of our Moon" at the IIST@Schools program, Thalassery, Kannur, Kerala, November 25-27, 2016.
- Conducted a geology exhibition "Marvels of our Earth" at IIST@Schools program, Thalassery, Kannur, November 25-27, 2016.

CAMPUS INFRASTRUCTURE AND AMENITIES

6| CAMPUS INFRASTRUCTURE AND AMENITIES

6.1 Infrastructure - Buildings

The Institute shifted to its main campus at Valiamala from its alternate campus at Veli in 2010. The buildings housing Department of Aerospace Engineering has been completed and it accommodates Departments of Avionics and Humanities. The Physical Sciences block is also completed amd accommodates all the other academic departmerts. The Avionics block, Inter disciplinary block and Student Activity Centre are nearing completion.

In addition to this, 11 hostels, administrative block and library are fully operational.

6.2 Laboratory Facilities

IIST maintains the following laboratory facilities for teaching and research purposes.

DEPARTMENT OF AEROSPACE ENGINEERING

The major milestones achieved by Department of Aerospace engineering, related to facility development, during the year 2016 are;

- Setting up of a Flame Diagnostics Lab: Which is proposed as an experimental test facility for combustion diagnostics in subscale and standard burner flames. The lab also aims to facilitate the employment of state- of- the -art optical and laser diagnostic measurement techniques to combustion studies.
- Setting up of Thermal and Fluid Calibration facilities to cater the precision research requirements in thermal and fluid mechanics area.
- Augmentation of cryogenic lab facility with a liquid nitrogen plant of 120 Liters/day capacity, to facilitate cryogenics related research activities. The lab is currently supporting other Departments like Chemistry and Physics as well.

The department also highlights the augmentation activities and experimental studies completed at Advanced Propulsion and Laser Diagnostics facility (APLD) during the year 2015.

The manufacturing processes lab and Engineering workshop under Department of Aerospace could effectively support many of the project and research related activities in IIST, offered support to almost all the departments in IIST. Further, the manufacturing processes lab in aerospace department could appreciably support ISRO, specifically the AERO entity in VSSC, to realize 3D rapid prototyped models for the wind tunnel testing of LVM III (GSLV-III).

Major lab facilities established under Department of Aerospace Engineering include

- Engineering workshop
- Strength of Materials Lab
- Engineering Drawing Lab
- Thermal and Propulsion Lab
- Fluid Mechanics Lab
- Heat Transfer Lab
- Computer Aided Design and Analysis Lab
- Metrology and Computer Aided Inspection Lab
- Manufacturing Processes Lab
- Materials Characterization lab
- Aerospace Structures Lab
- Aerodynamics Lab
- Advanced Propulsion and Laser Diagnostics Lab (Centre of Excellence)
- Flame Diagnostics Lab

DEPARTMENT OF AVIONICS

The department has excellent lab facilities and state-of-the-art software tools in various disciplines of electrical engineering, electronics and communications engineering, and computer science and engineering. The teaching and research laboratories in the department are as follows:

- Analog Electronics Lab
- Basic Electrical Lab
- Basic Electronics Lab
- Computer Networks Lab
- Control System Lab
- Digital Communication Lab
- Digital Electronics Lab

- Digital Signal Processing Lab
- ECAD Lab
- Instrumentation and Measurement Lab
- Micro Processor Lab
- Navigation Systems and Sensor Lab
- Power Electronics Lab
- RF and Microwave Lab
- VLSI and Microsystem Lab &Micro/Nanosystem Characterization Lab

Some of the Labs were further appended with new equipments and research facilities in the budget year:

1. MEMS & NanoFAB (Phase-I)

Department of Avionics has taken initiative in establishing laboratories and research facilities in the area of Micro-Electro Mechanical Systems (MEMS) and Micro/Nanoelectronics. These laboratories were proposed to support the newly introduced Post Graduate programme VLSI and Microsystems in the year 2013 and Research activities in the areas of micro/nano electronics, micro electromechanical systems (MEMS/NEMS), devices and technologies. These laboratories would also support the R&D activities in the area of MEMS and Microsystems for ISRO also. As per the current plan, these laboratories and research facility would eventually be evolved as an R&D centre named NEMO Research Centre in the Department of Avionics to nurture research and technology development activities in the area of NEMS, Nano and Optoelectronics Devices, Technology and Systems.

Out of the different laboratories being established as part of this facility, Phase-I of MEMS and Nanofabrication facility namely MEMS & NanoFAB has been established during July 2016-February 2017.

The facility is planned for 4" silicon wafer substrates with upgradability for 6" wafers. The Cleanroom area shall comprise of ISO 6 (Class 1000) Modular Wall Cleanroom with support area. The proposed Cleanroom facility has been designed, built, installed and commissioned as per ISO-14644: 2001 standards. Phase-I of MEMS &NanoFAB has been established during July 2016-February 2017 with this Modular Wall Cleanroomin R-216(D4)

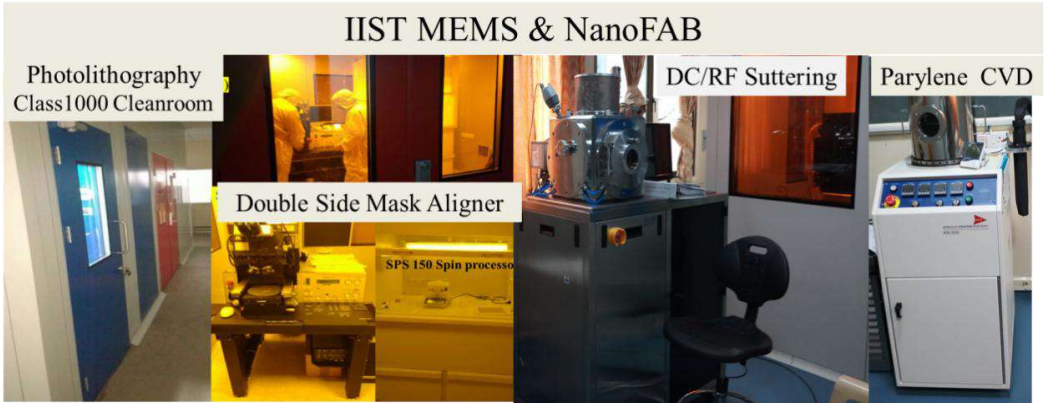


Figure: Phase 1: MEMS &NanoFAB with Modular wall clean room (D4)

The major equipment commissioned in Phase-1 of MEMS &NanoFAB include the following:

- SUSS MA6/BA6 Double Side Mask Aligner for photolithography
- SPS 150 Spin processor
- Wet chemical station
- Laminar flow solvent bench
- Nanomaster NSC 4000 DC/RF Pulse DC Sputter System
- SPS PDS 2010Parylene CVD Deposition System

2. Gas Sensor Calibration Facility

The facility is equipped with following equipment:

1. **State of Gas calibration System:** After fabrication of the sensor, the calibration system is mandatory to find out the performance of the devices. This setup is capable to generate the desire concentration of the gas in the chamber and the chamber can be heated depending on the sensor requirements. The Set up includes the monitoring of electrical signals (based on the sensor) of the sensor at different concentration of gas.

2. **Nanomaterials Synthesis System:** The performance of the sensor can be enhanced by introducing nanomaterials. The facility of this lab is capable to generate different form of nanomaterials by following equipment.
    1. Microwave assisted synthesis
    2. Electrochemical workstation (will be installing very soon)
    3. Refrigerated centrifuge system.
    4. Picolitre dispensing unit (will be installing very soon)
    5. Optical calibration system(will be installing very soon)

DEPARTMENT OF CHEMISTRY

Department has developed the following laboratories for catering to the needs of laboratory courses of B.Tech/ M.Tech programmes and research and development activities.

- General Chemistry
- Polymer Processing
- Organic Chemistry
- Polymer Technology
- Chemical Engineering
- Inorganic Chemistry
- Materials Characterisation

State of the art facilities for analysis, processing and testing are available in these laboratories. The major instruments include:

Analysis and testing: TGA, DSC, DMA, GPC, HPLC, ESI Q-TOF Mass Spectrometer, Universal testing machine, Surface area analyser, Permeability Tester, Particle size analyser, Rheometer, Goniometer, battery testing Unit.

Spectroscopy: infrared, UV-visible, Fluorescence

Microscopy: Atomic Force Microscope, Inverted microscope andHot stage polarised microscope

Processing: Electrospinning machines, Micro compounder, Lyophiliser, Planetary ball mill and*Twin screw extruder*

DEPARTMENT OF EARTH AND SPACE SCIENCES

The department has developed various facilities across sub-disciplines for research and Under Graduate / Masters courses.

Atmospheric Science Lab

Atmospheric science lab has standard meteorological instruments to monitor wind speed & direction, air temperature, relative humidity, pressure, rainfall, soil temperature & moisture; Computer lab in the department for weather data processing and analysis; Planetary Boundary Layer Laboratory with a wide variety of field instrumentation; Cloud-aerosol interactions laboratory housing a cloud condensation nucleus counter and surface based cloud droplet probe; Solar radiation instruments for energy budget studies; Air pollution and climatology observatory

Astronomy & Astrophysics Lab

This group has set up an experimental and computational lab alongwith the Astronomical Observatory. A CCD characterisation experiment set-up is routinely used for the UG and PG courses. In addition, the lab is equipped with a blackbody, infrared photometer and a spectrograph, used in teaching and outreach. The lab includes computing facilities for Astronomical Data Analysis and Computational Astrophysics courses. Two telescopes, a 14-inch Cassegrain and a 8-inch Newtonian, are housed in the Observatory. These are extensively used for teaching and outreach.

Geology Lab

The geology lab has a geological museum with good collection of rock samples (igneous, metamorphic and sedimentary), ore minerals, rock forming minerals, precious and semi-precious minerals, and various faunal and floral fossils. The lab also has variety of terrestrial analogue minerals and rocks to study the geological conditions and evolution of Moon and Mars. 3D models of various geomorphological features are also available to teach students about the basic geological concepts. The lab hosts an advanced petrological trinocular microscope (Nikon Eclipse LV100 optical microscope for detailed petrographic observations of thin sections for mineral identification, textural and optical studies), a stereozoom microscope (designed for low magnification observation of a sample typically using light reflected from the surface of an object rather than transmitted through it) and a dedicated petrological microscope equipped with heating freezing stages (for the fluid inclusion study of the wafers(0.3mm thickness) of various rock and vein samples). The research on planetary geosciences includes processing and interpretation of satellite data from Moon and Mars for terrain morphology and spectral characterization of various rocks and minerals to understand the evolutionary processes. The facilities required for carrying out the scientific studies on planetary data are available in the lab. Data processing softwares such as ENVI (Environment for visual imaging), Arc GIS and MATLAB are being employed for processing and analyses of the planetary data. Planetary data sets from different missions such as Compact Reconnaissance Imaging Spectrometer (CRISM) and High Resolution Imaging Science Experiment (HiRISE) onboard Mars Reconnaissance Orbiter (MRO), Thermal Emission and Imaging Spectrometer (THEMIS) onboard Odyssey spacecraft, and Mars Color Camera (MCC) onboard Mars Orbiter Mission (MOM) are being used for Martian studies.

Hyperspectral Imager (HySI) and Terrain Mapping Camera (TMC) data on-board Chandrayaan-1 spacecraft are being utilized for the research on Moon.

Remote Sensing Lab

Remote sensing lab is installed with updated set of remote sensing and image processing software for multispectral, hyperspectral and LIDAR data of field/ air/ space borne data and and GIS softwares for 3D geospatial data analysis. Good amount of satellite data archive is available as repository which is also used for the regular lab sessions, internships and projects of B. Tech and M Tech students. Further research activities on various fields of geospatial technology are supported by necessary field data collection equipments such as spectro-radiometer, Plant canopy analyser, Differential Global Positioning System, hyperspectral imager etc. benefiting the research scholars.

DEPARTMENT OF HUMANITIES

Communication Skills Lab

Department of Humanities offers a course in Communication Skills which uses both theory and practical classes for learning and teaching language in one semester. The objectives of the Communication Skills Lab are:

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills which will make the transition from the institute to workplace smoother and help them to excel in their jobs.

- To enhance students' performance at seminar presentation, in technical writing, in framing project presentation, Group Discussions and other skill-oriented exercises.

The lab practice is divided into two categories as "English Language Lab" where listening comprehension, reading comprehension and vocabulary and speaking tests are conducted, and "Career Lab" where writing tests on Resume/Report preparation and Letter writing are conducted. The students are also given training in presentation, Group Discussion and interview skills

Audio Visual Lab

The Audio Visual Lab is intended to be utilized for creating audio and video modules, study materials, to create content generation for lectures (both online and offline), documentaries, etc, by the faculty members, the students and the administrative fraternity of the Institute.

The studio can be utilized for the following purposes:

- As a tool for Enhancing Communiaction Skills
- Creating Content for various ISRO Centres
- Content Devepolment and Materials Development
- Recording of Interviews, talks of Dignitaries, etc

DEPARTMENT OF PHYSICS

The follwoing labs function in the department

- Applied and Adaptive Optics
- Atomic and Molecular Physics
- Computational Physics
- Electronic Materials and Devices
- General Physics
- Lasers and Photonics
- Modern Physics
- Optics
- Solid State Technology

The Labs acquired the following facilities during the last year.

Electronic Materials and Devices:

- Scanning Tunneling Microscope (Spectroscopy and lithography model)
- Spectroscopic Ellipsometer (Holmarc, for the detection of optical parameters of thin films),
- Nd-YAG nanosecond Laser (Spectra-Physics)
- Pulsed laser deposition system (being built up)
- Spray pyrolysis set up (Holmarc, for thin film projects)
- Probe ultra-sonicator.
- Spin-coating unit and hot-plates.

Experimental set-up to study electron impact ionization (e, 2e) processes in large molecules by using electron-ion coincidence technique (Atomic and Molecular Physics Laboratory)

Electron impact ionization (*e, 2e*) is very useful technique to study the structure and dynamical properties of large molecules (Eg: Poly Aromatic Hydrocarbon (PAH)). The procedure usually produces a range of molecular fragments that in most cases, helps to elucidate the structure of the molecule. However, although molecular ions are often produced by knowing the secondary electron energy and angular distribution, we can extract the dynamical properties of molecule, since these properties are related to molecular orbital. An electron-ion coincidence setup is designed, fabricated at IIST. It was tested and established in October 2015. By using the current experimental set-up, we study indirect ionization (auto-ionization) and related structural effect on the large molecules (Eg: PAH). For that, a beam of electron from electron gun (E-Gun) will interact with the molecular sample (injected to the system perpendicular to the electron beam direction). We use a high resolution and high efficiency cylindrical mirror analyser (CMA) for secondary electron-coupled to a linear and reflecting

type of time of flight mass spectrometer for produced molecular ion. By using CMA, the energy and angular distribution of secondary electron-coincidence with recoil ion for large molecule from linear type/ Reflectron will be studied, in order to separate direct impact ionization process (single particle) from auto-ionization/collective excitation.

Comprehensive Stationary Plasma Thruster Diagnostic Instrumentation (Atomic and Molecular Physics Laboratory)

IIST-LPSC collaboration has been active in the field of electric propulsion since October 2011.The expertise and infrastructure available in Atomic and Molecular Physics Laboratory, IIST provide support to the ongoing ISRO program in electric propulsion systems. In the one year duration from 1st April 2015 one new facility is added to support this collaboration and five new sets of diagnostic probes were developed. Out of which three probes, namely RPA, Faraday Probe and Langmuir probe have been tested and are in regular use at IVTF, LPSC, Bangalore for the test of 75 mN Hall effect thrusters.

General Purpose Vacuum Chamber

- A vacuum chamber of 44 cm height and 50 cm diameter
- A top flange that can rotate 180^0 using a hydraulic lift mechanism.
- A 700 L turbo pump is attached to create a vacuum up to 10^{-8} mbar.
- An ion source which can effectively cause plasma is another specialty.

List of probes that have been tested and/or delivered

- Langmuir Probe : Effective in measuring plasma properties like plasma potential, electron temperature, electron and ion density at a given position, plume divergence
- Faraday cup Probe: Perform beam intensity measurements accurately and as close as possible to the thruster without disturbing the plasma itself
- E X B Probe (Wien filter)**:** Can measure the velocity of the ions irrespective of their masses.

- Retarding Potential Analyzer: Measures the ion beam/plume characteristic as a function of the spatial coordinates as well as with duration of operation. Can be employed for the energy analysis of the charged particle species.
- Parallel Plate Analyzer: The instrument will be able to obtain the full energy spectrum of the ions. A pulsed injection of ions will help in identifying the mass to charge ratio of the species present in the plume down to parts per million levels.

Retarding Potential Analyzer

E X B Probe

Parallel Plate Analyzer

DEPARTMENT OF MATHEMATICS

Programming Lab

- 50 Desktop Computers with Internet facility.
- Dual Operating Systems (Windows and Linux).
- C, C++, MATLAB courses.

Soft Computing Lab

- 10 Desktop Computers with Internet Facility
- 4 High-end Workstations, 8 Core Xeon Processor with 80 GB RAM, 2.4 Ghz Speed, 20MB Cache, NVIDIA Quadro K4200 Graphics and 24 inch LED Monitor.
- Artificial Neural Networks, Pattern recognition and Machine Learning, Modelling and Simulation Lab courses.

6.3 Central Facilities

6.3.1 Library & Information Services

IIST library supports academic activities of IIST by providing information resources and also by subscribingto electronic databases. It provides an enjoyable right ambience for study and research with a seating capacity for 150 people at a time. Library is automated using the open source library application software – Koha. Entire library is wi-fi enabled and have 12 LAN connections for browsing electronic journals.

Resource position of the library is given below:

Sl. No.	Resource	Quantity
1	Books	28388
2	Journals (Print)	87
3	Online Databases	14
4	Online journals	5000
5	CDs	991
6	Bound Journals	210

Online Resoruces: Library subscribed to the following online resources during the reporting period:

ACM Digital Library, AIAA Journals, American Institute of Physics, American Meteorological Society, American Physical Society, American Society of Mechanical Engineers, IEL Online (IEEE), JSTOR, MathSciNet, Optics Infobase, Oxford University Press, Royal Society of Chemistry and ScienceDirect. Being the member of ISRO e-journal consortium – Antariksh Gyan, access were enabled for SPIE digital library collection. Library subscribed separately to seven individual e-journals in different subject areas.

Services Offered by IIST Library

Front Desk Service: Front desk acts as the reference, transaction and help desk for the user community. During the reporting period nearly 15000 documents issued from the library. Library kept open on all holidays except two national holidays. Library remained open during 0900 to 0900 during Monday to Saturday and from 9000 to 1730 on Sundays. Library timing extended till 2230 during examinations.

Remote Access Facility: A facility has been provided for faculty members to access the subscribed electronic resources and other useful open source documents remotely from any part of the world.

Text Book Bank: The collection in the book bank reached to 9711. During the period 8365 text books were issued to the students through this service.

Inter Library Loan and Resource Sharing: Through this facility 26 books and 44 journal articles were arranged from other libraries and 30 articles were sent to other libraries in response to their requests. Prior art service were provided to users on demand to get patent related information.

Book Grant Service: Library taken up the book grant service for B Tech students. New guidelines were prepared for the book grant and representatives were selected from students for this service. Monthly reimbursement system introduced for the book grant.

Web OPAC: The online catalogue was deployed in the campus on 24x7 basis. In addition to searching the catalogue it was also helpful to personalise the service offered through LMS.

Current Awareness Service: Journal ToCs continued to offer to the users to follow content pages of their favourite journals and keep them informed about current articles in their areas of interest. From IIST, 468 users were following 415 journals. Library has started scanning and uploading of content pages of print journals subscribed by the library to the library portal. List of new addition of books uploaded to the library portal every fortnightly and intimated users through e-mail.

Library Portal: Library portal showcased the online resources subscribed by the library with provision to search various resources in a single stretch. This also provided extensive information about the library with respect to various resources available and services offered by it.

Graphic Design Facility: This is a vital facility, widely used for the designing of various documents from the IIST, such as annual report, institute brochure, calendar, proceedings, surabhi magazine, course materials, sounding rockets, students' publications etc.

Reprographic Facility: This facility continued its service to meet the printing and photocopying requirements of academic and administrative community of IIST. In the reporting year 7.10 lakh copies were printed by using this facility. An amount of 3.33 lakh was collected for extending this facility for personal purposes.

Binding Facility: All binding requirements of the institute were met with this facility. In the report year, 8079 volumes were bound. Rs. 22807.00 were collected for providing this service for personal purposes.The Graphic Design Facility, Reprographic Facility and Binding facility continues to cater to the publishing needs of the institute.

Resource Awareness Prgoramme (REAP): In order to familiarise electronic resources subscribed by the library and also to promote its usage, REAP were conducted at frequent intervals. During the reporting period 4 such programmes were conducted on various e-resources.

Library conducted three exhibitions of maps received form NRSC inside the library.

6.3.2 Computer System Group (CSG)

Computer Systems Group manages and maintains computer systems, networking and related electronic infrastructure in IIST for provisioning and facilitating IT and non-IT services for the institute. These include roaming wireless internet services, high-performance computing, web and mail services, audio-video conferencing services, audio-visual and multi-media services, and physical-security and surveillance systems in IIST.

IT services in IIST formally commenced with the formation of Computer Systems Group in 2010. In-house resources and capabilities have been developed by CSG over the period to undertake uninterrupted operations and routine maintenance to ensure 24x7 availability of these systems and services in the campus and on the Internet.

CSG today caters to the needs of about 900 undergraduate, postgraduate and research scholars, 100 faculty-members, 500 staff-members and 100 security-personnel, together having about 1800 deskop, laptop/tablet PCs and smart-phones in about 20 buildings within the campus.

As part of the operations, CSG manages and maintains a large inventory of devices and consumables as listed below.

Computers, including Servers	1252
Network devices	487
Audio/Video/Multimedia/Security devices	431
Telephone installations	265
Printers & Copiers	258
Printer Toner Cartridges	137
Consumables (Batteries)	1007

Computing Infrastructure

Computers, consisting of 913 numbers of desktop PCs and 204 laptop PCs are available in the institute, distributed amongst all academic departments, laboratories, administrative

offices and service facilities. A few amongst these are faulty and beyond economical repair. All networked PCs are provided with internet access.

More than 800 laptop/tablet PCs and smart-phones, owned by students, research scholars and members of the staff and faculty, are also provided with round-the-clock roaming wireless internet services in all hostels and academic blocks.

Comprehensive contract for maintenance and repair of desktop PCs is in operation with two on-site service-support engineers in IIST.

High Performance Computing (HPC) Workstations.

55 workstations are installed with various scientific and engineering software and maintained in the laboratories of various academic departments in IIST.

10 of these are maintained by CSG as a common-facility in a 10-seat HPC laboratory facility. This is being made available for round-the-clock use by students and research scholars.

Procurement of additional workstations for use as common infrastructure in the year 2017-18 is in progress.

Comprehensive contract for maintenance and repair of workstations is in place.

High Performance Computing (HPC) Cluster

3 TFLOPS Intel cluster, maintained by CSG as a common facility in the institute since the year 2011, is made available through remote-access to students and faculty-members through the campus network round-the-clock.

Resident students and research scholars have been facilitated round-the-clock physical-access to the work-stations in the HPC facility controlled through biometric access systems.

Procurement of new 32-TFLOPS Intel Cluster to augment the 8-year old infrastructure is in progress.

IIST proposes to consolidate further requirements of HPC and workstation of various departments and operate this as a common infrastructure in the coming years in order to improve utilization and hasten return-on-investment.

Computer Operating Systems & Softwares

Operating systems of desktop PCs and laptop PCs is pre-dominantly Windows that were procured along with original equipment. Servers are installed with Redhat Linux.

24 licenses are available for installation of virtual servers on VMWare ESX hypervisors. Summary count of operating systems is listed below.

Linux	90
UNIX	1
Vmware	4
Windows	1049

Licensed and open-source application softwares for preparation of documents, spreadsheets and presentations are in use. Use of open-source applications are promoted for this purpose.

Licensed scientific and engineering softwares for academic and research purposes are procured by respective academic departments, and maintained in the central licensing servers in CSG.

Sl No	Software	No of License	Owner
1	AutoCad 2009	60	Aerospace
2	AWR	40	Avionics
3	Cadence (OrCAD)	20	Avionics
4	Ansoft	1	Aerospace
5	Altair (hw9)	1	Aerospace
6	XILINX Vivado 2017	25	Avionics
7	Abacus Simulia 6.13	15	Aerospace
8	MATLAB R2009a	30	Avionics
9	Adams (MSC)	3	Avionics
10	CATIA	30 & 30	Aerospace
11	OPERA	10	Avionics
12	89601B_Education	15	Avionics
13	AutoCad Inventor 2011 -3D	30	Aerospace
14	Cadence	10	Avionics
15	CFD++ (12, 14.1, 15.1, 16.1)	4 & 60	Aerospace
16	Calibre	1	Avionics
17	Synopsis	10	Avionics
18	Altera 7.0	10	Avionics
19	Maple 14,15,16	25	Mathematics
20	Mathematica	30	Mathematics
21	Modfrontier 4.4,4.5	5	Aerospace
22	Pointwise 17.3	1	Aerospace
23	Coventor	6	Avionics
24	ADS	30	Avionics
25	Phoneix		Avionics
26	Ansoft (HsFs)	5	Aerospace
27	Cadstar	6	Avionics
28	Solidworks 2014	60	Aerospace
29	TCAD Saber (Synopsis 11.11)	5 1	Avionics
30	Ansys 14.5	25	Aerospace

31	MATLAB R2013b, 2015b, 2016a	Floating UL(10000)	Avionics
32	COMSOL 4.4/5.2	UL	Avionics
33	EMPRO	25	Aerospace
34	FEKO	1 + 9	Avionics
35	CST Classroom License	10	Avionics
36	CST Full License	3 + 7(free)	Avionics
37	Tecplot	1	Aerospace
38	Adams (MSC) 2015, Nastran, Patran - Student License	150	Aerospace
39	Altair Hyperworks	1500000	Aerospace
40	Ansys 16.2	25	Aerospace
41	Bluespec	5	Avionics
42	SILVACO	5	Avionics
43	Tecplot	2	Aerospace
44	Mentor Graphics	50	Avionics
45	OriginLab	3	Aerospace

Networking Infrastructure:

The institute's networking infrastructure operates at the core from a dual redundant pair of modular-high end network-switches installed in the server-room, and spreads out through a 1Gbps OFC backbone of distribution-switches and access-switches installed in various administrative buildings and academic blocks.

Wired LAN is currently operational through 79 switches and wireless LAN over 136 wireless access-points that are in operation round-the-clock.

Summary count of various network devices currently available in inventory of CSG as part of the network infrastructure is listed below.

Firewall, eMail Services	2
Firewall, Network Services	2
Firewall, Peripheral Network	2
Router/Modem, ADSL/4G, Wireless	5
Router, Peripheral Network	4
Server, Firewall Log Analysers	2
Software, Network Management	3
Switch, 05port, Unmanageable	10
Switch, 12port, Manageable	4

Switch, 24port, 08PoE, Manageable	12
Switch, 24port, 24PoE, Manageable	42
Switch, 24port, Manageable	28
Switch, 24port, Unmanageable	8
Switch, 48port, Manageable	36
Switch, Core, Modular, 9slot, Manageable	2
Wireless Access Point, AP-1252AG-N-K9	30
Wireless Access Point, Lightweight, LAP-1252G-A-K9	175
Wireless Access Point, Lightweight, LAP-1261N-A-K9	39
Wireless Bridge, AIR-BR1310G-A-K9-R	16

**list includes operational, faulty, spare and new stocks*

COWAA Wired Network connecting COWAA clients to COWAA Sybase Application and Databases Servers has been setup and is operational as a separate network.

SPACENET Wired Network connecting COWAA clients to COWAA Sybase Application and Databases Servers has been setup in 2017 and is also operational as a separate network.

Wireless Network is made available to facilitate mobile roaming internet services using any BYOD in all academic and hostel buildings inside the campus.

Internet Security is managed through firewalls and unified threat management devices deployed in multiple layers of the network.

Security of networks and internet/email services has been enhanced with the introduction of gateway security devices in the year 2015-16. Security logs are now also being retained in separate servers for prospective use by audit or investigation agencies.

Internet Services

Internet services using 1000Mbps link from National Knowledge Network (NKN) of the MHRD, Government of India, have been made available round-the-clock at all offices and academic and residential locations in the campus since 2011.

Additional 10 Mbps Internet link from BSNL facilitates web-hosting and also backs-up the 1000Mbps link in case of network-outages since 2011.

In the year 2016-17, peak daily internet usage remains under 149Mbps.

Internet services is also facilitated by maintaining a 24-seat internet room as a common-facility for use by students in the academic blocks, a 4-seat internet facility for the 1st year undergraduate boys' hostel and a 2-seat facility in the undergraduate girls' hostel.

SPACENET VPN Services

IIST's network has commissioned uplink to the SPACENET VPN, in the year 2016, to access information services made available centrally by Dos/ISRO.

Augmentation & Upgrade

Several of the network equipment is due for augmentation on account of end-of-technical-support and advancement of technologies.

Augmentation by replacement of faulty networking equipments appear to be more prudent and economical than undertaking short-term maintenance contracts for old and technology-outdated devices through costly AMCs.

Thirty-four 48-port switches and fourteen 24-port PoE switches have been procured in the year 2017 as part of augmentation.

Provisioning of wired networks in the rooms of faculty-members and labs are currently in progress and expected to be completed by end of 2017.

Provisioning of wireless networks in the new buildings are also expected to be completed by end of 2017.

Financial proposal for augmenting backbone bandwidth of the network infrastructure to 10Gbps is awaiting budgetary approval for the year 2018-19.

Server Infrastructure

Computer Servers maintained by CSG currently consists of about 66 multi - processor server hardware devices (including the cluster hardware) as listed below:

Server, Blade	8
Server, Blade, HPC	32
Server, Rack Mount	20
Server, Tower	6

These servers have been optimally divided into numerous multi-platform virtual servers to cater to the need to host new academic and scientific software and web-applications of the institute on ad-hoc basis.

These host several web services and information systems for management of routine administrative functions and also academic functions like admissions, courses and exams.
Server hardware equipment are due for augmentation on account of cent-per-cent utilization, end-of-technical-support, lack of processor and memory resources, and advent of newer and faster technologies.
Maintenance contracts of existing sever hardware are not to be renewed further, as these are being augmented with new servers.

Procurement of replacement servers is in progress and are due for replacement by the end of year 2017.

Storage Servers have been augmented in the year 2016 by additional 50TB, and currently consists of two Storage Area Networks totaling formatted space of 68 TB.

Information Systems

Services currently facilitated through the server and network infrastructure are listed below.

Web Sites and services hosted include:

www.iist.ac.in : Internet Web Server for Official Web Site
moodle.iist.ac.in: eLearning Server
nanosat.iist.ac.in : Nano-Satellite Project Blog
ns.iist.ac.in : External Name Server

Internet Web Application services hosted include:

academics.iist.ac.in as Student Web Portal
icampus.iist.ac.in for Academic Management
admission.iist.ac.in for Counselling & Admissions
Online-registration portals for seminars and conferences.

Intra-IIST Web Application Services hosted include:

Csg.iist.ac.in as IT Services Management System
Students Directory, of all students admitted since 2007.
Office Orders, Circulars and Forms Directory.
Gate Pass Management System Software.
Canteen Material Management System Software.
Koha Library Management Software.

Management Information Systems hosted include:

COWAA client-server based MIS.
cowaamis.iist.ac.in web-based MIS.
pis.iist.ac.in web-based Personnel Information System.

Network Management & Security Systems maintained include:

MRTG Network Bandwidth Monitoring Server
Wireless Network Management Server
Network Management Server
Network Anti-Virus and End-Point Security Server.

Software License Management Servers host licenses of scientific and academic software.

Multimedia, Audiovisual and Satellite Communication Facilities are maintained to support conduct of academic lectures and conferences in classrooms, seminar halls and meeting rooms.

Satellite-based SPACENET Video Conferencing commissioned in the year 2014-15 continues to remain operational in the Administrative block.

IP-based Internet Video Conferencing has been facilitated in D4-Academic block and the Administrative block, making use of existing NKN internet connectivity.

These facilities have also been augmented with overhead LCP projectors and web-conferencing devices in the year 2016.

This has enabled virtual multi-location multi-media conferences with various ISRO centres and other universities and research institutions in India and abroad.

Public Address Audio Systems and Multimedia Projectors have been installed in all Class Rooms and are maintained on daily basis to facilitate smooth conduct of classes.

Installation of these facilities is in progress in the buildings occupied newly after completion of construction.

Physcial-Security, Identity and Access Control Systems have been established to facilitate round-the-clock entry/exit at the main-gate, and also access various laboratories and facilities.

Biometric Access Control Systems as per DoS/ISRO guidelines have been made operational. Four additional turn-styles with eight IN/OUT readers and five mobile readers have been made operational to lessen congestion at the main-entry-gate during morning arrivals and evening departures.

The system now facilitates self-authenticated entry/exit through the main gate for students and staff.

BACS has also been installed at exit-points in various other buildings to record the time of return after work.

Smart Card Personalization and Photo ID Card Printing facilities have been set-up and are being operated and maintained in-house by CSG personnel.

Smart ID cards have been issued to all IIST employees and staff-on-contract as per DoS/ISRO guidelines. All students are being issued smart-cards and expected to be completed by end of 2017.

Operations of Multi-centre online-counseling for UG Admissions of 2017 was facilitated by CSG, by setting up ad-hoc local-area-networks and computers systems in ISRO centres in Ahmedabad, Bengaluru, Kolkata, Delhi and Thiruvananthapuram.

WAN network was re-designed and setup making use of NKN and 4G wireless links available at the centres, resulting in substantial financial savings.

Inventory & Stores Managment

CSG manages a large inventory of computer devices, network devices, other electronic devices and consumables. Summary count of inventory is listed below.

Computer devices	1252
Network devices	487
Audio/Video/Multimedia/Security devices	431
Phones	265
Printers & Copiers	258
Printer Toner Cartridges	137
Consumables (Batteries)	1007

*as on 25-Aug-2017

Consumables, spares and faulty devices are maintained in appropriate storage rooms with auditable registers.

Open-source inventory and help-desk software 'IT Services Management System' (ITSMS) implemented by CSG has entered its second year of successful operation.

ITSMS comprehensively covers all aspects of inventory and support management of networks, computers, audio, video and multimedia devices and consumables. Information in this is available for use information over the network by all users.

6.3.3 Software Support Group (SSG)

Software Support Group (SSG), lead by a team of IT professionals provides various software services and technical assistance in Indian Institute of Space Science and Technology.

SSG implement software services to the various departments such as Academics, Administration, Canteen, Purchase, Stores, Accounts and Placement in the Institute. SSG has designed, implemented, customized, tailored and updated many applications within limited time constraint with accuracy. SSG plays an important role in providing software solutions based on Institute demand.

SSG Activities – A quick walk through

a. Software tools developed for various activities in the Institute:

Analysis, Design, Coding, Implementation, Maintenance and Enhancement

1. iCampus – Manages academic functions in IIST campus
2. Academic Portal – Student view for academic activities in IIST
3. Placement Software – For placement assistance
4. Material Management System – For Stores, Construction and Maintenance Division
5. Student Activity Board – Event Management System
6. Appointment on Short-term Contract Basis – Online Application Submission
7. IIST Admission Software (Ph.D., M.Tech. and Undergraduate Programmes)
8. IIST Multi-center Counselling Software for Undergraduate Programmes
9. ISRO Absorption Counselling Software
10. Convocation Portal – For registration and posting convocation related information
11. Summer Internship Programme - For internship registration and list publishing
12. Gate Pass Management System – For managing student, guest, vehicle pass
13. Card Generation System – For printing identity cards and canteen cards
14. IQAC- AQAR – Online Criteria submission
15. Payment Information System – For tracking budget details
16. Student/Staff Directory – Manages student and staff details
17. Student Payment Information System – Manages student payment details

b. Customized Applications:

Implementation, Maintenance and Enhancement

1. COWAA IIST MIS
2. Canteen Management System
3. TOMD for Transport
4. Personal Information System
5. Cheque Printing
6. Diarising System
7. Online Registration for conferences and workshops

c. Software Support:

Technical and User support

1. IIST Website
2. COWAA Database support, backup and trouble shooting

d. Other Activities:

1. Website design for seminars/workshops on request
2. Record keeping and document preparation
3. Analyze and provide various reports and charts based on requirement
4. Query response for admissions through email.
5. Uploading and version control of applications in server.

e. Current Software Development:

Analysis, Design, Coding, Integration and Testing

1. IIST/IIST-ISRO Project Tracking
2. CSIF – CHSS Contribution Tracking
3. Conference Travel Management System
4. Budget Compilation System

6.3.4 Hostels

11 hostels named after the mythological-constellations 'nakshatras' viz. Dhruva, Dhanista, Chitra, Revathi, Rohini, Ashwini, Ardra, Phalguni, Anuradha, Arundathi & Vishaka accommodate around 800 students.

All the hostels has provision for safe drinking water with hot and cold water dispensers, 24 hr uninterrupted power supply with generator backup, housekeeping services, reading room with national and vernacular newspapers, indoor games facility, LCD television with satellite connection etc. and centralized gym facility with modern fitness equipments. All hostels are WiFi enabled with High-Speed Access to the Internet, Digital Library and other Digital Learning Resources. A laundry service provider meets the needs of resident students.

6.3.5 Canteen Services

More than 800 inmates are residents in the Institute hostels. Canteen Services therefore is fully functional round the clock through two well equipped kitchens catering to the needs of not only the residential population but also the regular functionary population of more than 300 people which includes Faculty members, Officer, staff. Student Dining Halls viz. 'Aditi' and 'Akshaya' having a capacity of 150 each caters to the auxiliary staff also. In addition to this, 'Tripthi' and 'Subhiksha' is for the faculty members and VIP services respectively.

Menu is finalized by the Canteen and Hostel Committee which includes student representatives. In addition to this, Canteen Management Committeen Canteen Procurement Committee and Canteen Accounting Committee are constituted to assist the smooth functioning of the Canteen Services.

6.3.6 Sports and Recreation

Even though infrastructure development is still on its way, IIST has given utmost importance to sports facilities for its students. A Sports Ground (100m x 50 m) in the area earmarked for the future residential area is available to the students for all kinds of sports activity. This is now being upgraded to (100m x 100m). All the hostel are provided with Table Tennis tables. Academic blocks viz. Aerospace Building (D4) and Physical Sciences (D2) building are also supplied with TT tables. An open Basket ball court and Volley ball Court are alos available in the campus. There are two badminton courts in the Physical Sciences building.

Gymnasium

IIST is having a fitness centre to maintain Health and Fitness of students, which is situated in Hostel Dhanishta and Hostel Arundhathi. It features a selection of Cardio Vascular Endurance training machines, Resistance training equipments and free weights.

In Dhanishta building the Cardio area is composed of Two Club Momentum treadmills and cross-trainers located in first floor. The Strength training area is located in ground floor, composed of Body Fit and Muscle Fit selectorized equipment and a multitude of free weight equipment.

In Arundhathi building the Cardio area is equipped with two Stationary upright Bikes and two Body vibrator exclusively for the lady students. The strength training area is composed of Muscle Fit selectorized multi gym. Instructional and fitness oriented classes are provided like Yoga, Pilates, Aerobics and dance classes.

Additionally the Outdoor gymnasium has space for functional strength training and core training. This facility is extended to students for various training programme such as a Kettlebell workout, the Medicine ball workout and Jump rope workout.

6.3.7 Health Centre

Medical Centre extends primary health care to students and staff of the institute. It is operational with doctors and para medical staff on round the clock duty. Necessary medicines are kept available in stock. A fully equipped ambulance is always ready to meet emergency situations in addition to the vehicle which is assigned medical duty.

For cases requiring specialised treatment or hospitalisation, patients are referred to Sri Uthradom Thirunal Institute of Medical Sciences, Vattapara, Thiruvananthapuram located 13 kms from the Institute. All students of the institute are having medical coverage which includes accident insurance coverage through this hospital.

Permanent staf including faculty members, officers and other technical and administrative staff are covered by the Contributory Health Service Scheme (CHSS) of ISRO which meets their medical needs as well as that of their dependents.

6.3.8 Other Amenities

The following amenities are available in the campus for the students and staff.

Communication

The Institute has a central exchange from M/s BSNL with 250 direct lines to different departments, offices and facilities.
Centralised electronic franking takes care of outward postage.
Fax facility is available in most of the departments in addition to the centralised one available in the administrative office.

Bank

Union Bank has a fully computerised branch with all facilities including ATM in the campus.

Cafeteria

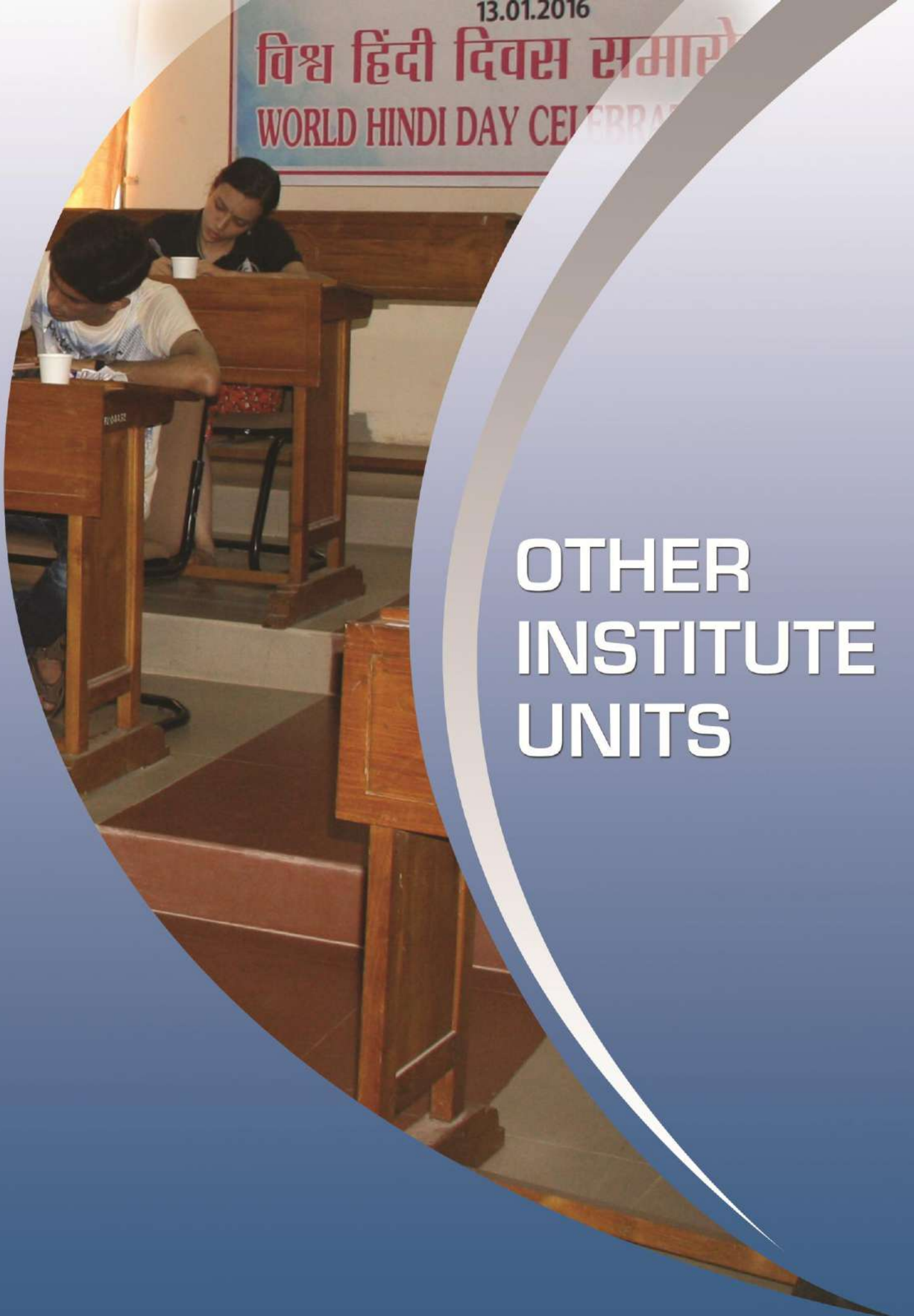
Private run cafeterias are present in the Aerospace (D4), D2 buildings and near the gate complex. A juice outlet is also available. All necessary requirements of stationery and other toiletries are met by the stationery counter operational along with the cafeteria.

Security Services

Campus Security services is now entrusted to CISF personnel. A CISF contingent including Assistant Commandant and 107 officials keep vigil for 24 x 7 in the residential campus.

Transport

The transport section maintains a fleet of service through institute owned vehicles as well as hired vehicles.



OTHER INSTITUTE UNITS

7| OTHER INSTITUTE UNITS

7.1 Placement Cell

The Placement Cell at IIST continually liaise with industry, R&D organizations, and management Institutions, with the vision of Training, Career-Guidance, Internship/Project, and Campus Placements for our post graduate and undergraduate students. The Placement Officers are Dr. Deepak Mishra, Associate Professor, Department of Avionics and Dr. Bijudas C. R. , Assistant Professor, Department of Aerospace Engineering.

The Placement Cell works in line with the policies of the Institute and tries to coherently match the interests of students with an appropriate job profile. The Placement Cell channelizes feedback from Industry, R&D Organizations and Management Institutions on academic programmes, to the Institute. The Placement Cell continually functions to safeguard the interest of the students and endeavors to be a part of their safe and secure future.

A company/R&D/Management, registers with the Placement Cell, through an online job portal for the purpose of placement and internship. Upon registration, the Company will receive a Log-In ID and Password to input more details. The Placement Cell will appropriately co-ordinate to take the process further.The internship period for both B.Tech. and M.Tech. Programmes usually lasts for two months, tentatively from May to July, every year. However, internships which require more than two months, for selected M.Tech Programmes, can be worked out in line with the Institute policies and guidelines. The Companies /Organizations are welcome to contact the Placement Cell for further details and discussions. Companies visited us during the period April2016 to March 2017 include M/S Analog Devices, M/S Philips Innovation, M/S Viz experts, M/S Math works, M/S TCS-CTO, M/S Kottackal Business Solutions, M/S Team Indus, M/s Subex Limited, M/S LM Wind power and M/S Intel.

Invited Talks / Workshops conducted by Placement Cell

Sl. No.	Company	Visited Personnel	Event
1	TCS	Dr. Kesava Swamy, Head, Academic Interface Programme Shri. Selvan Suryaprakasham, Quality Assurance Team, Head	Technical Presentation
2	Sebastian Associates	Mr. George Sebastian, Corporate Trainer	Workshop on Soft skill Training
3	KPIT Technologies	Mr. Krishnan Kutty, Associate Technical Manager Mr. Chaitanya Rajguru, Leader for Center for Research in Engineering Sciences and Technology	Technical Presentation

4	Analog Devices	Mr. Anand Venkitasubramaniom, Technical Head	Technical Presentation
5	NFTDC	Dr. Balasubramaniom, Director	Technical Presentation
6	Measat Satellite Systems	Mr. Lakshmi Narasimham, Principal Engineer	Expert Lecture and Workshop on Ground Station Design & Development
7	Dhruva Space	Mr. Sanjay Nekkanti, Co-Founder	Expert Lecture and Workshop on Nano Satellite and Ground Station Activity
8	Ernst and Young	Mr. Binu Sankar, Assistant Director Mr. Brijesh Madhavan, Associate Director	Technical Presentation

7.2 Official Language Department

IIST has a full fledged Hindi Section which not only caters to the Constitutional and Statutory requirements regarding the Official Language, Hindi, but also creates a conducive environment for the officials of the Institute to learn Hindi and work in Hindi. Implementation of Hindi in IIST continued with vigor during the year.

Major activities related to policy implementation

- Four Hindi Workshops were conducted on 28th and 29th June, 2016 (for the Employees of Technical areas), September 21, 2016 (for the faculties), December 27th and 28th (for the Employees of Administrative areas) and on March 09, 2017 (for the Executives of the Institute).

- Four Quarterly meetings of the OLIC were conducted on 23.06.2016, 28.09.2016, 21.12.2016 and 28.03.2017 and four Quarterly Progress Reports regarding progressive use of Hindi in the Institute were sent to the Department of Official Language.

- September, 2016 was celebrated as Hindi Month. During this month various competitions were conducted in Hindi for both Students and Staff members of IIST. Merit certificates and cash prizes were awarded to the winners of various Hindi Competitions on October 26th, 2016. Software Training in Hindi was also imparted to all the Assistants.

- World Hindi Day was organized on 17th and 18th January, 2017 with various competitions in Hindi for the Faculty, Staff and Students of IIST. Merit certificates and cash prizes were awarded to the winners on January 26th, 2017.

- Telephone Directory, Course Record, Record of Degrees conferred, Provisional Certificates, Degree Certificates and all other certificates such as certificate of participation/ certificate of merit etc., were prepared, printed and issued in bilingual

format (both Hindi and English). Institute Booklet, Annual Report 2015-2016 were printed in Hindi. Abstracts of the Ph. D Thesis were prepared in Hindi.

- Standard forms used in various Administrative and other Departments were bilingualised, visiting cards, name boards and rubberstamps were prepared in bilingual format.

- In order to ensure the compliance of Official Languages Act, 1963, Official Languages Rules, 1976 and relevant orders issued by the Dept. of Official Language time to time check Points were re- established.

- In order to encourage the progressive use of Hindi the incentive scheme for doing official work in Hindi was continued.

- Hindi Officer, IIST provided faculty assistance for the conduct of OL workshops in various ISRO Units as well as other central government offices in Thiruvananthapuram ie. VSSC, IISU and IPRC.

Participation in various programmes:-

- IIST, Valiamala is a member of Town Official Language Implementation Committee (Office-2), Thiruvananthapuram and actively participated in their activities. Registrar as the Head of Administration along with the Hindi Officer participated in the first meeting of TOLIC held on December 7, 2016. The employees of the Institute participated in Joint Hindi Fortnight Celebrations held under the auspices of TOLIC and two employees won prizes in Noting and Drafting, Recitation and Extempore Speech. They participated in the Inter TOLIC competitions between the four TOLICs of Thiruvananthapuram and one of the officials won the first prize in Extempore Speech.

- Hindi Officer along with Jr. Hindi Translator participated in the Official Language Special Orientation Programme conducted by Department of Space on 14th & 15th July, 2016 at ISRO Guest House Devanahally, Bangalore on 'Updated Space Science Terminology'.

- Shri. Abhay Jain attended Inter Centre Hindi Technical Seminar organized by IIRS, Deharadun on 5th August 2016. The topic for the OL Session was *'राजभाषा को सर्वग्राह्य बनाने के उपाय'*

- Smt. Cimy Asaf, Junior Hindi Translator attended one week Refresher Translation Training Programme organized by Dept. of Official Language at Central Translation Bureau, Bangalore from 5th to 9th December, 2016.

- Smt. Cimy Asaf and Shri. Abhay Jain attended Hindi Technical Seminar organized by IISU, Thiruvananthapuram on 16th March, 2017.The topic for the OL Session was *'राजभाषा हिंदी के प्रचार प्रसार: कुछ व्यावहारिक समस्याएं'*

Papers Presented In Seminars / Conferences during The Year 2016 - 17

Sl. No.	Name of the Presenter /	Seminar / Venue / Date	Title of the paper presented
1	Shri. R. Jayapal	Presented paper in Hindi Technical Seminar - 2016, VSSC, Thiruvananthapuram, 19th & 20th July, 2016	' विज्ञान के अनुवाद की समस्याएं
		Presented paper in Hindi Technical Seminar- 2016, IISU, Thiruvananthapuram, 16th March, 2017	'राजभाषा हिंदी के प्रचार प्रसार: कुछ व्यावहारिक समस्याएं'
2	Smt. Cimy Asaf	Presented paper in Hindi Technical Seminar - 2016, VSSC, Thiruvananthapuram, 19th & 20th July, 2016	'वैज्ञानिक साहित्य के अनुवाद की समस्याएं व चुनौतियां'
		Authored an article in the OL Orientation Programme, MCF Hassan, 22nd & 23rd December, 2016	'इसरो में .वि .अं / राजभाषा कार्यान्वयन प्रौद्योगिकी – में सूचना का उपयोग'
3.	Shri. Abhay Jain	Presented paper in OL Orientation Programme, MCF Hassan, 22nd & 23rd December, 2016	'इसरो में .वि .अं / राजभाषा कार्यान्वयन प्रौद्योगिकी – में सूचना का उपयोग'

7.3 SC/ST Cell

Being an autonomous body under Department of Space, the institute follows Government of India directives / orders regarding reservations, concessions, relaxation etc. In favour of Scheduled castes and Scheduled tribes. Register of roster pertaining to direct recruitments and promotions are maintained for both teaching and non-teaching staff. Shri V. Sennaraj, Deputy Registrar (Academics) has been appointed as Laison Officer in the Institute for this purpose.

The SC/ST Cell was set up 10.08.2016 with Dr. Kuruvilla Joseph, Dean (Student Activities) as Chairman and Laison Officer for SC/ST as Member Secretary. The SC/ST Cell has the mandate to

a) Look into reservation of SC/ST students in admission to Undergraduate and Post Graduate Courses in the Institute as per UGC guidelines.
b) Look into reservation of SC/ST employees in the post/cadres wherever applicable as per the orders, rules and regulstions of Department of Space/ISRO.

c) Deal with representations and discriminating complaints received from the SC/ST Students/Teachers/Non-Teaching staff regarding their admission, recruitment, promotion and other similar matters and submit remedial recommendations thereof to Registrar and maintain a comlaint register;
d) Make suggestions/recommendations to provide congenial atmosphere in the campus to SC/ST students to concentrate on their studies for their successful passing in the examinations.
e) Function as a Grievances Redressal Cell for the grievabces of SC/ST students and employees of the Institute and render them necessary helpin solving their academic as well as administrative problems.
f) Focus on activities to promote higher education among these two communities suffering economic, social and educational deprivations.
g) Laison with Heads of Departments in all discipline to provide post admission orientation and capacity building sessions to SC/ST students.
h) Organise Dr B R Ambedkar Birthday celebrations & anniversary Programmes.

The 125th Birth Anniversary of 'Bharat Ratna' Dr. B. R Ambedkar was celebrated on 28th April, 2016. Shri. K. S. Mony Azhikode, Former Deputy Director, Kerala State Planning Board was the chief Guest for this function. After the function, a special lunch was served to all Employees and students of the institute.

7.4 Gender Sensitization Cell

The Women's Cell was established in the year 2008 with the objective of addressing matters relating to women in the Institute. The mandate of the cell was

- To discuss and suggest methods to promote gender amity amongst all IIST employees and students
- To address the gender discrimination and sexual harassment cases whenever reported and recommend appropriate necessary action
- To suggest awareness lectures/workshop for IIST members on different aspects of women welfare
- To consider any other matter on women issues referred to the committee.

The Cell was reconstituted by the Director, vide Office order 465 dated 01.12.2016 with Dr. Nirmala Rachel James, Professor and Head, Department of Chemistry as the Chairperson and has Presiding Officer of ICC as one of its member.

7.5 Internal Complaints Committee

The Honourable Supreme Court has laid down certain guidelines and norms to be observed in institutions to ensure the prevention of sexual harassment of women at workplace. As per the directives in the Sexual harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act 2013, an Internal Complaints Committee was set up vide Directors Office order 424 dated 17.12.2015 with Dr. Nirmala Rachel James as Chairperson which has reconstituted Vide Office Order 431 dtd 04.03.2016 and again on 01.12.2016 Vide Office Order 449 dtd 05.08.2016 with Dr. K. Y. Sandhya, Associate Professor, Department of Chemistry as the Chairperson. The Committee would facilitate gender sensitive and congenial environment in our Institute and to comply with the obligations and duties laid out for the prevention, prohibition and redressal of sexual harassment of employees and students.

7.6 Anti Ragging Committee

As per UGC guidelines, an Anti Ragging Committee was constituted vide Office order no 413 dated 21st September 2015 with Director as the Chairman, Deans, Heads of Departments, Parent and student representatives and non teaching staff as members as a preventive measure against the occurrence of incidents of ragging. It is the duty of the committee to ensure compliance with the provisions of the UGC Regulations on curbing the menace of Ragging in Higher Educational Institutions, 2009 as well as the provisions of law for the time being in force concerning ragging and also to monitor and oversee the performance of the Anti Ragging Squad constituted in 2012 for the prevention of ragging in the institution.

7.7 Public Information Office

The Institute adopted the Right to Information Act, 2005 and has disseminated required information in a time bound manner. Shri S. Ramanathan, Senior Administrative Officer (Recruitment and Review) is the Assistant Public Information Officer (APIO).

7.8 Counselling Centre - Sameeksha

SAMEEKSHA - Counseling services at IIST started functioning as a full time department from 01-08-2015. A webmail - sameeksha@iist.ac.in was created to relate with every individual in this institution. Starting from the initial days, SAMEEKSHA has now become one of the most efficient and happening department within the institution. SAMEEKSHA stands for the mental wellbeing of the students and staff of the institution. The department has two full time counselors who are professional psychologists. The counseling centre makes appropriate referrals when professional assistance can no longer be fruitful. The confidentiality of the data is maintained and releases personal data only according to prescribed laws or institute policies. The services of the cell try to ensure that IIST is not just an institute, but a home away from home.

SAMEEKSHA organized different activities which ensure the cooperation of all the faculties and staff of the institution along with the students.

- Battle of Flavours -IIST's Food Festival in collaboration with the Cultural Committee on 13.04.2016

- A talk- "Neurobiology of Happiness" by Dr. Kiran Kumar (Psychiatrist , Kerala Health Services, Mental Health Centre, Trivandrum) on 07.09.2016 in connection with World Suicide Prevention day 2016

- A run named as the "Run to spread HOPE" which was enthusiastically attended by students and Faculty members alike on the same day 07.09.2016.

- Training session on " Emergency Life Care and First Aid" by Dr. Anoop.T. Chakrapani (Emergency Physician , KIMS Hospital, Trivandrum) on 09-11-2016

- "Say ..Cheese..." Photography contest in February 2017


OF SPACE SCIENCE AND
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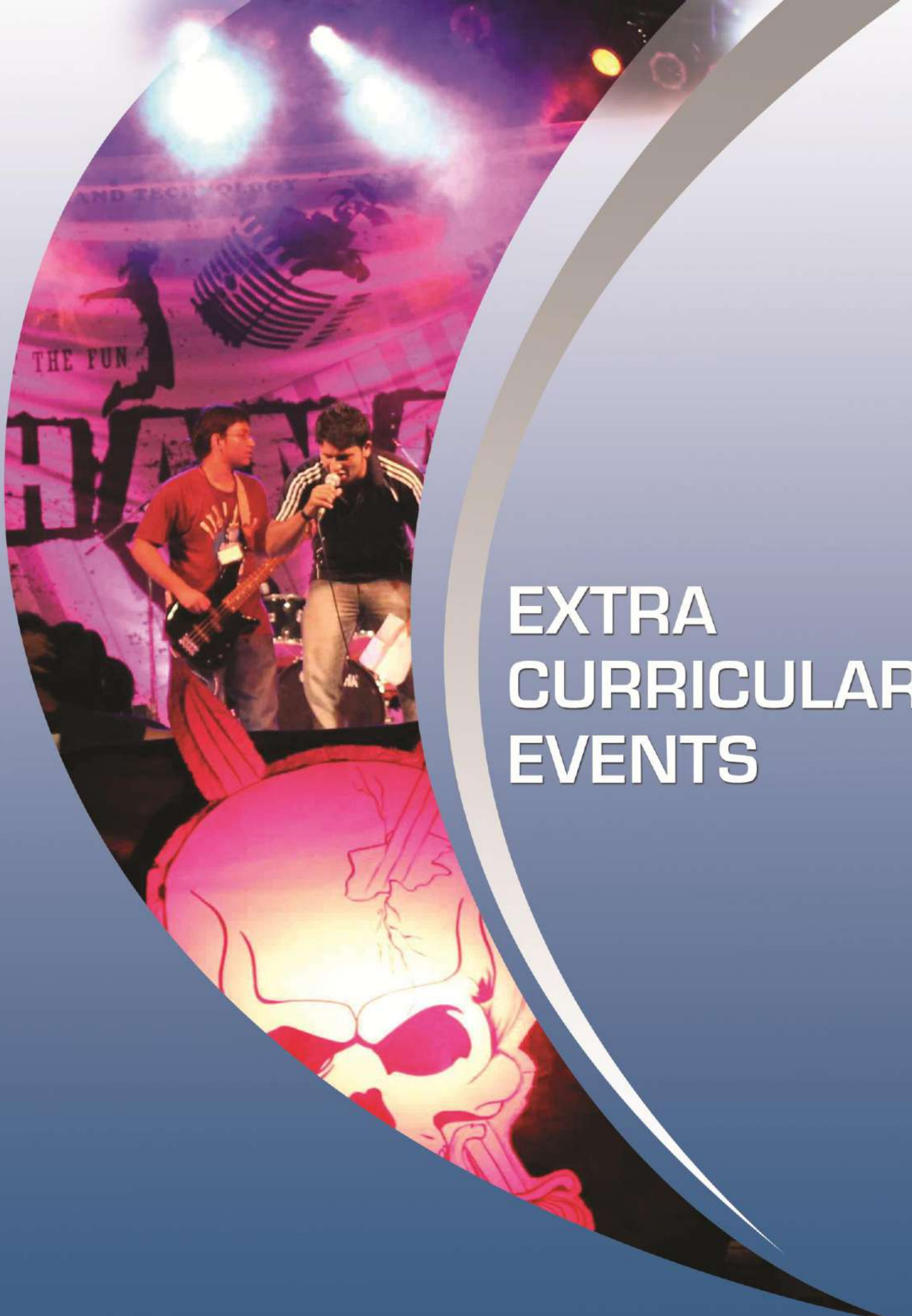


EXTRA CURRICULAR EVENTS

8| EXTRA CURRICULAR EVENTS

8.1 Sports Activities

Sports Council IIST

Sports Council, IIST has regular programs for training students in various sports activities. In-house and inter-house matches on different sports events are regularly organised round. In addition to this, IIST students also participated in various national level tournaments in India.

Annual Sports Day

The Annual Sports meet 2016-2017 was held on 25th February (Saturday) 2017 at LNCPE (Kariyavattom).Thiruvananthapuram. Shri.Sanjayan Kumar, IFS (Secretary, Kerala State Sports Council) inaugurated the event.

This was followed by lighting of torch by the chief guest and other dignitaries. The meet had various track and field events for students and faculty. The winners were honoured with medals and certificates.

Twenty-seven students participated in the Revels cup organised by Manipal Institute of Technology in the following events: Cricket, Football, and Badminton.

Yoga training sessions were organised during September 2016. Around fourty five students participated in the morning yoga sessions and various asanas that include Tadasana, Vriksasana, Trikonasana, Parivrtta Trikonasana, Garudasana, Chandrasana, Sarvangasana, Sirsasana, Shavasana etc. were taught and practiced.

To improve the morale of the staff, various inter-house competitions were also organised across the year. The events include cricket, football, basketball, badminton, volleyball, carom, and chess. Director, IIST distributed the medals and certificates to the winners. This year the Krithika house was adjudged the best house bagging 136 points.

Faculty staff cricket tournament was organised on 18 March 2017 with six teams participating in the tournament. The transport team (Transfighters) won the cup for the year 2016-2017.

Students were given swimming classes at the International Aquatic Complex at Pirappancode. Sixty students participated in the same.

The sports council is also committed to improving sports facilities at the Institute. During the last academic year, new courts for badminton in D3 and a ball badminton court near administration block were established. The present foot ball ground is being expanded to 110 m X 110 m to accommodate other outdoor events.

8.2 Dhanak 2016 - The Annual Cultural Festival

Dhanak 2016 was organized from October 21-23, 2016, with Dr Babu Paul, IAS, former Chief Secretary, Govt. of Kerala inaugurating the program. It had a footfall of around 738 students with 40 events such as visual arts, dance, music, literature, quizzing photography etc. These four days of joy, splendour, excitement, dedication and passion affirmed the abundance of creativity in human spirit, The Flagship event, Battle of the Bands was partnered with MTVI Xtreme, who offered to let the winner of the event play in their festival in Bangalore/Mumbai. Fun Events were conducted on a larger scale than previous years to engage the crowd. Along with competitions and social initiatives, Dhanak also had science expo and workshops planned before as well as during the four days of the fest, to enhance the creative inclinations of the participants. This edition saw a hugely popular and successful exhibition by the VSSC, which was enjoyed by school-goers, students especially from the tribal schools, members of faculty and outside participants alike. These exhibits the Indian Space Programme made a valuable addition to the plethora of experiences gained by the participants. The pro-show by famous festival organizers Sunburn was the star attraction of the fest.

8.3 Conscientia 2017 - The Annual Technical and Astronomy Festival

Conscientia 2017 was the ninth edition of the Annual Technology and Astronomy fest of the Indian Institute of Space Science and Technology. The curtains for the festival were raised by the Dr. V. K. Dadhwal, Director, IIST on the evening of 3rd March 2017. The occasion was graced by the Chief Guest Shri. S. Rakesh, CMD Antrix Corporation. With his inspirational words and the experiences he shared, Conscientia 2017 was off to a glittering start.

Challenges in a variety of fields ranging from Physics and Astronomy to Robotics and Aerospace Engineering, Conscientia 2017 proved to be an exhilarating experience for the participants from all around the country. Having a total footfall of 1100 in this Conscientia, the hospitality team were all geared up to host nearly 500 students coming from all across India. Students from far reaches of the country attended the event, highlighting the name and fame Conscientia has gathered over the years.

Publicity for this extravaganza had started months before the main event. Throughout the city hotspots, posters and decorations were put up. Pamphlets describing the vibrant events were sent to colleges and universities all across the country. The state-of-the-art website designed solely for catering to the needs of Conscientia 2017 (www.conscientia.co.in), enabled users to have full-fledged access to all information on events, event schedules and guidelines for the various programs in the college campus. Specially allocated transport brought in participants from key locations of the city to the buzz of the campus. Vehicles were also arranged to facilitate commute back to the city zones late in the evenings after a power-packed day in the campus.

Guest lectures by renowned personalities and a plethora of events such as Robot Wars, Hovercraft, Water Rocketry contests, Online Treasure Hunts, Contraptions, Astronomy sessions were held. Workshops on 3D Printing, Wrist Controlled Robots and Solar Mobile chargers were some of the other highlights and saw the largest ever participation from outside colleges.

Dr. N Shyam Mohan, Deputy Director RLV-TD, VSSC, ISRO enthralled the crowd by his talk on marvellous feats of ISRO.

Time slots free from the fun filled schedule had the participants savouring the tastes offered by our food partners – Haveli Restaurants and Dominos. Mouthwatering desserts and delicious snacks were also offered by ZeroDegree and Chat Waala.

With an extravaganza of online events starting weeks before the fest, ranging from C language coding to Photography contests, a total prize money worth Rs. 4.25 lakhs were distributed to the winners. Generous support by our title sponsor, Union Bank Of India, and other companies added upto a total of 4.5 Lakhs, which paved way for the smooth functioning of the program..

With the Hospitality team having the opportunity to host the guests of the fest for 4 days, on 6th March, the events concluded with the Valedictory function. The Chief Guest for the day was Dr. M. Annadurai, Director ISAC, ISRO and the guest of honour was Mr. B Balakrishna, Regional Head, Union Bank of India. The inspirational speech by the dignitaries motivated the students to explore their academic and co-curricular pursuits with more zeal and vigour.

8.4 Konchords – the inhouse musical bonanza

Konchords was conducted in IIST on February 23, 2017. There were a multitude of performances ranging from singing to dancing to the usual much appreciated stand-up comedy. There were a bunch of brilliantly choreographed dances and melodies that lifted the moods of everybody irrespective of the rains attempting hard to play spoilsport

8.5 Induction (Orientation) Programme

A two day intensive induction program was offered for the B.Tech. first semester students by the Department of Humanities on September 4-5, 2016 . The workshops were designed to provide information and support on issues relevant to new students and also to facilitate the easing of transition into the life of IIST as well as encouraging academic and personal success. The workshops were handled by trainers in the field, Dr AS Manoj, Faculty, ICT Academy of Kerala and Dr Sanjay Mattoo, All India Radio. Some of the topics covered include *Self Esteem and Motivation*, *Positive Attitude, Goal Setting,* and *Creativity*. The program had classroom sessions and outdoor training activities.

8.6 Swachh Bharat Abhiyan Implementation

Swachh Bharat Abhiyan Implementation Committee was constituted vide office order 433 on 6th April 2016 for the effective implementation of the novel initiative of Government of India to make a India "A Clean India". As enumerated in the Action Plan 2016 of IIST for Swachh Bharat Mission, Director, IIST formally inaugurated the programme on 27th April 2016 in front of a huge gathering of students, faculty members, Officers and staff. On 22nd April 2016, the cleaning staff of IIST was sensitised about the Swachh Bharart Abhiyan programme by the members of the Committee constituted by Director, IIST for the implementation of the same in IIST. The staff were given opportunity to voice their concerns and problems faced during the everyday cleaning of the Institute. Responsible Officers were specifically instructed to implement corrective measures to sort the problems faced by the cleaning staff.

On 27th April 2016, 2 pm the students, faculty members and staff of IIST assembled in front of the administrative building and were divided into three groups and set out for the task of cleaning three major areas in the Institute viz. Aerospace Engineering building, Library and Administrative block. It was a mass endeavour which brought the feeling of togetherness and responsibility in individuals. All three buildings were cleaned exceptionally well including the outside premises.

On 31st May 2016, an organised cleaning operation was taken up in the D2 building which houses Department of Chemistry, Earth and Space Sciences, Mathematics and Physics. All the faculty members, students, Ph.D Scholars and rest of the staff participated

enthusiastically to clean their premises along with the cleaning staff. Special focus was given to the chemical laboratories situated in the building.

Swachhta Pakwada was organised from 24-28 October 2016 which was inaugurated by Director, IIST by administering the Swachhta Shapath. On 25th October 2016, a long wall was identified for the students to paint their views and ideas on cleanliness and hygiene. On 25th and 26th October 2016, special cleaning drives were organised to clean the entire campus. On 27th October 2016, a training programme was organised through Kerala Tourism Development Corporation (KTDC) wherein a professional Smt Bindu was invited to deliver a class on Cleanliness and Housekeeping to the cleaning staff of the Institute. The final programme of the Swachhta Pakhawda was the visit of Students and faculty members to Ananda Nilayam orphanage in Manacaud by IIST on 30th October 2016 where they sensitised the inmates who are basically girls in the age group of 4-18 years on personal hygiene. As a follow up, the inmates were also invited to IIST on 28th December 2016 and given special session on personal hygiene and sanitation. The session was coordinated by Dr K G Sreejalekshmi.

8.7 Neuro-Linguistic Programme (NLP)

The Department of Humanities organized an NLP programme for the first semester students in the first week of October 2016. It was a three day orientation programme handled by the "Mind Masters" fame Dr. Abraham Abraham.

This programme was structured in such a way as to guide them properly through proper mind mapping, to identify their talents and hidden potentials, to understand their positives and negatives, and to improve their mental abilities and skills.

8.8 German Class

In IIST, German classes are provided for Ph.D, M.Tech and B.Tech students. An MoU has been signed with Goethe Zentrum Trivandrum and an 'A 'Level certificate course is provided to the students. On completion of the course, the students can also write the 'A ' Level certificate exam and procure the certificate from Goethe Zentrum Institute, Trivandrum.

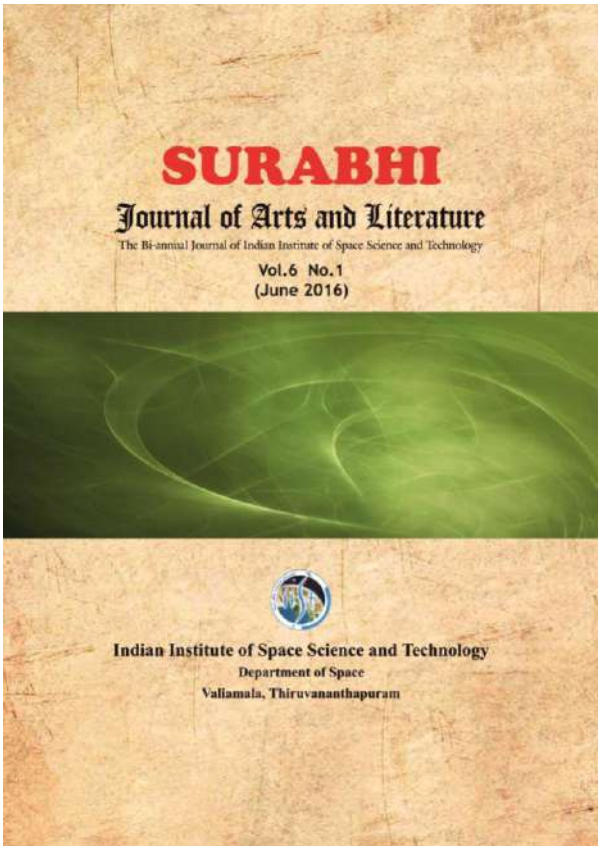
8.9 German Film Festival & Photography Workshop

The German Film Festival was organized on campus from 7th to 9th October, 2016 in collaboration with Goethe Zentrum, Trivandrum as part of the Institute Elective Course, Visual Communication. For three days, a series of world classics and award winning films and documentaries of 2015 and 2016 were streamed and as a culminating move a workshop on photography and a field trip to Adimalathura were organized.

8.10 Inhouse Publications: Drishtikon The Sounding Rocket & Surabhi

Drishtikon is the student magazine of Indian Institute of Space Science and Technology. It is brought out once a year which allows students as well as staff and faculty of the institute to showcase their artistic side. Drishtikon has separate sections for Hindi and English entries. Entries may range from prose and views on world issues like current affairs to poems, sketchings and paintings.

The Sounding Rocket (TSR) is the biannual student newsletter composed and designed by students at IIST chronicling life and times at the institute. Originally started by enthusiastic students who felt the need of a student newsletter in our institute, TSR started off as a crowd sourced entity. Currently, it is funded by the institute which provides resources for the printing of its hard copies, and a Publication Committee which oversees the content published.It includes news about latest developments in the institute, current affairs in general, pop culture, reviews, campus news, opinions, comic strips etc. Both students as well as faculty members contribute to it. The editorial body consists of students of all years and streams. Through its columns, the Sounding Rocket aims to promote one's desire to read things and cultivate a literary and artistic appreciation of life, for which it conducts a Literary Fest with events like Movie Critique, Book Panel Discussion and Comic Panel Discussion. Release of each issue of TSR is avidly awaited by every one of its readers.



As a platform to showcase the creative aptitude of all employees of DOS, an Institute bi-annual Journal, Surabhi: Journal of Arts and Literature is being published with Sri P. Radhakrishnan, retired Deputy Director, LPSC (Known as Space Radhakrishnan) as the Chief editor and Dr Gigy J Alex, Assistant Professor, Dept of Humanities as its Associate editor. It is a bi-annual journal that will publish poems, stories, memoirs, critical reviews, reports, interviews, sketches, paintings, and photographs. The journal has successfully completed its 8 issues and has currently invited articles for its next issue.

8.11 Fresher's Day @ IIST

The first year students were bestowed a warm welcome to the campus by the second year IISTians on the Fresher's Day on August 10th 2016. This was followed by an orientation about the various clubs and activities of IIST and a membership drive for the various clubs.

8.12 Field Trips

A trip to the the tribal community of Kodaikanal were organized for the 3rd year students by the Department of Humanities in the last week of April 2016. The students talked to the tribal people and tried to understand the primitive life and culture, the changes that is happening in the tribal life due to modernization as well as due to the climate change.

CELEBRATIONS @IIST

9| CELEBRATIONS @ IIST

9.1 National and Regional Festivals

The Institute celebrated Independence Day and Republic Day with all dignity and fervour during the report year 2016-17. Director, IIST hoisted the national flag followed by distribution of awards and cultural programs by the students. Other regional festivals such as Onam, Holi, Ganesh Chathurthi, Diwali, Raksha Bhandan were also celebrated.

Onam, the biggest and the most important festival of the state of Kerala was celebrated with all joy and enthusiasm in IIST on September 9, 2016. It witnessed the get together of students, faculty members and staff of IIST as a family to inculcate the sense of equality, harmony and brotherhood. The program took off with the competition of intricately decorated athapookalam from 7.30 am, followed by onam procession, exotic and traditional cultural programs, sumptuous onam feast and onam games. Shri L Radhakrishnan IAS (Retd), Former Principal Secretary. Govt of Kerala delivered the Onam message.

The students of the social outreach club of IIST, Panacea celebrated Onam with the students of Government School for the Blind, Jagathy, Trivandrum. They also distributed Onam Kits to the 30 students in the school and participated in their Onam celebrations.

9.2 International Yoga Day Celebrations

Asatomā sad gamaya
Tamasomā jyotir gamaya
Mrityormā amritam gamaya
O śhānti śhānti śhāntiḥ

Following the success of the First International Yoga day on June 21st 2015, the second International Yoga Day, was celebrated by of an enthusiastic group of students, faculty and staff members of IIST on 21st June, 2016.Before the commencement of the inaugural function at 10:30 Shri. Rayaroth Surendran, a trainer from International Shivananda Yoga Vedanta Center and two of his advanced pupils, Kumari Norin Pereira and Shri Kannan V. A. conducted the Yoga demonstrations, introductory talk followed by Yogaasana/pranayama practice for the IIST faculty/staff/student members. Motivating the attendees by a talk on the health and mental benefits of practising Yogaasana, Pranaayaama and Meditation, the trainer directed the audience through a series of warm-up stretching exercises starting from head down to foot before starting the Yogaasana poses. The aasanas included many standing, sitting and lying down aasanas. The Yogaasana poses started with Suryanamaskara series through various aasanas before ending with haalasana and sarvaangasana. A few simple breathing exercises were also introduced before ending the morning session with shavaasana and guided meditation.

A healthy and delicious refreshments were provided to all the participating members after the practice session. Many posters on yoga were displayed. Captivating graphics were used to convey the simplicity of including yoga in the daily life for relieving stress, permanent cure to many ailments and diseases, improving metabolism, better lifestyle and sustainable living. The posters were on display through out the day.

The inauguration and prize distribution was organised after the refreshments break and three best yoga practitioners from the institute were awarded prizes. Two talks followed the refreshments starting with Smt..Kamala Bharatwaj on "Living without Medicine through Yoga and Naturopathy" and Dr. Madhan Kumar on "Yoga and Diet".Question were asked at the end of the talk and attractive prizes were given to those in the audience who answered them.

Smt. Kamala Bharatwaj is a yoga instructor based out of Bangalore. She holds a bachelor's degree in Naturopathy and a PG Diploma in Yoga. For the past several years she has been exploring the theropatic aspects of Yoga, working with patients suffering from thyrodium, arthiritis, hypertension, alzhemier's disease and many lifestyle related health conditions. Smt. Kamala gave a motivational talk on how many lifestyle based diseases can easily be controlled by following a simple natural diet and regular exercises. Her talk was well appreciated by all in the audience.

Dr. Madan Kumar holds a bachelor's degree in Ayurvedic Medicine and Surgery from the Government Ayurveda Medical College, Trivandrum and has a post graduate degree in ayurveda from the Government Ayurveda Medical College, Trivandrum. He holds several years of experience as an ayurveda course instructor, as a dietician and lifestyle counsellor. Dr. Madhankumar is also a course Instructor and the Consultant physician at Vasudeva Vilasom Ayurveda Nursing home. He gave an engrossing talk on diet. Stressing the need for maintaining a good health for happy and peaceful living he talked about the long life and health of our ancestors mainly due their diet. He emphasised the necessity of satisfying all the five senses by the diet and the separation of male and female food types. The program successfully concluded after the Dr. Madan Kumar's talk with an improved awareness among the audience towards their well-being.

9.3 National Remote Sensing Day Celebration

Remote Sensing Day was celebrated on 12th August 2016, to commemorate the Birth Anniversary of Dr. Vikram Sarabhai, the father of Indian space programme. On the event of Remote sensing day 2016, IIST organized a special lecture on "Challenges in New Operational Remote Sensing Applications: NRSC Experiences" delivered by Dr. V. K. Dadhwal for the benefit of research scientists and students of IIST and other organsiations and Institutions in Trivandrum.

9.4 World Environment Day

World Environment day was celebrated on June 8th 2016. It was organized by the eco club of IIST. Dr. K Vasuki IAS, Executive Director, Suchitwa Mission, Govt. of Kerala inaugurated the programme and Director, IIST presided over the function.

Dr. Vasuki talked about the tonnes of plastic wastes, all over India, that are being burnt everyday, which releases dioxins and furans, some of the most toxic substances known to mankind, into the atmosphere. Still we don't have fool proof methods to dispose the plastics. According to her the best way to improve the situation is to cut down the use of plastics. She urged the Indians to go back to their roots and look at their own ethos, how our parents used to carry food and water in tiffin carriers and metal flasks, so that generations of disposable wastes would immediately come down.

9.5 Teachers day

Teacher's day was celebrated on September 7, 2016 by the students to honour the teachers of IIST.

9.6 UN International Day for Women and Girls in Science

The student community of IIST celebrated the 2nd UN International Day for Women and Girls in Science on 8th February 2017. Keeping up with the spirit of promoting scientific cogency and upholding humanism and the spirit of inquiry and reform, the event was dedicated to falicitate and acknowledge the work of women scientists both in and out of IIST. Dr Seena, Associate Professor, Dept of Avionics and Dr Ambili, Inspire Fellow, Dept. of ESS were honoured during the occasion.

CLUBS @ IIST

10| CLUBS @ IIST

Aeroclub

AeroClub, IIST is a student endeavour in the campus that tries to instil the engineering and scientific aptitude among IISTians through its various activities. Founded back in November 2013, the club has since then organised various demonstrations, workshops, talks, sessions, seminars and competitions. The club is run by a mix of students from all batches and supported by two faculty mentors.

The concept of the club is to provide a platform for students at IIST to try out various innovative ideas that involves application of the fundamental engineering concepts. The club has conducted workshops, talks and competitions across various disciplines of aerospace, avionics and mechanical. The club is one of its kind in the sense that the senior students guide the juniors regarding certain ideas and concepts while the juniors reciprocate them in terms of excellent work, and in the process, both of them learn something new, which is quite enthusiastic. The same has been showcased in the form of AeroClub Summer Projects. Workshops on topics of interest such as Hovercraft, RC Glider, and Ornithopters organised by AeroClub are packed with immense participation from students of all discipline and batches and the projects done by the students in these fields have been quite innovative. Club's outreach has been to various industry experts both inside ISRO and outside of it, where it has invited eminent personalities to discuss topics in its Open House sessions. The club also seeks out to merriment and fun occassionally, organising certain GoPublic events such as Kite Flying, Hot Air Balloons where for a short period of 30-40 minutes, the crowd enjoys pleasure of flying or the sight of flight.

Many projects undertaken by members of the club and others under it have been promising in results. These projects are partially funded by the Club and thoroughly reviewed by the faculty of IIST. Few notable are development of tilt rotor, RC Plane, Ornithopter and Two Stage Water Rocket. These works are regularly presented in the sessions organised by the club. All the activities of AeroClub are summed up in its annual magazine, UDAAN.

Overall, the club seeks out to keep up to the principle, 'Knowledge and happiness are best enjoyed when shared', through the efforts of many in the institute with wide participation.

Astronomy Club

Astronomy Club at IIST is one of the most active clubs of IIST, with students participating from all the years in sessions every Friday night. The incentive of the club is to present marvelous objects in space and the astonishing phenomena related to them in form of presentations, videos or sky-watching. Sessions are followed by a quiz which is for the purpose of introducing strange facts. Since the establishment of the club it has experienced several advancements. This year a blog page was created as a platform where all could read the club activities, ask questions, answer the questions asked during the session and access the presentation and videos. The page is 'astroclubiist.blogspot.in'. This page also includes the references used for further reading. The club also invites professors and researchers from in and outside the college. We also plan to teach professional sky-watching techniques with the help of professors this year. The club has an active group on facebook where students post club activities and articles they find interesting.

Nanosatellite Club

The nanosatellite club is a student driven arm of the nanosatellite program at the Indian Institute of Space Science and Technology, Thiruvananthapuram. It was formed in 2015 by a group of Btech students to motivate and encourage students from various disciplines to participate in the satellite building activities of the institute and also to act as a research wing for the home missions as well as collaborative challenges taken up by IIST at the international level. The students are inducted into the club by the members on an yearly basis and also on merit base in case of exceptional interest shown by any student in credited courses or voluntary competitions which are conducted by the club. The activities of the club are monitored and mentored by a faculty members of IIST.

The members of this club were also a part of IIST's delegation at the National Central University, Taiwan which was sent to participate in the INSPIRE workshop.

Currently, the club is involved in mission and spacecraft design for IIST's maiden home mission "IISTnSAT" and for the flagship international collaborative missions like INSPIRE and AAREST with University of Colorado, Boulder, Caltech University, and University of Surrey.

FOSS Group

The FOSS Group, IIST is IIST's FOSS chapter aimed at promoting the use of Free and Open Source Software tools in the fields of core research pertaining to Aerospace, Avionics and the physical sciences. The group, germinating from the basic idea of a shared and thus free community, is aimed at promoting a complete or near-complete adoption of FOSS based platforms for all academic research and development activities going on at IIST. The group revolves around conducting and hosting software workshops, lectures and other activities designed at improving the overall comfort of students with FOSS software and scientific computing in general. It must also be noted that the FOSS group at IIST is India's only FOSS group with special emphasis placed upon space science and related fields.

Eco Club

Eco Club @ IIST, inaugurated as a club for students and faculty on 19.09.2012, aims to make our campus, clean and green. It deals with activities related to campus environment, maintenance of its ecology, hygiene, and waste disposal. The ultimate aim of this club is to emerge with a unique way of preserving our campus which may serve as a model system for institutes throughout the country. The frequent activities of the club were: Observance of Earth Hour, campus cleaning drives, disposal of non biodegradable waste, organic farming etc. Projects undertaken include Statistical Estimation of resources, Bio Gas Plant, classes for cleaning staff to do work efficianetly, frequent monitoring of garbage dump, waste segregation etc.

Photography Club

This club has a moto "Photography is an art of observation. It has little to do with the things you see, and everything to do with the way you see them." – Elliot Erwitt. We spread love for photography among the IISTians. We discuss about the works of different photographers and their techniques. This club also teach about the technical aspects of camera and post-processing of images (Digital Image Processing)

Quiz Club

The Quiz Club of IIST is an informal gathering of quizzing enthusiasts which meets every Friday to hold a quizzing session. The club is one of the most regular clubs on campus. Teams of two take part in the quiz which is usually held by a volunteering member (or team). Teams from this club represent the college in various intercollegiate events. The team by Aravind and Mustafa of fourh year won the first prize in a national level renewable energy quiz held by the University of Kerala and another team won the General Quiz held in CET, Trivandrum as runners up in 2016. The club members are also responsible for organising quizzing events during the annual cultural and technical festivals.

Movie and Performing Arts Club

The Movie and Performing Arts Club of IIST is an active student club which holds its sessions approximately once every two weeks on Saturday nights. These sessions usually consist of the screening of award-winning and critically acclaimed movies. The club has seen an admirable increase in the staging of skits and short plays, written by the students themselves, which has popularised a healthy culture of performing arts and stagecraft in the college. Collaboration on these plays has strengthened relationship between the juniors and seniors.

Social Outreach Clubs

Nirmaan

Nirmaan is a student driven program started in the year 2015 to ensure equitqble outcomes for the marginalized and underprivileged children. In initial phase, government schools around IIST is visited, a need assessment survey is conducted to understand the problems faced by the children. Accordingly the members give weekend classes on Space Science for the students of a school nearby and later start the weekend classes at IIST. As the institute aim towards social development of the surrounding area, the members of Nirmaan also provide weekend classes to students nearby the institute. It organizes classes twice a week for 2 hour. The members also help students to explore the area of basic sciences and moral values.Nirmaan has helped students to look at sciences in an experimental way by demonstrations and also by giving guidance for their future endeavours. It conducts small competitions to encourage students to show up their skills.

Panacea

With a vision that even the vulnerable children are able to realize equitable outcomes, Panacea, the social outreach club of IIST address the problems of these children. Panacea focuses on providing additional care and support system for the children who do not have families or children whose families cannot provide safe space for them to grow up. The students of IIST visit orphanages such as "Nirmala Shishu Bhavan", "Divine Children's Home, Poojapura" and help the students out there in their studies. These students were also brought to IIST during Dhanak to give a feel of the cultural fest of iist and also to witness the exhibition organized as part of Dhanak. A blood donation camp was also organized during Dhanak. Most of the festivals were celebrated with the orphans and the elderly who are left alone in the old age homes. The students of IIST have been donating generously for these social cause and have also been arranging dresses, toys, bags and books for the kids in the orphanages and for the elderly in the different old age homes. Every week end the students from the neighbouring schools and villages in the class of 5-12 are brought to IIST and given remedial teaching by the students of IIST. Remedial coaching is offered in the subjects of science, maths, English and social studies.

Audit Report
2016-2017

SUBRAMONI & MADHUKUMAR
Chartered Accountants

Off :
BG-5, TC. 36/1569-41, Pradakshina,
Sreevaraham, Manacaud P.O., Trivandrum - 695 009
Tel / Fax : 0471 - 2466136, Mob : 9349317999, 9037512276
E-mail : casubbumadhu@gmail.com

INDEPENDENT AUDITOR'S REPORT

We have audited the accompanying financial statements of M/s **INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY (Society), Valiamala PO, Trivandrum-695547** which comprise the Balance Sheet as at 31 March 2017 & the Income and Expenditure Statement for the year then ended, and a summary of significant accounting policies and other explanatory information.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation of these financial statements that give a true and fair view of the financial position & financial performance of the Institute in accordance with the Accounting Standards issued by the Institute of Chartered Accountants of India. This responsibility includes the design, implementation and maintenance of internal control relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with the Standards on auditing issued by the Institute of Chartered Accountants of India. Those Standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgement, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or

error. In making those risk assessments, the auditor considers internal control relevant to the Institute's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of the accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Basis of Qualified Opinion:

1. The balances in personal accounts are subject to confirmation by respective parties.

2. No provision for gratuity, pension and leave encashment has been provided in the accounts as specified in 4.d of Notes forming part of accounts.

Qualified Opinion

In our opinion and to the best of our information and according to the explanations given to us, subject to the above mentioned opinion, the financial statements give the information required by the Act in the manner so required and give a true and fair view in conformity with the accounting principles generally accepted in India:

i in the case of the balance sheet, of the state of affairs of the Institute as at 31st March 2017;

ii in the case of the Income and Expenditure statement, of the deficit for the year ended on that date;

SUBRAMONI & MADHUKUMAR CHARTERED ACCOUNTANTS TRIVANDRUM

For SUBRAMONI & MADHUKUMAR
Chartered Accountants

RAHUL B.S. B.com, ACA
M.No.234170 (Partner)
FRN.008570S

Place: Thiruvananthapuram

Date : 11/10/2017

INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
THIRUVANANTHAPURAM

BALANCE SHEET AS AT 31ST MARCH, 2017

(Amount in Rs.)

	Schedule	As at 31.03.2017	As at 31.03.2016
CORPUS/CAPITAL FUND AND LIABILITIES			
Corpus / Capital Fund	1	2,38,85,49,844	2,40,18,26,461
Reserves and Surplus		2	2
Earmarked Funds / Endowment Funds	2	1,96,94,949	28,31,975
Long Term Liabilities and Provisions	3	8,19,75,792	6,31,76,610
Current Liabilities and Provisions	4	24,02,19,447	19,29,02,942
TOTAL		**2,73,04,40,035**	**2,66,07,37,990**
ASSETS			
Fixed Assets	5	2,10,77,26,104	2,01,44,20,962
Long Term Assets, Loans, Advances etc	6	6,05,75,730	6,06,02,050
Current Assets, Loans, Advances etc	7	56,21,38,201	58,57,14,978
TOTAL		**2,73,04,40,035**	**2,66,07,37,990**
Significant Accounting Policies & Notes on Accounts	16		

As per our report of even date attached.

For Subramoni & Madhukumar
Chartered Accountants
FRN : 008570S

C.A. Rahul B. S.
(Partner, Mem No. 234170)

Place : Thiruvananthapuram
Date : 11th October, 2017

SUBRAMONI & MADHUKUMAR CHARTERED ACCOUNTANTS TRIVANDRUM

For and on behalf of
Indian Institute of Space Science and Technology (IIST)

Dr. V. K. Dadhwal
Director

R. Hari Prasad
Finance Officer

INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
THIRUVANANTHAPURAM

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2017

(Amount in Rs.)

	Schedule	2016-17	2015-16
INCOME			
Grants / Subsidies	8	59,50,00,000	56,50,00,000
Fees / Subscriptions	9	93,05,451	94,80,645
Interest Earned	10	84,65,827	87,44,833
Other Income	11	46,68,013	30,37,245
Gross Surplus/Deficit of Canteen Accounting Committee		47,73,098	43,83,931
Surplus/Deficit of Student Activities Account		(4,42,225)	(7,10,617)
TOTAL (A)		**62,17,70,164**	**58,99,36,037**
EXPENDITURE			
Establishment Expenses - Regular	12	23,24,22,703	16,09,56,717
Establishment Expenses - Support Services	13	12,37,06,348	9,12,82,223
Academic & Other Student Expenses	14	14,81,43,623	14,83,09,987
Other Administrative Expenses	15	10,76,52,586	10,43,59,055
Depreciation	5	19,25,88,683	19,55,76,567
TOTAL (B)		**80,45,13,943**	**70,04,84,549**
Excess of Income over Expenditure (A-B)		(18,27,43,779)	(11,05,48,512)
Less : Prior Period Items		5,32,838	(2,63,08,783)
Balance being Surplus/(Deficit) carried over to Corpus/Capital Fund		**(18,32,76,617)**	**(8,42,39,729)**
Significant Accounting Policies & Notes on Accounts	16		

As per our report of even date attached.

For Subramoni & Madhukumar
Chartered Accountants
FRN : 008570S

C.A. Rahul B. S.
(Partner, Mem No. 234170)

Place : Thiruvananthapuram
Date : 11th October, 2017

SUBRAMONI & MADHUKUMAR * CHARTERED ACCOUNTANTS * TRIVANDRUM *

For and on behalf of
Indian Institute of Space Science and Technology (IIST)

Dr. V. K. Dadhwal
Director

R. Hari Prasad
Finance Officer

INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
THIRUVANANTHAPURAM

SCHEDULES TO BALANCE SHEET AS AT 31ST MARCH, 2017

	As at 31.03.2017	As at 31.03.2016
Schedule 1 :: CORPUS / CAPITAL FUND		
Total Grant Received - Capital and Revenue (A)		
Opening Balance of Total Grant Received	5,80,42,24,987	5,14,77,24,987
Add : Grant received during the year	76,50,00,000	65,65,00,000
	6,56,92,24,987	5,80,42,24,987
Total transfer to Revenue Grant (B)		
Opening Balance of amount transferred to Revenue Grant	1,93,96,72,442	1,27,46,72,442
Add : Transfer to Revenue Grant of 2016-17	59,50,00,000	-
Add : Transfer to Revenue Grant of 2015-16	0	56,50,00,000
Add : Transfer to Revenue Grant of 2014-15	0	10,00,00,000
	2,53,46,72,442	1,93,96,72,442
Surplus / Deficit transferred from Income & Expenditure Account (C)		
Opening Balance of net income / (expenditure)	(1,46,27,26,084)	(1,37,84,86,355)
Add/Deduct : - Current Year Surplus / (Deficit)	(18,32,76,617)	(8,42,39,729)
	(1,64,60,02,701)	(1,46,27,26,084)
Balance at the year end (A - B + C)	2,38,85,49,844	2,40,18,26,461

INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
THIRUVANANTHAPURAM

SCHEDULES TO BALANCE SHEET AS AT 31ST MARCH, 2017

Schedule 2 :: EARMARKED/ENDOWMENT FUNDS	1 Ministry of Earth & Space Science	2 ISRO-GBP - ABLN & C Project	3 DST Inspire - Dr. Sakthivel	4 DST Inspire - Dr. Mahesh	5 SERB - Dr. Seena V	6 DST Inspire - Dr. Ambili K M	7 DOS-SAC- Dr. Rajesh V J
a) Opening balance of the funds	1,30,582	7,23,170	(1,23,882)	(3,92,022)	4,37,400	10,86,135	3,54,488
b) Additions to the Fund							
i) Donation/Grants	0	0	11,60,063	26,81,663	3,50,000	7,97,878	4,00,000
ii) Income from Investment made on account of Funds	7,964	0	0	0	0	0	0
iii) Other additions	0	0	0	0	0	0	0
Total (a + b)	1,38,546	7,23,170	10,36,181	22,89,641	7,87,400	18,84,013	7,54,488
c) Utilisation/Expenditure towards objective of funds							
i) Capital Expenditure							
- Fixed Assets	0	0	0	0	2,61,610	2,21,731	0
- Others	0	0	0	0	0	0	0
Sub Total	0	0	0	0	2,61,610	2,21,731	0
ii) Revenue Expenditure							
- Salaries, Wages & Allowance	0	0	6,75,140	12,44,632	2,07,420	9,86,488	2,34,710
- Rent/Consumables	0	0	0	0	63,117	0	0
- Other Administrative Expenses	0	0	1,06,158	1,89,011	43,749	1,37,264	2,14,515
Sub Total	0	0	7,81,298	14,33,643	3,14,286	11,23,752	4,49,225
iii) Fund Returned to the Funding Agency	1,38,546	0	0	0	0	0	0
Total (c)	1,38,546	0	7,81,298	14,33,643	5,75,896	13,45,483	4,49,225
Net Balance payable as at the year-end (a+b-c)	**0**	**7,23,170**	**2,54,883**	**8,55,998**	**2,11,504**	**5,38,530**	**3,05,263**
Net Balance receivable as at the year-end (c-a-b)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Note : Classified under Current Assets under Sch 8							

INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
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SCHEDULES TO BALANCE SHEET AS AT 31ST MARCH, 2017

Schedule 2 :: EARMARKED/ENDOWMENT FUNDS (contd.)	8 AICTE - INAE - PhD - R S Mohankumar	9 NBHM-DAE-PDF- Dr. V.Govindraj	10 SERB - Dr. Jayanthi S	11 LPSC - Dr. Umesh Kadhane	12 DST - Dr. Rama Rao N	13 VSSC - Dr. Natarajan E	14 SERB - Dr. Rakesh Kumar Singh
a) Opening balance of the funds	25,000	75,200	0	0	0	0	0
b) Additions to the Fund							
i) Donation/Grants	1,90,000	5,50,400	14,12,600	10,15,000	1,08,43,000	2,80,000	22,75,000
ii) Income from Investment made on account of Funds	0	0	0	0	0	0	0
iii) Other additions (Specify Nature)	0	0	0	0	0	0	0
Total (a + b)	2,15,000	6,25,600	14,12,600	10,15,000	1,08,43,000	2,80,000	22,75,000
c) Utilisation/Expenditure towards objective of funds							
i) Capital Expenditure							
- Fixed Assets	0	0	8,78,551	5,08,729	15,47,685	1,27,890	10,59,492
- Others	0	0	0	0	0	0	0
Sub Total	0	0	8,78,551	5,08,729	15,47,685	1,27,890	10,59,492
ii) Revenue Expenditure							
- Salaries, Wages & Allowance	1,80,000	5,18,400	1,64,355	0	3,63,263	0	1,81,936
- Rent/Consumables	0	0	0	2,13,441	46,927	0	28,648
- Other Administrative Expenses	20,000	59,808	1,04,705	0	3,97,080	0	1,53,159
Sub Total	2,00,000	5,78,208	2,69,060	2,13,441	8,07,270	0	3,63,743
iii) Fund Returned to the Funding Agency	0	0	0	0	0	0	0
Total (c)	2,00,000	5,78,208	11,47,611	7,22,170	23,54,955	1,27,890	14,23,235
Net Balance payable as at the year-end (a+b-c)	**15,000**	**47,392**	**2,64,989**	**2,92,830**	**84,88,045**	**1,52,110**	**8,51,765**
Net Balance receivable as at the year-end (c-a-b)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Note : Classified under Current Assets under Sch 7							

SUBRAMONI & MADHUKUMAR CHARTERED ACCOUNTANTS TRIVANDRUM

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SCHEDULES TO BALANCE SHEET AS AT 31ST MARCH, 2017

Schedule 2 :: EARMARKED/ENDOWMENT FUNDS (contd.)	15 SERB - Dr. Roymon Joseph	16 UGC - DAE - Dr. Kuntala B	17 ISRO - MOM - Dr. Rajesh VJ	18 DBT - Dr. Rama Rao N	19 DOS - Dr. Rajesh V J (Spectral)	20 SAC - NavIC (IRNSS) Gagan	21 DST - PAMC - Meeting
a) Opening balance of the funds	0	0	0	0	0	0	0
b) Additions to the Fund							
i) Donation/Grants	16,76,000	3,49,219	6,10,000	49,13,000	5,10,000	4,27,000	5,00,000
ii) Income from Investment made on account of Funds	0	0	0	0	0	0	0
iii) Other additions (Specify Nature)	0	0	0	0	0	0	0
Total (a + b)	16,76,000	3,49,219	6,10,000	49,13,000	5,10,000	4,27,000	5,00,000
c) Utilisation/Expenditure towards objective of funds							
i) Capital Expenditure							
- Fixed Assets	5,62,491	0	0	0	0	0	0
- Others	0	0	0	0	0	0	0
Sub Total	5,62,491	0	0	0	0	0	0
ii) Revenue Expenditure							
- Salaries, Wages & Allowance	3,92,097	1,69,355	0	0	0	0	0
- Rent/Consumables	2,87,071	0	0	0	0	0	0
- Other Administrative Expenses	1,16,000	16,977	0	4,09,113	0	0	3,49,472
Sub Total	7,95,168	1,86,332	0	4,09,113	0	0	3,49,472
iii) Fund Returned to the Funding Agency	0	0	0	0	0	0	0
Total (c)	13,57,659	1,86,332	0	4,09,113	0	0	3,49,472
Net Balance payable as at the year-end (a+b-c)	**3,18,341**	**1,62,887**	**6,10,000**	**45,03,887**	**5,10,000**	**4,27,000**	**1,50,528**
Net Balance receivable as at the year-end (c-a-b)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Note : Classified under Current Assets under Sch 7							

SUBRAMONI & MADHUKUMAR CHARTERED ACCOUNTANTS TRIVANDRUM

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SCHEDULES TO BALANCE SHEET AS AT 31ST MARCH, 2017

Schedule 2 :: EARMARKED/ENDOWMENT FUNDS (contd.)	22 SERB - Expert Committee Meeting	23 KSCSTE - Seminar - SPEED 2016	24 NPDE - TCA - 2016 - Seminar	25 SERB - Seminar - NCD 2016	26 SERB - Travel - Dr. Govindan Kutty	27 SERB - Travel - Dr. Apoorva Nagar	28 SERB - Travel - Dr. Rajesh Joseph Abraham
a) Opening balance of the funds	0	0	0	0	0	0	0
b) Additions to the Fund							
i) Donation/Grants	6,00,000	5,85,500	9,70,000	75,000	1,82,056	59,435	1,15,683
ii) Income from Investment made on account of Funds	0	0	0	0	0	0	0
iii) Other additions (Specify Nature)	0	0	0	0	0	0	0
Total (a + b)	6,00,000	5,85,500	9,70,000	75,000	1,82,056	59,435	1,15,683
c) Utilisation/Expenditure towards objective of funds							
i) Capital Expenditure							
- Fixed Assets	0	0	0	0	0	0	0
- Others	0	0	0	0	0	0	0
Sub Total	0	0	0	0	0	0	0
ii) Revenue Expenditure							
- Salaries, Wages & Allowance	0	0	0	0	0	0	0
- Rent/Consumables	0	0	0	0	0	0	0
- Other Administrative Expenses	4,84,208	3,27,140	8,50,682	75,000	1,71,229	59,435	1,15,683
Sub Total	4,84,208	3,27,140	8,50,682	75,000	1,71,229	59,435	1,15,683
iii) Fund Returned to the Funding Agency	1,15,792	2,58,360	1,19,318	0	0	0	0
Total (c)	6,00,000	5,85,500	9,70,000	75,000	1,71,229	59,435	1,15,683
Net Balance payable as at the year-end (a+b-c)	**0**	**0**	**0**	**0**	**10,827**	**0**	**0**
Net Balance receivable as at the year-end (c-a-b)	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Note : Classified under Current Assets under Sch 7							

SUBRAMONI & MADHUSUDANAR CHARTERED ACCOUNTANTS TRIVANDRUM

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SCHEDULES TO BALANCE SHEET AS AT 31ST MARCH, 2017

Schedule 2 :: EARMARKED/ENDOWMENT FUNDS (contd.)	29	30	TOTAL	
	SERB - Travel Ruchi Sandilya	SERB - Travel Vinu RV	2016-17	2015-16
a) Opening balance of the funds	0	0	23,16,071	57,72,464
b) Additions to the Fund				
i) Donation/Grants	78,391	1,46,140	3,37,53,028	44,48,514
ii) Income from Investment made on account of Funds	0	0	7,964	40,947
iii) Other additions (Specify Nature)	0	0	0	0
Total (a + b)	78,391	1,46,140	3,60,77,063	1,02,61,925
c) Utilisation/Expenditure towards objective of funds				
i) Capital Expenditure				
- Fixed Assets	0	0	51,68,179	35,74,272
- Others	0	0	0	0
Sub Total	0	0	51,68,179	35,74,272
ii) Revenue Expenditure				
- Salaries, Wages & Allowance	0	0	53,17,796	39,11,581
- Rent/Consumables	0	0	6,39,204	1,34,575
- Other Administrative Expenses	78,391	1,50,000	46,28,779	2,39,833
Sub Total	78,391	1,50,000	1,05,85,779	42,85,989
iii) Fund Returned to the Funding Agency	0	0	6,32,016	85,593
Total (c)	78,391	1,50,000	1,63,85,974	79,45,854
Net Balance payable as at the year-end (a+b-c)	**0**	**0**	**1,96,94,949**	**28,31,975**
Net Balance receivable as at the year-end (c-a-b)	**0**	**3,860**	**3,860**	**5,15,904**
Note : Classified under Current Assets under Sch 7				

SUBRAMONI & MADHUKUMAR CHARTERED ACCOUNTANTS TRIVANDRUM

INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
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SCHEDULES TO BALANCE SHEET AS AT 31ST MARCH, 2017

	As at 31.03.2017	As at 31.03.2016
Schedule 3 :: LONG TERM LIABILITIES AND PROVISIONS		
a) Employee Provident Funds and Retirement Benefits		
- General Provident Fund	2,78,31,204	2,51,69,708
- Contributory Provident Fund	43,01,082	37,90,672
- New Pension Scheme	16,868	-
- Other Retirement Benefits	4,16,33,638	2,77,21,230
Sub Total (a)	**7,37,82,792**	**5,66,81,610**
b) Caution Deposit		
- Caution Deposit from Students	81,93,000	64,95,000
Sub Total (b)	**81,93,000**	**64,95,000**
TOTAL	**8,19,75,792**	**6,31,76,610**
Schedule 4 :: CURRENT LIABILITIES AND PROVISIONS		
a) Current Liabilities		
1. Sundry Creditors		
- For Goods		
Capital Goods	1,72,83,957	2,11,79,200
Revenue Expenditure	24,754	21,433
- For Services	1,79,44,965	1,57,83,834
2. Statutory Liabilities		
- Overdue	-	-
- Others	80,42,196	8,77,013
3. Other Current Liabilities		
- Interest refundable to DOS (received)	1,72,72,060	2,15,15,969
- Interest refundable to DOS (accrued)	1,13,36,879	1,06,65,324
- B.Tech Fees refundable to DOS	15,72,72,573	11,38,95,925
- Others	1,10,42,063	89,64,244
Sub Total (a)	**24,02,19,447**	**19,29,02,942**
TOTAL	**24,02,19,447**	**19,29,02,942**

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SCHEDULES TO BALANCE SHEET AS AT 31ST MARCH, 2017

(Amount in Rs.)

Schedule 5 :: FIXED ASSETS

Particulars	Gross Block (at cost) as at 01.4.2016	Additions		Transfer to Installed from Uninstalled	Deletions	Gross Block (at cost) as at 31.03.2017	Rate of Depreciation	Depreciation				Net Block as at 31.3.2017	Net Block as at 31.3.2016
		Installed	Under Installation					As at 01.04.2016	For the year	Deletions	As at 31.3.2017		
Land	3,32,52,002	0	0	0	0	3,32,52,002	0.00%	0	0	0	0	3,32,52,002	3,32,52,002
Building	1,30,12,66,870	12,79,085	0	0	0	1,30,25,45,955	10.00%	47,63,31,407	8,26,21,457	0	55,89,52,864	74,35,93,091	82,49,35,463
Plant & Machinery	75,16,13,280	9,74,33,588	0	0	0	84,90,46,868	15.00%	33,76,84,783	7,67,04,313	0	41,43,89,096	43,46,57,772	41,39,28,497
Furniture & Fittings	14,98,89,657	20,89,247	0	0	0	15,19,78,904	10.00%	6,59,77,983	86,00,093	0	7,45,78,076	7,74,00,828	8,39,11,674
Ambulance	8,80,644	0	0	0	0	8,80,644	15.00%	4,20,943	68,955	0	4,89,898	3,90,746	4,59,701
Motor Cars & Bikes	1,12,62,430	0	0	0	0	1,12,62,430	15.00%	74,19,721	5,76,407	0	79,96,128	32,66,302	38,42,709
Motor Buses & Truck	61,29,906	8,18,614	0	0	0	69,48,520	15.00%	38,75,808	4,60,907	0	43,36,715	26,11,805	22,54,098
Computers	8,62,28,078	4,51,547	0	0	0	8,66,79,625	60.00%	8,27,84,281	23,37,206	0	8,51,21,487	15,58,138	34,43,797
Software	6,48,99,478	93,33,010	0	0	0	7,42,32,488	60.00%	5,44,83,498	1,02,98,340	0	6,47,81,838	94,50,650	1,04,15,980
Library Books	5,08,41,155	9,70,751	0	0	0	5,18,11,906	60.00%	4,82,14,485	21,58,453	0	5,03,72,938	14,38,968	26,26,670
Campus networking	3,02,48,951	1,13,02,574	0	0	0	4,15,51,525	60.00%	2,91,18,688	74,59,702	0	3,65,78,390	49,73,135	11,30,263
Canteen Equipments	1,61,13,282	23,20,598	0	0	0	1,84,33,880	15.00%	97,48,213	13,02,850	0	1,10,51,063	73,82,817	63,65,069
Soft Furnishing	10,43,023	0	0	0	0	10,43,023	100.00%	10,43,023	0	0	10,43,023	0	0
Uninstalled Assets													
Plant & Machinery	4,62,27,801	0	5,37,55,259	4,56,07,321	0	5,43,75,739	0.00%	0	0	0	0	5,43,75,739	4,62,27,801
Furniture & Fittings	0	0	2,90,064	0	0	2,90,064	0.00%	0	0	0	0	2,90,064	0
TOTAL	**2,54,98,96,557**	**12,59,99,014**	**5,40,45,323**	**4,56,07,321**	**0**	**2,68,43,33,573**		**1,11,71,02,833**	**19,25,88,683**	**0**	**1,30,96,91,516**	**1,37,46,42,057**	**1,43,27,93,724**
Previous Year	**2,43,86,83,903**	**12,21,79,586**	**2,43,45,129**	**3,53,12,061**	**0**	**2,54,98,96,557**		**92,15,26,266**	**19,55,76,567**	**0**	**1,11,71,02,833**	**1,43,27,93,724**	**1,51,71,57,637**
Capital Work in progress	**58,16,27,238**	**0**	**15,31,26,476**	**16,69,667**	**0**	**73,30,84,047**		**0**	**0**	**0**	**0**	**73,30,84,047**	**58,16,27,238**
TOTAL												**2,10,77,26,104**	**2,01,44,20,962**

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SCHEDULES TO BALANCE SHEET AS AT 31ST MARCH, 2017

	As at 31.03.2017	As at 31.03.2016
Schedule 6 :: LONG TERM ASSETS, LOANS, ADVANCES ETC		
a) Loans		
- Staff	15,90,381	18,85,380
b) Advances and other amounts on capital account recoverable in cash or in kind or for value to be received		
- Mobilisation Advance to SPCL	-	-
- Interim Advance to SPCL	5,43,00,000	5,43,00,000
c) Security Deposits	46,85,349	44,16,670
TOTAL	**6,05,75,730**	**6,06,02,050**
Schedule 7 :: CURRENT ASSETS, LOANS, ADVANCES ETC		
a) Current Assets		
1. Inventories		
- Canteen inventories	6,13,789	4,83,641
2. Sundry Debtors		
- Debtors outstanding for a period exceeding six months	-	-
- Others	-	-
3. Cash Balances in hand (including cheques/drafts and imprest)	19,805	5,048
4. Bank Balances		
a) With Scheduled Banks		
- On Current Accounts	21,89,28,930	1,36,59,566
- On Deposit Accounts	20,50,01,352	47,73,44,706
- On Earmarked & Retirement Benefits Accounts	9,46,74,482	5,82,52,821
Sub Total (a)	**51,92,38,358**	**54,97,45,783**
b) Loans, Advances and Other Assets		
1. Advances and other amounts recoverable in cash or in kind or for value to be received		
- On Capital Account	58,68,446	15,87,635
- Prepayments	1,45,58,583	1,35,50,389
- Others	67,52,357	68,41,553
2. Income Accrued		
- On Bank Deposits	1,55,40,650	1,38,08,975
- On Other Deposits	1,79,807	1,80,643
Sub Total (b)	**4,28,99,843**	**3,59,69,195**
TOTAL (a+b)	**56,21,38,201**	**58,57,14,978**

INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
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SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2017

(Amount in Rs.)

	2016-17	2015-16
Schedule 8 :: GRANTS / SUBSIDIES		
(irrevocable Grants & Subsidies Recovered)		
1. Central Government	59,50,00,000	56,50,00,000
TOTAL	**59,50,00,000**	**56,50,00,000**
Schedule 9 :: FEES / SUBSCRIPTIONS		
1. Entrance Fees	33,68,600	33,38,175
2. Annual Fees/Subscriptions	59,36,851	61,42,470
TOTAL	**93,05,451**	**94,80,645**
Schedule 10 :: INTEREST EARNED		
1. On Term Deposit		
a) With Scheduled Banks	83,47,408	86,97,893
b) Others	0	0
2. On Loans / Advances		
a) Employee/Staff	1,18,419	46,940
TOTAL	**84,65,827**	**87,44,833**
Schedule 11 :: OTHER INCOME		
1. Rent Receipts	9,63,058	7,92,018
2. Sale of Tender Forms	63,661	1,18,897
3. Sale of Scrap / Vehicles / Trees	54,454	3,42,612
4. Miscellaneous Income	35,86,840	17,83,718
TOTAL	**46,68,013**	**30,37,245**
Schedule 12 :: ESTABLISHMENT EXPENSES - REGULAR		
1. Salaries & Allowances	21,20,76,636	14,69,40,895
2. Contribution to NPS	1,15,97,434	89,33,755
3. Contribution to CPF	2,69,084	90,936
4. Medical Expense- Staff	34,66,327	36,24,074
5. Expense on Employees Retirement & Terminal Benefits	49,12,242	13,47,987
6. Interest on PF Contribution	19,480	0
7. Staff Training Expense	81,500	19,070
TOTAL	**23,24,22,703**	**16,09,56,717**

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SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2017

(Amount in Rs.)

	2016-17	2015-16
Schedule 13 :: ESTABLISHMENT EXPENSES - SUPPORT SERVICES		
1. Consultancy & Manpower Charges	7,76,00,914	7,37,46,954
2. Remuneration to Contract Employees	1,81,26,879	1,75,35,269
3. CISF Expenses	2,79,78,555	0
TOTAL	**12,37,06,348**	**9,12,82,223**
Schedule 14 :: ACADEMIC & OTHER STUDENT EXPENSES		
1. Admission Expense	98,60,450	1,20,34,517
2. Assistanceship to Students	4,14,98,567	4,20,84,741
3. Library Services	2,69,00,741	2,68,61,136
4. Academic Expense	5,86,07,665	5,15,63,793
5. Supplies & Materials	94,01,200	1,43,01,364
6. Student Activities Expense	18,75,000	14,64,436
TOTAL	**14,81,43,623**	**14,83,09,987**
Schedule 15 :: OTHER ADMINISTRATIVE EXPENSES		
1. Maintenance & Upkeep		
Repairs & Maintenance - CMD	2,03,44,993	1,84,07,063
Repairs & Maintenance	95,04,008	80,15,408
House Keeping Expense	8,86,456	7,43,271
Sub Total (a)	**3,07,35,457**	**2,71,65,742**
2. Professional Charges		
Audit Fees	1,38,000	1,54,000
Legal Expense	59,600	2,65,320
Sub Total (b)	**1,97,600**	**4,19,320**
3. Administrative Expenses - Others		
Vehicle Operating Expense	2,29,04,351	2,05,34,284
Electricity & Water Charges	2,34,98,134	2,23,79,201
Travelling Expense	59,32,206	66,19,955
Research & Development Expense	78,20,054	84,26,102
Printing & Stationery	33,65,560	35,28,886
Advertisement & Publicity	7,97,251	13,98,836
Hospitality Expense	42,44,358	42,37,556
Telephone & Internet Expense	23,87,533	29,16,140
Office Expense	24,19,779	26,27,443
Recruitment Expense	32,16,481	40,93,336
CEP & IPR Expenses	1,16,975	0
Bank Charges	16,847	12,254
Sub Total (c)	**7,67,19,529**	**7,67,73,993**
TOTAL	**10,76,52,586**	**10,43,59,055**

SUBRAMONI & MADHUKUMAR CHARTERED ACCOUNTANTS TRIVANDRUM

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Schedule 16 :: SIGNIFICANT ACCOUNTING POLICIES AND NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31ST MARCH, 2017

A. Significant Accounting Policies

1. Basis of Accounting
   The financial statements have been prepared in accordance with the Generally Accepted Accounting Principles in India (Indian GAAP) and are prepared on accrual basis under the historical cost convention. The accounting policies adopted in the preparation of the financial statements are consistent with those followed in the previous year.

2. Use of estimates
   The preparation of the financial statements in conformity with Indian GAAP requires the Management to make estimates and assumptions considered in the reported amounts of assets and liabilities (including contingent liabilities) and the reported income and expenses during the year. The Management believes that the estimates used in preparation of the financial statements are prudent and reasonable. Future results could differ due to these estimates and the differences between the actual results and the estimates are recognized in the periods in which the results are known / materialize.

3. Inventories
   The inventories represents canteen inventories and is valued at lower of cost or net realizable value as certified by the Canteen Manager.

4. Depreciation
   a. Depreciation has been provided on the written down value method as per the rates prescribed in the Income Tax Act, 1961.
   b. Depreciation on assets acquired in a particular year is provided for the whole year irrespective of date of addition.
   c. Depreciation has not been charged on capital work in progress and on those assets under installation as on 31.03.2017.
   d. Software not having perpetual licenses are written off over the license period.

5. Revenue Recognition
   a. Grant in aid received from the Department of Space, is accounted on accrual basis. Out of the total grant received, the amount received towards revenue expenditure is treated as Revenue Grant / income over the period necessary to match them with the costs for which they are intended to compensate, on a systematic basis. The remaining grant forms part of the Corpus Fund along with other grant received.
   b. Tuition fees, fines and other recoveries from underperforming students (as per the policy of the institute) are accounted on cash basis. As per Department of Space instructions, Fees received from B.Tech students (performing and non-performing students) is not recognized as income and is shown as a liability payable to Department to Space after adjusting related costs.
   c. Interest income is accounted on accrual basis. Interest on deposits created out of grant received is not recognized as income and is shown as a liability payable to Department to Space.

6. Fixed Assets
   a. Land - Land at Ponmudi has been valued at cost of acquisition. The present activity of the Institute is in the Valiamala campus which has been handed over by LPSC vide letter no. VSSC/CMG/2010 dated 05.08.2010, and has been measured at 53.43 acres. No value has been separately provided in the books for this land. . Land received free of cost from

Schedule 16 :: SIGNIFICANT ACCOUNTING POLICIES AND NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31ST MARCH, 2017 (contd)

Government of Kerala has been shown at a nominal value of Re. 1/- (for each property) in the books

b. Building – Construction of buildings is still in progress. Buildings, the construction of which are more than 90% complete, certified by the Construction and Maintenance Division and which have been put into use have been transferred from Capital Work-in-Progress to Buildings based on actual payments made.
c. Plant and Machinery – It mainly constitutes Laboratory Equipment, Office Equipment, Electricals & Electronics and other Machinery.
d. Buildings and other Fixed Assets are carried at cost less accumulated depreciation. Cost comprises the purchase price or acquisition cost, installation charges and any attributable cost of bringing the assets to working condition for its intended use. Exchange differences arising on restatement / settlement of foreign currency payables relating to acquisition of depreciable fixed assets are adjusted to the cost of the respective assets and depreciated over the remaining useful life of such assets.
e. Capital Work-in-Progress pertains to construction in progress at Valiamala.
f. Assets that have been delivered to IIST up to 31.03.2017 have been recognized as assets but depreciation has not been charged on Assets under installation.

7. Foreign currency transactions
Foreign currency monetary items outstanding at the Balance Sheet date are restated at the year-end rates. Non-monetary items are carried at historical cost. The exchange differences arising on restatement / settlement of long-term foreign currency monetary items are capitalised as part of the depreciable fixed assets to which the monetary item relates and depreciated over the remaining useful life of such assets.

8. Earmarked / Endowment Funds
Earmarked / Endowment Funds mainly include external agency funding received for research & development purpose and conduct of seminars & workshops. Value of assets procured out of such funds for the purpose specified have gone to reduce the value of Fund in hand and have not been treated as an asset of the Institute as the ownership of the same vests with the funding agency. Earmarked / Endowment Funds are held in a separate Current Account linked to Term Deposits. The interest received in the account has been taken as the Institutes Income. Interest claims in the future, if any, from the disbursing parties of such Earmarked / Endowment Funds will be met at the time of the claim based on the deposit rates prevailing during the period of holding of the particular Fund.

9. Employee Benefits
Employee benefits include General Provident Fund (GPF), Contributory Provident Fund (CPF), New Pension Scheme (NPS), and Group Insurance Scheme (GIS). The Institute's contribution to CPF and NPS are considered as defined contribution plans and are charged as an expense as they fall due based on the amount of contribution required to be made.
GPF and CPF funds are maintained separately by the Institute in Savings Bank Account and linked Flexi deposits. Annual Interest provision on GPF and CPF balance is made from Interest earned during the year from investment of such funds in flexi deposits. Interest earned over and above the provision made is transferred to an Interest Fluctuation Reserve and in the event of a shortfall in interest earned, the difference is met from such Reserve, and any balance shortfall after adjustment with Reserve is met by IIST.
Retirement Benefits consisting of pension fund, gratuity and leave encashment received from previous employers of employees joining from other Government organizations have been maintained separately in a Current Account and linked Term Deposits.

INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
THIRUVANANTHAPURAM

Schedule 16 :: SIGNIFICANT ACCOUNTING POLICIES AND NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31ST MARCH, 2017 (contd)

10. Taxes on income
    Being a non-profit institution existing solely for education purposes and being wholly financed by the Government of India, the income of the Institute is exempt under section 10[(23C)][iiiab] of the Income Tax Act, 1961.

11. Research and Development Expenses
    Revenue expenditure pertaining to research is charged to the Income and Expenditure Account. Fixed assets utilized for research and development are capitalized and depreciated in accordance with the policies stated for Fixed Assets.

12. Provisions and Contingencies
    A provision is recognised when the Institute has a present obligation as a result of past events and it is probable that an outflow of resources will be required to settle the obligation in respect of which a reliable estimate can be made. Provisions (excluding retirement benefits) are not discounted to their present value and are determined based on the best estimate required to settle the obligation at the Balance Sheet date. These are reviewed at each Balance Sheet date and adjusted to reflect the current best estimates.

B. Notes to the Accounts

1. Depreciation
   Assets are depreciated at written down value method as per rates prescribed in the Income Tax Act, 1961 as recommended by the Office of the Principal Director of Audit, Scientific Departments, Bangalore. Software not having perpetual licenses are written off over the license period

2. Revenue
   a. Out of Grant of Rs. 76,50,00,000/- received during 2016-17, Rs. 59,50,00,000/- received specifically towards revenue expenditure has been transferred to Revenue Grant.
   b. Interest earned (actually received) on funds from grant-in-aid maintained in deposits is refundable to DOS. Interest of Rs. 1,72,72,060/- (excluding the interest received on the Provident Fund Accounts and Earmarked Funds) has been actually received during 2016-17 and the same has been shown as refundable to DOS.
   c. Department of Space has, vide Letter No. B. 12011/7/2015-Sec.2 dated 21.10.2015, instructed that "Fees paid back by students on receipt of Assistanceship package and receipts from non-performing students" are to be remitted back to Government Account. During 2016-17, an amount of Rs. 4,33,76,648/- has been shown as refundable to DOS after adjusting related costs.
   d. Canteen Accounting Committee accounts is maintained separately and the gross deficit / surplus, which is exclusive of administrative cost, is recognised in the Income and Expenditure Account.
   e. Student Activities Account is maintained separately and the deficit / surplus is recognised in the Income and Expenditure Account.

3. Fixed Assets
   a. Land – There is a stay by the Honorable High Court of Kerala on carrying out construction activities on a part of land (approximately 80 acres) purchased at Ponmudi in Trivandrum District for setting up the Institute. Over and above this 80 acres, approximately 20 acres of land at Ponmudi and 44.18928 acres at Valiamala has been transferred by the Government of Kerala free of cost in December 2007 and April 2009 respectively. These two properties have been brought into the books of accounts in 2013-14 by assigning a

Schedule 16 :: SIGNIFICANT ACCOUNTING POLICIES AND NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31ST MARCH, 2017 (contd)

nominal value of Re. 1/- each. The present activity of the Institute is in the Valiamala campus which has been handed over by LPSC vide letter no. VSSC/CMG/2010 dated 05.08.2010, and has been measured at 53.43 acres. No separate lease agreement / transfer of ownership of land was obtained by IIST. No value has been separately provided in the books for this land. An amount of Rs. 3,00,969/- was incurred in 2016-17 towards decreetal compensation pertaining to this land. The same has been classified under Loans, Advances and Other Assets and not under Fixed Assets as the ownership of the property still vests with LPSC, Valiamala

b. Capital Work-in-Progress includes a sum of Rs. 3,75,24,917/- towards project management and consultancy charges and service tax of Rs. 6,57,61,904/-, both pending for appropriation to fixed assets on final completion of all buildings.
c. An amount of Rs. 5,46,65,803/- pertaining to assets that have been delivered to IIST before 31.03.2017 but under installation as on 31.03.2017 have been accounted as fixed assets & depreciation has not been charged on the same.

4. Employee Benefits
   a. Employer and Employee contribution to New Pension Scheme is being transferred to NSDL.
   b. The Institute has entered into a Group Insurance Scheme (GIS) agreement with Life Insurance Corporation of India from 2011-12 onwards.
   c. Provision for interest on PF Contribution, at the rates prescribed, have been made and the corresponding expenditure has been adjusted against Interest earned on GPF and CPF funds parked in Savings Accounts (linked to flexi deposits) and the balance interest earned has been retained as Interest Fluctuation Reserve. Provision for liability in respect of gratuity, pension and leave encashment has not been made. Permission from DOS for creation & maintenance of a separate pension fund has been received during 2013-14. The actuarial valuation amount will be brought into the books of accounts on obtaining necessary approval for the same from the Board of Management. In addition, the retirement benefits from the previous employers for the members governed under the GPF have not been received in all cases.

5. Prior Period Item
   Details of prior period items are as given below :-

Details	Prior period expenses
Diesel Cost – CMD	6,03,056.00
Total (A)	**6,03,056.00**

Details	Prior period income
Telephone charges (refundable by KSHB)	7,957.00
Phd Stipend	62,261.00
Total (B)	**70,218.00**

Net prior period expense (A-B) = Rs. 5,32,838.00

6. Academic Expenses
   Academic Expenses mainly include expenses towards Lectures for students, Project & Internship expenses, stipend / fellowship paid to PhD and M.Tech students and expenses incurred on Seminars, Symposiums and Conferences.

SUBRAMONI & MADHUKUMAR CHARTERED ACCOUNTANTS TRIVANDRUM

INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
THIRUVANANTHAPURAM

Schedule 16 :: SIGNIFICANT ACCOUNTING POLICIES AND NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31ST MARCH, 2017 (contd)

7. Admission Expenses
   Admission expenses include expenses incurred towards B.Tech, M.Tech and PhD admissions

8. Assistanceship to Students
   As per the approval of The Chairman, Board of Management-IIST / Secretary, DOS vide Letter No. PP & PM : IIST : 09-10 dated July 17th, 2009, the B. Tech students of the Institute are entitled for an assistanceship of Rs. 49,000/- [increased to Rs. 51,400/- from Even semester 2014-15] for each semester towards Statutory Semester Fee, Student Amenity Fee, Hostel & Dining, Establishment charges and Medical cover. The assistanceship amount of Rs. 48,400/- (exclusive of book grant) for a semester is disbursed to eligible students based on the performance of the previous semester. The assistanceship amount disbursed is then remitted back by the students to the Institute and expenditure corresponding to the assistanceship so received (under Hostel, Dining & Medical cover) is set off against the assistanceship amount. During 2016-17, an amount of Rs. 3,95,91,200/- was disbursed as assistanceship.The assistanceship amount of 25 students amounting to Rs. 12,10,000/- could not be disbursed and collected back.

9. Supplies and Materials
   Supplies and Materials mostly consist of lab consumables.

10. Bank balances
    The negative balance in the UBI Current Account represents the cheques issued on the closing date of the financial year which are not presented for payment. The Institute has sufficient balance to cover these cheques issued in the flexi deposits maintained with UBI. Hence, the negative balance does not represent any Overdraft.

11. Format of accounts
    The accounts of the Institute are prepared as per proforma suggested by the Office of the Principal Director of Audit, Scientific Departments, Bangalore.

12. Insurance
    The Institute being an autonomous body under the Department of Space (DOS), it is governed by the rules and regulations as applicable to DOS. As per the "Book of Financial Powers" prescribed by DOS "No Government property whether movable or immovable shall be insured. No liability shall be incurred in connection with the insurance of such property without the prior approval of the Department of Space in consultation with the Member for Finance." The matter was taken up for consultation with the Department of Space during 2012-13 and it was decided in the Seventh Finance Committee meeting of IIST dated 3rd June, 2014 not to insure the assets of the institute.

13. Balances in personal accounts
    Balances in personal accounts are subject to confirmation from respective parties.

14. Contingent Liabilities
    a. The unexecuted portion of the contracts entered into by the Institute will form part of the current liability of the Institute. However, the same could not be quantified.
    b. Interest earned on Earmarked / Endowment Funds held in a separate Current Account linked to Term Deposits has been taken as the Institutes Income. Interest claims in the future, if any, from the disbursing parties of such Earmarked / Endowment Funds will be

Schedule 16 :: SIGNIFICANT ACCOUNTING POLICIES AND NOTES TO THE ACCOUNTS FOR THE YEAR ENDED 31ST MARCH, 2017 (contd)

met at the time of the claim based on the deposit rates prevailing during the period of holding of the particular Fund

c. In the case of buildings / structures completed by SPCL, only 90% has been billed by SPCL and subsequently paid by IIST. The balance 10% (approximately Rs. 12.53 crores) has not been billed and the same will be paid only on completion of the project. In case of all other works completed by SPCL and not billed as on 31.03.2017, provision has not been made in the books of accounts since the same is not quantifiable.

15. Building Construction:
The institute entered into a contract with SPCL, Mumbai on 27.08.2008 for Rs. 278.60 crores with a completion period of 18 months for setting up building and infrastructure at its campus in Valiamala on turnkey basis. As per the note provided by the CMD office the project was delayed due to various unforeseen reasons and the extension of the contract was given up to 22.02.2018 without prejudice to the right of the institute to impose the levy of compensation for the delay. As per clause 2 of the agreement the institute can levy penalty on the works which will have an impact on the accounts. The same could not be quantified due to want of details. As on 31.03.2017, advance amount paid to SPCL towards interim advance amounts to Rs. 5.43 crores. The Institute currently holds the following instruments as security with respect to the contract with SPCL.

Nature of security	Amount (in crores)
Security Deposit – Bank guarantee	13.93
Performance Bank guarantee	13.93
Bank guarantee against Interim Advance	5.43

16. Figures for the previous year
Figures for the previous year have been regrouped and/or reclassified wherever considered necessary.

As per our report of even date attached

For Subramoni & Madhukumar
Chartered Accountants
FRN : 008570S

C.A. Rahul B. S.
(Partner, Mem No. 234170)

For and on behalf of
Indian Institute of Space Science and Technology (IIST)

Dr. V. K. Dadhwal
Director

R. Hari Prasad
Finance Officer

Place : Thiruvananthapuram
Date : 11th October, 2017

SUBRAMONI & MADHUKUMAR CHARTERED ACCOUNTANTS TRIVANDRUM

INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
THIRUVANANTHAPURAM

RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 2017

(Amount in Rs.)

Receipts	2016-17	2015-16	Payments	2016-17	2015-16
I. Opening Balance			**I. Expenses**		
a.Cash and DD's in hand	5,048	20,942	**a.Establishment Expenses - Regular**		
b.Bank Balances			Salaries & Allowances (admin & faculty)	21,19,56,005	14,71,85,469
In current accounts	1,36,59,566	2,60,04,661	Contribution to NPS	1,15,97,434	89,33,755
In deposit accounts	47,73,44,706	34,51,04,313	Contribution to CPF	2,69,084	90,936
In earmarked/retirement benefits accounts	5,82,52,821	3,44,23,086	Medical Expense- Staff	31,86,073	36,69,508
			Employees Retirement Benefits	49,12,242	13,47,987
II.Grants Received			Interest on PF Contribution	19,480	0
a.From Government of India	76,50,00,000	65,65,00,000	Staff Training Expenses	81,500	19,070
III. Interest Received			**b.Establishment Expenses - Support Services**		
a.On Bank Deposits	83,35,621	87,62,951	Consultancy & Manpower Charges	7,88,15,341	7,39,84,822
b.On Other Deposits	0	0	Remuneration to Contract Employees	1,81,26,879	1,75,35,269
c.Loans, Advances etc.	1,18,419	46,940	CISF Expenses	2,35,73,123	0
IV. Other Income			**c. Academic & Other Student Expenses**		
a.Entrance Fees	33,68,600	33,38,175	Admission Expense	98,04,210	1,20,34,517
b.Annual Fees/Subscriptions	56,68,937	53,91,082	Assistanceship to Students	4,14,09,980	4,27,98,903
c.Other Income	44,99,855	31,15,575	Library Services	2,75,04,030	3,32,43,802
			Academic Expense	5,84,51,739	5,08,46,229
V. Any other receipts			Supplies & Materials	1,05,47,099	1,37,87,108
a. Refund from Branches	0	0	Student Activities Expense	18,32,699	14,31,378
b.Security Deposits received	23,55,053	26,80,009			
c.Earnest Money Deposits received	41,57,606	73,98,577	**d. Other Administrative Expenses**		
d.Performance Guarantee	7,32,288	9,73,947	Repairs & Maintenance	1,04,28,036	83,34,083
e.Advance for Research & Seminars	3,37,60,992	44,89,461	Repairs & Maintenance - CMD	1,99,86,590	1,91,83,612
f. B.Tech Fees refundable to DOS	4,33,76,648	4,13,05,145	House Keeping Expense	8,22,481	7,43,271
g.Caution Deposit from Students	16,98,000	17,83,000	Audit Fees	1,17,000	1,54,000
h.Security Deposit (Asset)	0	6,498	Legal Expense	49,860	2,72,822
i.Stale cheques	2,69,128	99,870	Vehicle Operating Expense	2,26,88,800	2,12,10,990
j.Canteen Accounting Committee	1,99,55,104	2,03,32,533	Electricity & Water Charges	2,30,47,743	2,26,98,964

INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
THIRUVANANTHAPURAM

RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 2017

(Amount in Rs.)

Receipts	2016-17	2015-16	Payments	2016-17	2015-16
k.Employee recovery - interest	12,336	3,20,183	Travelling Expense	65,74,299	61,91,996
l.Interest received and payable to DOS	1,72,72,061	2,15,15,969	Research & Development Expense	79,53,097	82,48,844
m.Contingency advance	0	2,48,207	Printing & Stationery	35,10,867	37,76,024
n.Mediclaim recovery	0	(2,41,200)	Advertisement & Publicity	7,97,251	13,98,836
o.Student Activities Account	12,99,037	10,90,490	Hospitality Expense	43,17,670	42,22,589
p.Recovery of loans to staff	7,21,571	11,35,644	Telephone & Internet Expense	24,00,330	29,31,327
q. Miscellaneous receipts	10,00,000	0	Office Expense	25,88,527	24,52,977
r. Sundry debtors	68,966	450	Recruitment Expense	33,70,286	39,42,733
s.Increase in TDS, VAT & Labour Cess	71,65,183	5,01,667	CEP & IPR Expenses	1,16,975	0
t. Net addition to Statutory Liabilities(Staff)	1,61,42,691	2,83,79,197	Bank Charges	16,847	12,254
			II. Payments made against funds for various projects		
			ISRO-GBP - ABLN & C Project	0	35,60,022
			MOES - CTCZ	1,38,546	0
			DST Inspire - Dr. Sakthivel	7,81,298	11,25,538
			DST Inspire - Dr. Mahesh	14,33,643	12,93,965
			SERB - Dr. Seena V	5,75,896	2,03,547
			DST Inspire - Dr. Ambili K M	13,36,725	8,13,865
			DOS-SAC- Dr. Rajesh V J	4,49,225	1,45,512
			AICTE - INAE - PhD - R S Mohankumar	2,00,000	2,10,000
			NBHM-DAE-PDF- Dr. V.Govindraj	5,78,208	4,75,200
			DBT - Robotics in Medicine	0	1,15,593
			SERB - Preeti Manjari Mishra	0	2,612
			SERB - Dr. Jayanthi S	11,12,436	0
			LPSC - Dr. Umesh Kadhane	7,00,833	0
			DST - Dr. Rama Rao N	24,81,395	0
			VSSC - Dr. Natarajan E	1,27,890	0
			SERB - Dr. Rakesh Kumar Singh	14,17,880	0
			SERB - Dr. Roymon Joseph	8,16,457	0
			UGC - DAE - Dr. Kuntala B	1,86,332	0
			DBT - Dr. Rama Rao N	4,09,113	0

SUBRAMONI & MADHUKUMAR CHARTERED ACCOUNTANTS TRIVANDRUM

INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
THIRUVANANTHAPURAM

RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 2017

(Amount in Rs.)

Receipts	2016-17	2015-16	Payments	2016-17	2015-16
			DST - PAMC - Meeting	3,49,472	0
			SERB - Expert Committee Meeting	6,00,000	0
			KSCSTE - Seminar - SPEED 2016	5,85,500	0
			NPDE - TCA - 2016 - Seminar	9,70,000	0
			SERB - Seminar - NCD 2016	75,000	0
			SERB - Travel - Dr. Govindan Kutty	1,71,229	0
			SERB - Travel - Dr. Apoorva Nagar	59,435	0
			SERB - Travel - Dr. Rajesh Joseph Abraham	1,15,683	0
			SERB - Travel - Ruchi Sandilya	78,391	0
			SERB - Travel - Vinu RV	1,50,000	0
			III. Expenditure on Fixed Assets & Capital Work-in-Progress		
			a.Purchase of Fixed Assets	14,31,17,932	6,62,78,868
			b.Expenditure on Capital Work-in-progress	15,27,23,683	3,08,31,177
			IV. Other Payments		
			Security Deposits (Asset) paid	2,68,679	5,64,570
			Security Deposits repaid to Contractors	11,49,757	26,86,582
			Earnest Money Deposits repaid	36,05,789	56,96,339
			Performance Guarantee	8,64,932	9,97,906
			Contingency Advance to Staff	14,366	0
			Loans to staff	4,26,572	13,07,703
			Canteen Accounting Committee	1,52,07,467	1,59,07,574
			Sundry debtors	0	1,22,479
			Interest repayment to DOS	2,15,15,969	1,82,78,355
			Stale Cheques - paid	35,344	1,63,050
			Repayment of miscellaneous receipts	0	25,380
			Student Activities Account	16,10,046	19,75,319
			LPSC - Land	3,00,969	0

INDIAN INSTITUTE OF SPACE SCIENCE AND TECHNOLOGY
THIRUVANANTHAPURAM

RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 2017

(Amount in Rs.)

Receipts	2016-17	2015-16	Payments	2016-17	2015-16
			V. Closing Balances		
			a.Cash in hand	19,805	5,048
			b.Bank Balances		
			In current accounts	21,89,28,930	1,36,59,566
			In deposit accounts	20,50,01,352	47,73,44,706
			In earmarked/retirement benefits accounts	9,46,74,482	5,82,52,821
Total	**1,48,62,40,238**	**1,21,47,27,372**	**Total**	**1,48,62,40,238**	**1,21,47,27,372**

Significant Accounting Policies & Notes on Accounts 16

As per our report of even date attached.

For Subramoni & Madhukumar
Chartered Accountants
FRN : 008570S

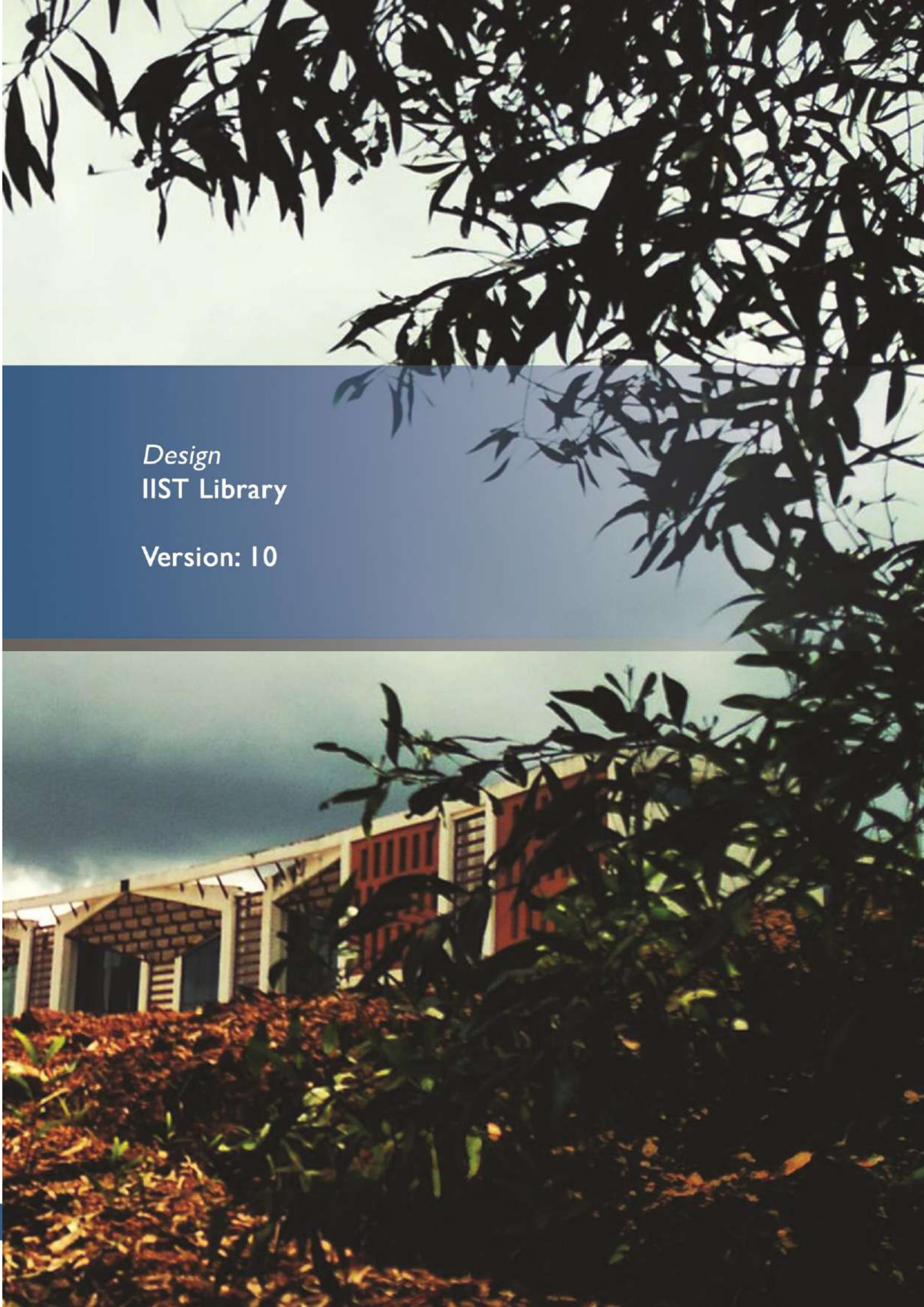
C.A. Rahul B. S.
(Partner, Mem No. 234170)
Place : Thiruvananthapuram
Date : 11th October, 2017

SUBRAMONI & MADHUKUMAR * TRIVANDRUM * CHARTERED ACCOUNTANTS

For and on behalf of
Indian Institute of Space Science and Technology (IIST)

Dr. V. K. Dadhwal
Director

R. Hari Prasad
Finance Officer



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Indian Institute of Space Science and Technology

(An autonomous institute under Department of Space, Govt. of India)
(Declared as Deemed to be University under Section 3 of the UGC Act, 1956)

Valiamala, Thiruvananthapuram - 695 547, Kerala

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