1977

FEBRUARY 2011

CMS

CENTRE FOR MATHEMATICAL SCIENCES

PROFILE

(1977-2011)

PMMC

(Project Management & Monitoring Committee)

Dr C. E. VENI MADHAVAN
(II Sc, Bangalore), Chairman,
PMMC

Dr ASHOK KUMAR SINGH
(DST, New Delhi),
DST Representative, Member, PMMC

Dr A. M. MATHAI
(Director, CMS)
Convener, Member, PMMC

Dr B. D. ACHARYA *
(DST, New Delhi),
Member, PMMC
* Retired from DST with
effect 1st October 2007

Dr D. V. PAI
(IIT Gandhinagar),
Member, PMMC

Dr R. N. RATTIHALLI
(Shivaji University,
Kolhapur), Member,
PMMC

Dr A. V. JEYAKUMAR
(Madurai Kamaraj
University, Trichy),
Member, PMMC

CENTRE FOR MATHEMATICAL SCIENCES
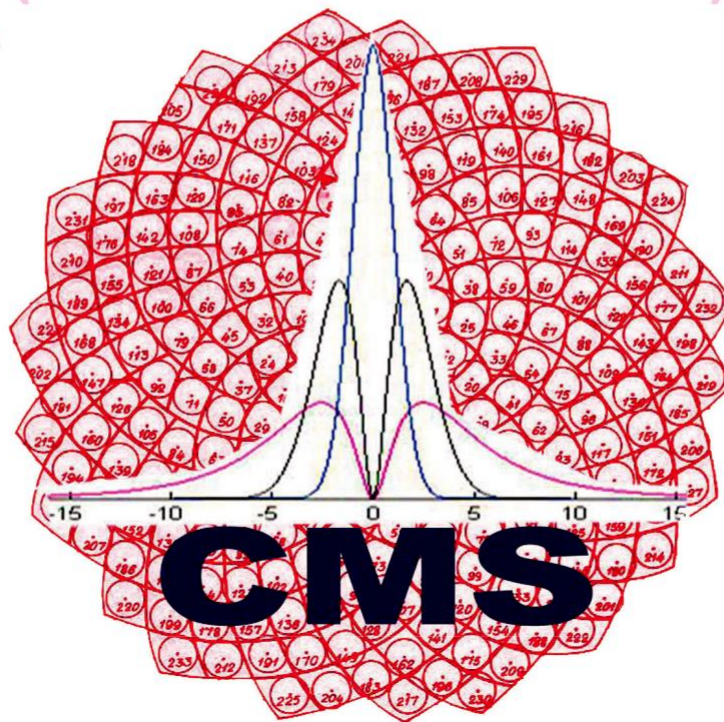
SOUTH, PALA & HILL AREA CAMPUSES
Arunapuram P.O., Palai, Kerala-686574
Phone/fax 91+4822-216 317 (04822 216317)
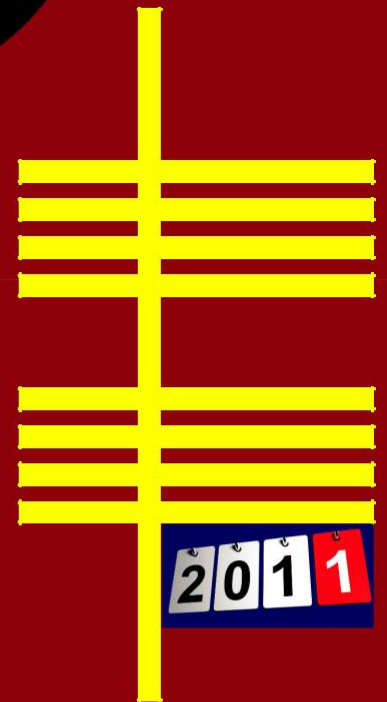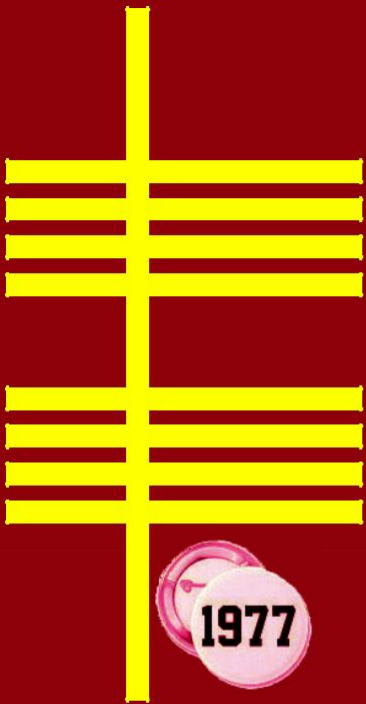**E-mail: cmspala@gmail.com; mathai@math.mcgill.ca**
Website: www.cmsintl.org

CMS EMBLEM

The emblem of the Centre for Mathematical Sciennces depicts the mathematically reconstructed sunflower head by Davis and Mathai 1974 [*Mathematical Biosciences*, 20 (1974), 117-133]. By assigning the Fibonacci angle of 137.507... degrees between any two consecutive individual flowers (florets), and controlling the Archimedes' scatter of the floral positions, a sunflower head or capitulum was constructed. The formation of the individual florets on the capitulum which eventully causes the emergence of arcs or spirals on it, whose numbers invariably match with the terms of Fibonacci sequence, can be explained thus. A mathematical explanation for the newly constructed sunflower head has been given in the above paper. The graphs in the emblem are of pathway model introduced by Mathai in 2005 [*Linear Algebra and Its Applications*, 396, 317-328].

The letters CMS are written at the bottom of the emblem. The emblem was created in 2006 when CMS became a Department of Science and Technology Government of India (DST) Centre for Mathematical Sciences. The emblem was designed by A.M. Mathai and the graphs were inserted by Seemon Thomas.

Centre for Mathematical Sciences

South, Pala and Hill Area Campuses Office : Pala Campus, Arunapuram. P.O, Pala, Kerala - 686 574, India Phone/Fax : 91+4822 216317 (04822 216317) E-mail : cmspala@gmail.com; mathai@math.mcgill.ca Website : www.cmsintl.org

I N T R O D U C T I O N

The Centre for Mathematical Sciences (CMS) was established in 1977 and registered in Trivandrum, Kerala, India, as a non-profit scientific society and a research and training centre covering all aspects of mathematics, statistics, mathematical physics, computer and information sciences. Since 1977, CMS has executed a large number of research and training projects for various central and state governmental agencies. In 2002, CMS has shifted its office and library into St Thomas College Pala compound into a two-storied building donated by the Diocese of Palai, Kerala, India. From 2006 onward CMS is a Department of Science and Technology, Government of India, Centre for Mathematical Sciences. Since 1977, the centre has grown into a leading research centre of international repute in various aspects of Mathematical Sciences, particularly those concerning research in Astrophysics, Special Functions, Statistics, and Fractional Calculus. CMS has a publications series (books, proceedings, collections of research papers, lecture notes, 42 so far), a newsletter of two issues per year, a mathematics modules series (self-study books on basic topics, 7 so far) and a mathematical sciences for the general public series (2 so far). The institute has been making all efforts to keep pace with developments all around the world and making major contributions to bring India into the frontline research in Mathematical Sciences and allied disciplines. Though it is difficult to summarize the wide ranging activities of the Centre in a small booklet, an attempt is made to present a brief overview of its activities in the span of last 23 years.
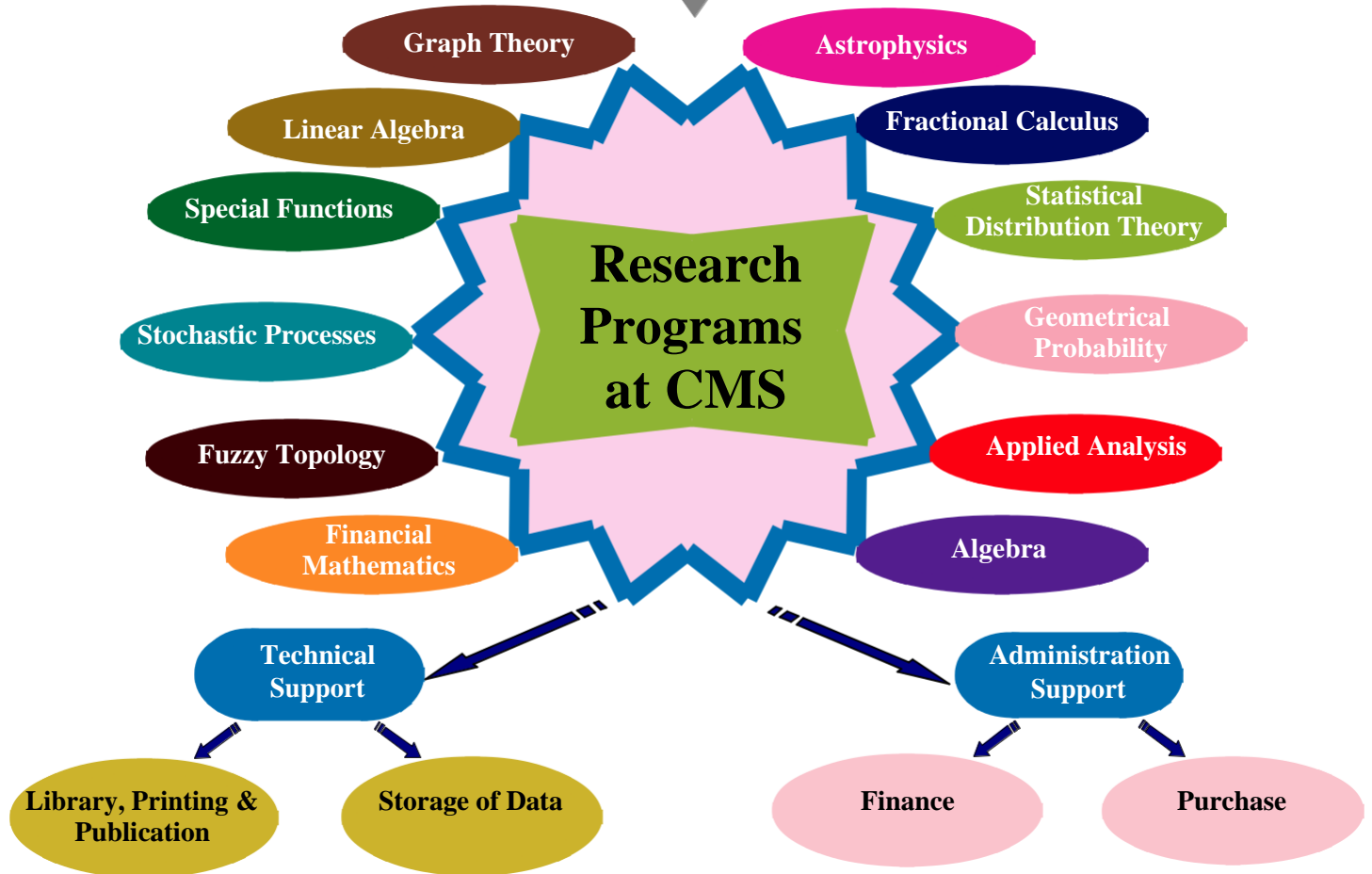
A.M. Mathai

Director

ORGANIZATIONALPROFILE

Government of India
Ministry of Science & Technology

↓

Department of Science & Technology

↓

PMMC
(Project Management & Monitoring Committee)

↓

DIRECTOR

↓

Research Programs at CMS

- Graph Theory
- Astrophysics
- Linear Algebra
- Fractional Calculus
- Special Functions
- Statistical Distribution Theory
- Stochastic Processes
- Geometrical Probability
- Fuzzy Topology
- Applied Analysis
- Financial Mathematics
- Algebra

Technical Support

- Library, Printing & Publication
- Storage of Data

Administration Support

- Finance
- Purchase

HISTORICAL BACKGROUND OF CMS

The Centre for Mathematical Sciences (CMS) was established in 1977 by the late Professor Aleyamma George and registered as a non-profit scientific society under the Travancore-Cochin Literary, Scientific and Charitable Societies Registration Act XII of 1955.

Applicants for incorporation were Mr K.T. Chandy, Dr A. Abraham, Dr Jacob Zachariah, Dr V.I. Subramoniam, Dr K. Sankara Rao, Dr Y. Sitaraman and Dr Aleyamma George

No fund was coming from any State Government source. Professor George spent her own savings and later took loans against her pension and gratuity funds and equipped the office space and classroom in a rented building in Vazhuthacad, Trivandrum, Kerala India and CMS started functioning. Research and project activities started at CMS and at one time there were 35 project staff but these projects could not generate any capital fund at CMS.

By the end of 1984 Professor George passed away and the then governing council of CMS requested Dr A.M. Mathai to take over and build it up into as international centre of excellence. Dr Mathai agreed to volunteer all his spare time for five years, from 1985 to 1990, and build it up into an international centre of excellence if fund was available from the State Government or from other sources. Starting from January 1985 Dr Mathai came to CMS twice a year on his own expense and spent nearly six months every year, and more time during his sabbatical years, at CMS. Thus, Dr Mathai became the Honorary Director of CMS in January 1985.

Dr Mathai did not know about the financial situation at CMS when he agreed to look after it for five years. There were several unfinished projects, including a major crop estimation project, but the funds were all finished and the project staff were not paid for months. Besides these, there was about Rs 60,000/- worth of cash debts owing to

Late Professor Aleyamma George - Founder of CMS

the shop-keepers for furniture bought on credit, for printing etc. Dr Mathai suspended all projects, relieved all project staff, promising them that their back wages would be paid when funds become available from other sources. He tried to finish the projects on his own with the help of the two office staff. He sustained CMS, two office staff, a peon, rent for the building and utility bills, with his own funds and meanwhile he could bring in some new projects. DST, Delhi, and various Departments of the State Government funded several projects. Finally he could pay all the back wages of all the project staff who were relieved and he managed to clear all debts owing to the shop-keepers. He approached the State Government for funds in 1985 itself. The State Chief Minister late Shri K. Karunakaran promised all help for buildings and grounds and released Rs 5 lakhs operating funds. But before the help for building and grounds could materialize the government fell. Nothing worked out after that with successive State Governments until 2002.

All the senior scientists in mathematical sciences in Kerala gave moral support to CMS and volunteered their time and energy in running various programs at CMS. A large number of programs were executed by CMS from 1985 onwards; the details are given below. When the State Government support was not coming in a large scale, Dr Mathai had offers of support from several colleges in Kerala and from the neighbouring States if CMS was shifted to their place. But the Council members of CMS wanted to build up CMS at Trivandrum and did not want to shift it to any other location. Dr Mathai himself wanted to build up CMS at Trivandrum itself because CMS would be helpful to all the scientists working in various institutions in Trivandrum area, besides Trivandrum being the capital of Kerala. But the long waiting period, hoping financial support from successive State Governments, was extremely costly in terms of time, energy and money for all involved in CMS and its activities.

MAJOR ACTIVITIES AT CMS

Centre for Mathematical Sciences has been functioning as a national centre for Mathematical Sciences Research starting from 1977. The main aim of the institution was to encourage youngsters to do research by organizing various activities in Mathematical Sciences. CMS has achieved remarkable progress in research, starting from 1977 onwards and has its full swing from 2007 onwards. The research groups at CMS cover almost all the major disciplines in Mathematical Sciences. The following are the research groups at CMS at present :

Astrophysics Research Group

Fractional Calculus Research Group

Special Functions Research Group

Statistical Distribution Theory Research Group

Geometric Probability Research Group

Stochastic Process Research Group

Discrete Mathematics Research Group

Algebra and Analysis Research Group

RESEARCH GROUPS

The research groups at CMS are very active in interdisciplinary research. [A write up about the teams is available from Volume 10, Number 2, 2007 of the Newsletter of CMS].

ASTROPHYSICS RESEARCH GROUP

The seniors in the group are Dr H.J. Haubold (Life Member of CMS) and Dr A.M. Mathai (Director). Recently Dr R.K. Saxena of Jodhpur (Life Member of CMS) also joined this group. A large number of papers are published by this group in top-level international research journals.

Dr Hans J. Haubold lecturing at CMS

Dilip Kumar (DST - SRF, CMS)

Dr Mathai addressing a gathering at CMS

Senior Research Fellows in the team are Dilip Kumar and Dhannya P. Joseph. Dilip presented papers in various
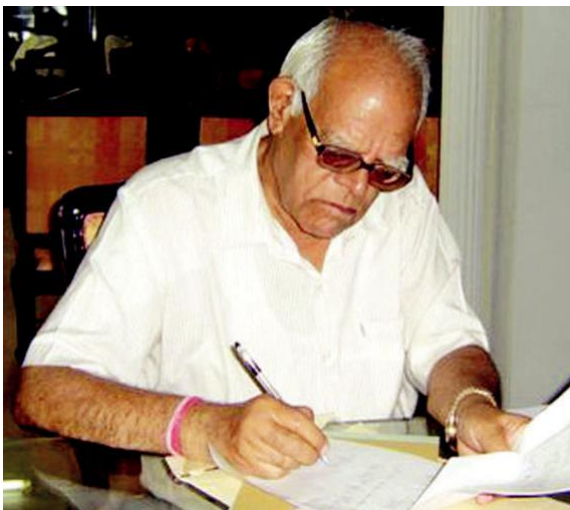
national and international conferences and won many awards. He presented a paper at the prestigious **COSPAR** meeting in **Montreal, Canada** and another paper at the international conference in **Minsk, Belarus**. He has joint papers with Dr Haubold of Austria and Dr Kilbas of Belarus. The second SRF in the team is Dhannya P. Joseph, who presented a paper in Sharjah in 2010. Realizing the importance of research in Astrophysics, CMS has included Astrophysics topics in every SERC Schools conducted at CMS.

FRACTIONAL CALCULUS RESEARCH GROUP

The seniors in the group are Dr R.K. Saxena, Dr A.M. Mathai and Dr H.J. Haubold. Over a dozen papers are published by this group recently. The Journal of Mathematical Physics stated that this group's paper of 2010 was on the top list of most downloaded papers. SRFs working in this group are Seema S. Nair, Anitha Kattuveettil and Nicy Sebastian. All have several papers published and accepted, which may be seen from the list of papers given later. Dilip Kumar also has work in fractional calculus. A national level workshop in this area was held at CMS in November 2009. As an emerging field, CMS conducted several short courses and included Fractional Calculus in the syllabus of many SERC Schools at CMS.

SPECIAL FUNCTIONS RESEARCH GROUP

This is one of the most active research groups at CMS. The seniors in the group are Dr R.K. Saxena, Dr P.N. Rathie, Dr S.B. Provost, Dr P. Moschopoulos, Dr H.J. Haubold and Dr A.M. Mathai. "*The H-function: Theory and Applications*" and "*Special Functions for Applied Scientists*" are the latest books of this group, which were out from Springer, New York, in 2010 and 2008

Miss Nicy Sebastian (DST-SRF, CMS)

Ms Seema S. Nair (DST-SRF, CMS)

Miss Dhannya P. Joseph (DST- SRF, CMS)

Dr R.K. Saxena engaged in research activity at CMS

respectively. Recent papers may be seen from the top-level international journals: *Linear Algebra and Its Applications* (2005, 2006, and 2007), *IEEE*

Transactions on Reliability (2006), *Physica A, Journal of Mathematical Physics, Astroparticle Physics, Plasma Physics* and others. SRFs working in this area are Dilip Kumar, Nicy Sebastian, Dhannya P. Joseph, Seema S. Nair, Anitha Kattuveettil and Naiju M. Thomas.

STATISTICAL DISTRIBUTION THEORY RESEARCH GROUP

The seniors in the group are Dr A.M. Mathai, Dr S.B. Provost, Dr W.J. Anderson, Dr H.J. Haubold and Dr P.N. Rathie. Various generalizations of Dirichlet integrals and Dirichlet densities are introduced by this group recently. Seemon Thomas, St Thomas College Palai, who is an associate of CMS, has received his Ph.D in this area. The pathway model introduced by Mathai in 2005 (*Linear Algebra and Its Applications*) is very popular in statistical distribution theory and non-extensive statistical mechanics now. The first Ph.D on pathway model was awarded to Shanoja S. Pai in 2010. Other researchers in this group are Nicy Sebastian, Seema S. Nair, Dhannya P. Joseph, Naiju M. Thomas, Prajitha P. and Princy T. CMS has always tried to conduct short-term courses in this area by various eminent faculties of national and International standing.

Mr Naiju M. Thomas (DST-JRF, CMS)

Miss Princy T. (DST-JRF, CMS)

Miss Sona Jose (DST-JRF, CMS)

Miss Prajitha P. (DST-JRF, CMS)

Miss Alphy Joseph (DST-JRF, CMS)

GEOMETRICAL PROBABILITY RESEARCH GROUP

Dr A.M. Mathai is the senior in this group and Seemon Thomas has joined and is working in the group.

STOCHASTIC PROCESS RESEARCH GROUP

The senior in this group is Dr K.K. Jose. Others are Dr Seetha Lekshmi, Dr Alice Thomas, Dr Shanoja S. Pai (Shanoja R. Naik). Nicy Sebastian and Seema S. Nair have also some work in this area.

DISCRETEMATHEMATICSRESEARCH GROUP

The seniors in this group are Dr B.D. Acharya (former Advisor to Government of India) who joined as a Visiting Full Professor at CMS, Dr R. Natarajan of Lakehead

Miss Diana Mary george (DST-JRF, CMS)

Miss Ginu Varghese (DST-JRF,CMS)

University, who is appointed as Reader at CMS, Dr K.A. Germina of the Hill Area Campus of CMS. Two Junior Research Fellows working in this group are Miss Alphy Joseph and Miss Sona Jose. They also participated and presented papers at an international conference in Sharjah. The activities of this group will also include building up a strong computer science base at CMS. A national level workshop in this area was held at CMS in February 2010 and another one was conducted in August 2010 in connection with the visit of Professor T. Zaslavsky (USA). Various short-term courses are conducted for the enhancement of research in this area.

ALGEBRA ANDANALYSIS RESEARCH GROUP

The seniors in this group are Dr Sunil C. Mathew Dr P.G. Romeo. The Junior Research Fellows working in this group are Miss Diana Mary George and Miss Ginu Varghese. Ginu Varghese has already published three papers. Various short-term courses are conducted to motivate the students in this area.

Miss Ginu Varghese and her research suprevisor Dr Sunil C. Mathew

RESEARCH RECOGNITIONS

CMS is an approved research centre of three universities, Banaras Hindu University, Varanasi, Anna University, Coimbatore and Mahatma Gandhi University, Kottayam. The students joining CMS for research can register themselves in any of the above universities for PhD. Some collaborative research is being done with other foreign and national institutions.

Major research projects undertaken

Crop Estimation Project (DST Delhi).

Diabetes Mellitus Project (Kerala State Government)

Optimal Diet Charts (DST, Delhi)

Expert system for Sampling Strategies (DST, Delhi)

An agricultural project related to jaggery production (DST, Delhi)

Power from the sea (DST, Delhi))

Monitoring Rainfall Depth (DST, Delhi)

Development project (DST, Delhi)

Minor research projects

Contact program with Professor A.M. Mathai

No-birth-bonus scheme for workers in tea estates Analysis of oral cancer data.

Mortality and morbidity studies at the Trivandrum Medical College.

Computer training for highly educated unemployed girls - several.

Computer training for SC/ST girls-several courses.

Data analysis for several sociological, biological, economic, educational projects of other people and agencies.

Concurrent evaluation of IRDP/CDS and Jawahar Rozgar Yojana Schemes of Government of India.

Short training courses for college/university teachers

Symposia and seminars

(for research workers, postgraduate students, university and college teachers)

National Nutrition Policy.

Functional Equations and Their Applications.

Stellar Models and Nuclear Reaction Rates.

Measurement of Poverty.

Theory of Regular Semi-groups and Applications.

Special Functions and Problem-Oriented research.

Computer-Oriented Research in Mathematical Sciences.

Operator Theory and Functional Analysis.

Reliability and Renewal Theory.

Design of Experiments.

Algebra and Number Theory.

Graph Theory and Combinatorics.

Statistical Distribution Theory.

Statistical Inference.

Mahalanobis Birth Centenary Symposium on Probability and Statistics.

Non-extensive Statistical Mechanics and Generalized Measures of Entropy

Workshops

(for selected college teachers and other scientists)

Model building, Prediction and Forecasting: Econometric Models.

Linear and Dynamic Programming Techniques.

Planning of Experiments.

Mathematical Economics.

Basic Mathematics for Physicists.

Linear Algebra for Applied Scientists.

Contact Programs.

Studies/research conducted on specific socio economic problems of the State

Construction of optimal diet charts for Kerala.

Stochastic models for predicting crop yields in Kerala.

Stochastic modeling of rainfall depth in Kerala.

Study of the pattern of diabetes mellitus in Kerala.

No-birth bonus scheme for workers in tea estates of Kerala.

Analysis of oral cancer data for Kerala.

Power from the sea with flow analysis near the shore.

Expert system for sampling strategies (patent taken by Government of India)

Palm Jaggery Project in Kanyakumari District of Tamilnadu.

Monitoring of Rainfall Depth in Kerala.

INFRASTRUCTURE SUPPORT

Equipments for Research

CMS is fully equipped with all essential items for active research in Mathematics. 34 computer systems with all necessary accessories including black and white laser printer are there. Each student is given an individual computer equipped with printer and internet connection. Besides these, there are two colour laser printers, two photocopying machines and a 4-colour printing unit. For presentations, 3 LCD projectors, one OHP, one audio-visual system are there in each room at CMS. For refreshments, two coffee machines, cutlery items to serve 120 participants of a conference etc are there. CMS does not have its own buildings and grounds. It is operating from two floors of 6000 sq. ft. area of a building donated by the Diocese of Palai, Kerala, India. Back volumes of more than 400 journals (with over 17,000 volumes) and more than 6000 books are available in mathematical sciences for reference purposes. Collections of reprints of individual articles are also arranged in CMS library for ready reference.

Library Development

CMS has built up a good library with books and journals collected by Professor Mathai from Canada and USA, from his colleagues, and shipped to India. Over Rs 3 crores worth of books and journals were already there at CMS library when the development project was approved by DST by the end of 2006. Since then at least another Rs 6 crores worth of books and journals were shipped from Canada. CMS has the best library in Kerala in mathematical sciences at present. CMS collection of books and journals include the full collections of books and journals of Professor Mathai, Professor Styan, full set of Mathematical Reviews donated by McGill University, Canada, partial collections of Professor Harold Ruben, Professor Charles Costley, Professor N.G.F. Sancho, Professor W.J. Anderson, Professor T.W. Anderson and Professor Morrison (full collections were offered to CMS but due to prohibitive cost of shipping, only some selected journals were taken by CMS) and a large collection from the University of Western Ontario, Canada.
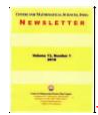
Well equipped printing unit is available at CMS. The equipments include one HMT 4-colour printing unit, one plate-making unit, one lamination unit, one stitching unit, one stapling unit, one perfect binding unit, one perforation and cresing unit, cutting unit, one high-resolution printer for the printing unit and two color laser printers. All CMS publications including SERC Notes, Module series, Newsletters, all pamphlets etc are printed at the CMS Press. Besides these, printing work is also executed for other nearby academic institutions.

Lamination unit

HMT colour printing unit

Platemaking unit

Binding unit

Stapling unit

Cutting unit

Stitching unit

PORTRAITS COLLECTION

CMS library has a collection of the portraits of over 300 world mathematicians. The enlarged and laminated color portraits are placed on the library walls at CMS for motivating the school/colleges students to do work in mathematical sciences. Such a collection may not be there in any other place in the world. Students of mathematical sciences have heard about the masters in mathematical sciences, they may have learnt about the discoveries of these masters but now the students have an opportunity to see their portraits and learn more about these great men and women by visiting CMS library at Pala Campus.

Liaison Officer Mr Saseendran Menon

A glimpse of portraits at CMS

ADMINISTRATIVE SUPPORT

The administrative support takes care of all developments, purchase, stores, office works, other maintenance, official communications etc for the smooth running of the activities of CMS. The Director is the head of all administrative activities and the office and technical staff work for the enhancement of the activities at CMS. A Liaison officer-cum Librarian is there for looking after all the correspondence with the academic institutions and looking after for the timely conduct of all programs. He is also in-charge of the library holdings.

Office Manager - Ms Sini Devassy

Office Assistant - Ms Girija R.

COLLABORATIVE RESEARCH PROGRAMS

International Research Visitors (2007 - 2011)

1. **Professor Dr Hans J. Haubold** of the United Nations, Vienna Office, visited from 24th to 26th November 2006 to work with Dr Mathai to complete the manuscript on "Special Functions for Applied Scientists" (This book was out from Springer, New York, in March 2008]. He visited during 16th to 26th May 2007 to work with Dr Mathai and Dr R.K. Saxena at CMS and to give a series of lectures on astrophysics topics to the 5th SERC School participants as well as to give an invited talk at the International Conference on Special Functions co-sponsored by CMS. A good number of papers were completed during this period of collaboration, the details may be found from the list of publications given later. He visited in May 2008 for sixth SERC School, from 18th to 23rd May for 2009 SERC School, from 10th to 14th may 2010 for 2010 SERC School and from 2nd to 9th January 2011 to participate at the international conference and discussion with the nonextensive statistical mechanics group.

2. **Barbara Haubold** of the Atomic Energy Agency of the United Nations, Vienna Office visited CMS in May 2007, accompanied by her husband, and gave general lectures under the "Mathematical Sciences for the General Public Series" to the undergraduates at St Thomas College Palai. She visited several times and the latest was on 2nd to 9th January 2011.

3. **Professor Dr S.P. Singh** (University of Western Ontario and Memorial University, Canada) visited from 4th to 7th February 2007 and gave a lecture on fixed point theory at the research level.

4. **Professor Dr K.N. GowriSankaran** of McGill University, Canada, visited from 5th to 7th February 2007 and gave a research level talk on many-variable complex analysis.

5. **Professor Dr Joseph Tharamangalam**, Mount St Vincent University, Halifax, Canada, gave a general talk on 26th October 2007.

6. **Professor Dr Peter Moschopoulos** of the University of Texas at El Paso, USA, visited CMS from 3rd to 9th January 2008.

7. **Professor Serge B. Provost** of the University of Western Ontario, Canada, visited CMS from 20th April to 24th April 2008 and gave lectures on quadratic forms in

International visitors at CMS

Professor Haubold and Barbara Haubold

random variables to SERC School participants. He visited again on 2 – 6 January 2011

8. **Professor Dr A. A. Kilbas** of Belarusian University in Belarus visited CMS for 3 weeks from 26th April to 18th May 2008. He gave 3 days of lectures at the 2008 SERC School and rewrote the works of JRFs Anitha Kattuveettil, Nicy Sebastian, Dilip Kumar and Seema S. Nair. This resulted in five good papers, all are in the published list

Late professor A.A . Kilbas delivering a lecture at CMS

now. More details may be seen from the list of publications given later.

9. **Professor Dr Bhu Dev Sharma** (USA and New Delhi) visited CMS from 24th to 30th October 2008 and gave a 3-day lecture series on 27th, 28th, 29th at the South Campus (Trivandrum) of CMS, on Mathematical Modeling and Simulation.

10. **Professor Dr Stratis Kounias** (Greece and Cyprus) visited CMS from 3rd May to 9th May 2009 and gave lectures on Optimal Designs and General Model Building to the all India participants and SRFs/JRFs at CMS.

11. **Professor Dr R Gorenflo** (Germany) visited CMS from 16th November 2009 to 10th December 2009 and gave a three-day lecture series on Fractional Calculus. SRFs at CMS initiated research collaboration with Professor Gorenflo. He visited CMS again from 1st to 21st January 2011.

12. **Professor Dr Allan Pinkus** (Israel) and his wife visited CMS on 27th January 2010. Professor Pinkus gave a lecture on approximation theory to research students, faculty and others at CMS.

13. **Professor Dr Francesco Mainardi** (Italy) and his wife visited CMS from 1st to 11th May 2010 and gave a series of lectures on Fractional Calculus. He visited again on 1st to 9th January 2011.

14. **Professor Dr Thomas Zaslavsky** (USA) visited CMS on 15th to 17th August 2010 and he was the chief guest in the National Workshop on Graph Theory, Set Valuations and Geometry on 15th to 20th August 2010 (two

International professors at CMS

Dr Jung Hun Han, visiting faculty from South Korea, who spent more than one year at CMS

Ms Gauri Shrestha visiting faculty from Nepal, who spent more than six months at CMS

days at CMS Pala Campus and one day at Mary Matha Arts and Science College, Mananthavady, Kerala; CMS Hill Area Campus)

15. **Professor C. Tsallis** of Brazil and USA conducted a mini-course at CMS from 6th to 8th January 2011 and visited CMS from 4th to 13th January 2011.

16. **Professor Dr J. S. Rao** of the University of California (Santa Barbara), USA, visited CMS from 2 -9 January 2011.

17. **Professor Dr P. N. Rathie** of Brazil visited CMS several times.

Distinguished National Research Visitors (2007-2010)

1. **Dr D. K. Ghosh** (Gujarat), 18th to 20th April 2007

2. **Dr (Mrs) Mukti Acharya** (New Delhi, 28th to 30th June 2007.

3. **Dr A. K. Agarwal** (Punjab), 13th to 15th August 2007.

4. **Dr M. A. Pathan** (Aligarh), 27th to 29th August 2007.

5. **Dr M. I. Qureshi** (New Delhi), 29th to 30th August and 1st September 2007.

6. **Dr B. K. Sinha** (Kolkata), 3rd to 5th October 2007.

7. **Dr R. B. Bapat** (New Delhi), 29th to 31st October 2007.

8. **Dr K. Muralidharan** (Gujarat), University of Baroda, Gujarat, 9th to 20th June 2009.

9. **Dr S. K. Upadhyaya** (Varanasi), Banars Hindu University, UP, 22nd to 27th June 2009.

10. **Dr O. P. Singh** (Varanasi), 28th June 2009 to 3rd July 2009.

11. **Dr E. Krishnan** (Trivandrum), University College, Trivandrum, Kerala, 8th to 10th July 2009.

12. **Dr P.K. Mishra** (Varanasi), Banaras Hindu University, Varanasi, UP, 5th to 8th April 2010.

13. **Dr D.V. Pai** (IIT Gandhinagar and Bombay),11th to 12th May 2010.

14. **Dr P.K. Banerji** (Jai Narain Vyas University of Jodhpur), 1st to 4th December 2010.

Other distinguished national visitors who came to CMS and gave lectures in the SERC Schools (23rd April to 25th May 2007, 14th April to 17th May 2008, April-May 2009, and April-May 2010) are the following: **Dr D.V. Pai** (IIT Bombay and IIT Gandhinagar), **Dr N. Mukunda** (IISc. Bangalore), **Dr R.K. Saxena** (Jodhpur University), **Dr K. Jayakumar** (Calicut University), **Dr P.R. Parthasarathy** (IIT, Madras), **Dr Yageen Thomas** (Kerala University), **Dr R.Y. Denis** (Gorakhpur University), **Dr K. Swaminathan** (IIT Madras), **Dr E. Krishnan** (University College, Trivandrum), **Dr Debasis Kundu** (IIT, Kanpur), **Dr Debasis Sen Gupta** (ISI, Kolkata)

The following distinguished visitors came, gave lectures and participated in the workshops conducted by CMS: **Dr B.D. Acharya** (New Delhi), **Dr Mukti Acharya** (New Delhi), **Dr E. Sampathkumar** (Mysore), **Dr K.A. Germina** (Mananthavady), **Dr V. Swaminathan** (Trichy), **Dr V. K. Jayaraman** (Pune), **Dr R.K. Kumbhat** (Jodhpur), **Dr Renu Jain** (Gwalior), **Dr Debasis Kundu** (Kanpur), **Dr Debasis Sen Gupta** (Kolkata), **Dr Yageen Thomas** (Trivandrum), **Dr V. Anandam** (Chennai), **Dr V. Jeyakumar** (Trichy).

Dr and Mrs Bhu Dev Sharma at CMS

Dr P.K. Banerji lecturing at CMS

Some recent National visitors at CMS

Sequence of Research Level Courses at CMS (2007-2010)

CMS decided to conduct a series of lectures by top research workers and make these courses compulsory for students registered for Ph. D through CMS. These are intensive courses with lectures from 8.30 to 10.30 hrs and 14 to 16 hrs, followed by problem-solving sessions from 10.30 to 13.00 hrs and 16 to 18 hrs and with written examinations and quizes. These courses are aimed at giving students a general background in mathematical sciences before they receive their Ph.Ds. For each course, up to 10 participants from outside are given free accommodation, food and study materials by CMS. The following courses have been conducted so far and the courses are continuing. [There were several one to 2 hours or one day lectures by international visitors. These are not counted as courses, though compulsory for all SRFs/JRFs at CMS].

Course 1: 18-20 April 2007, Dr D.K. Ghosh (Gujarat, India), "Design of Experiments" (Optimal Designs and Construction of Designs)". **Course 2:** 23rd April to 25th May 2007, 5th SERC School on "Special Functions and Functions of Matrix Arguments: Recent Advances and Applications in Stochastic Processes, Statistics, Wavelet Analysis and Astrophysics".

Course 3: 28-30 June 2007, Dr (Mrs) Mukti Acharya (New Delhi, India), "Basic Graph Theory".

Course 4: 13-15 August 2007, Dr A.K. Agarwal (Punjab, India), "Partitions".

Course 5: 27-29 August 2007: Dr M.A. Pathan (Aligarh Muslim University, India) "Lie Theory and Special Functions".

Course 6: 30-31 August and 1st September 2007, Dr M. I. Qureshi (Jamia Millia Ismalia, New Delhi, India), "Integral Operators and Special Functions".

Course 7: 3-5 October 2007, Dr B.K. Sinha (Kolkata, India), "Combinatorial Aspects".

Course 8: 29-31 October 2007, Dr R.B. Bapat (New Delhi, India), "Generalized Inverses of Matrices".

Course 9: 3-18 December 2007 (one hour each day from 16 to 17 hrs) on "basic aspects of thermodynamics and reaction rate theory", Dr Vincent Mathew, St Thomas College Palai, Kerala, India.

Course 10: 14th April to 17th May 2008 (five weeks): 2008 SERC School on Multivariable and Matrix-variate Calculus and Statistical Distributions with Applications in Model Building, Data Analysis and Astrophysics Problems. Lecture notes of this SERC School are brought out as Publication No.36 of CMS. Professor Dr A.A. Kilbas of Belarus was one of the main lecturers in this School.

Course 11: Dr Bhu Dev Sharma of the Forum for Interdisciplinary Mathematics (Professor at JIIT University, former Professor at several universities in the West Indies and USA) gave a 3-day lecture series on Mathematical Modeling and Simulation at CMS South Campus during 27,28,29 October 2008.

Course 12: 20th April to 22nd may 2009 (five weeks): 2009 SERC School on Model Building. Lecture notes are brought out as Publication No. 38 of CMS. Foreign lecturers included Professor Dr Stratis Kounias of Greece

Professor D.V. Pai delivering a lecture during SERC School

SERC School participant receiving cerificate from Dr Ashok Kumar Singh (DST)

Problem session during SERC School at CMS

and Cyprus and Professor Dr Hans J. Haubold of Vienna, Austria.

Course 13: 24th to 26th June 2009, Dr S.K. Upadhyay of Banaras Hindu University, on "Bayesian Inference and Computations".

Course 14: 29th, 30th June 2009 and 1st July 2009, Dr O.P. Singh of Varanasi on "MCMC Methods and BUGS Software and Applied Statistics".

Course 15: 8th to 10th July 2009 on Basic Analysis by Dr E. Krishnan of University College, Trivandrum.

Course 16: 19th to 21st November 2009, Dr R. Gorenflo of Germany, on "Fractional Calculus". He was also available for consultation for three weeks.

Course 17: 12th April 2010 to 14th May 2010, the 8th SERC School on Multivariable and Matrix Variable Calculus and Statistical Distributions with the 2010 focal theme of Stochastic Model Building.

Course 18: 6th to 8th January 2011, Professor C. Tsallis of Brazil and USA conducted a 3-day mini course on nonextensive statistical mechanics. He is the originator of this field.

Undergraduate Training Programs (2007-2010)

After recruiting the best available students for research work it was realized that the students are not clear about many basic concepts such as convergence of sequences, series and integrals, differentiability, integrability, continuity and so on. Some even had difficulty in graphing functions and geometrical interpretations of equations. Dr Mathai had been making requests to various agencies for funding to conduct a sequence of courses covering basic undergraduate mathematics, not tied up to any degree program in any university. Finally when Dr H.K.N. Trivedi, Director, DST, visited CMS he had personally witnessed the background of the best students selected from all across India. He took immediate steps and funds were released to run a few courses for undergraduates as a local activity. The Principals of colleges in Kerala were requested to find motivated students and send to CMS a list of 5 students each. Then 30 from these lists are selected by CMS. The courses are conducted during holiday periods so that their regular study programs are not disturbed. These are 10-day intensive programs. The courses start at 8.30 am and go until 6 pm every day continuously for 10 days. Every lecture is followed by an equal amount of time spent for problem-solving sessions. There are one-hour written examinations on the 3rd, 6th and 10th days and an individual quiz on the 10th day. The cumulative grades appear in their certificates.

The first in this sequence on "**Vectors, Matrices and Determinants**" was conducted with 30 participants during Onam holidays (August-September) in 2007. The second on "**Limits, Continuity, Convergence and Differential Calculus**" with 47 participants was conducted during Christmas holidays (December 2007). The third on

Listening to Professor Tsallis' mini course

Professor Mathai delivering a lecture during UG camp

"**Integrals and Integration**" with 25 students was conducted from 9th to 19th May 2008 [the number of participants went down from the 55 registered to 25 attended due to unexpected postponement of examinations by the universities in Kerala. This affected the 4th course also to some extent and only students from MG University could participate due to disruption of exam schedule in

UG camp participants with the faculty

Kerala, Calicut and Kannur universities] and the fourth on "**Basic Analysis**" with 35 students was conducted from 20th to 30th May 2008. Four 10-day undergraduate mathematics training camps are conducted every year. The first undergraduate camp in the second sequence took place from 6th to 15th September 2008 at CMS Pala Campus. It was a 10-day intensive camp on **Vectors, Matrices and Determinants** with 34 participants. The second camp in the second sequence was conducted from 19th to 28th December 2008 at CMS Pala Campus on **Limits, Continuity and Differential Calculus.** The third and fourth camps of the second series were from 7th to 16th May 2009 on **Integrability and integral calculus** and from 21st to 30th May 2009 on **Basic ideas in probability**

UG camp participants attending the lectures

UG camp onam celebration

and statistics, respectively. But again, due to postponement of examinations by all universities in Kerala, only one on **Basic Probability and Statistics** could be conducted from 25th May to 3rd June 2009 only with final year students. The last in the second sequence on **Integrals and Integration** was conducted from 8th to 17th June 2009 with 28 final year students. Others could not come due to postponement of examinations by all universities in Kerala. The next sequence of 4 camps started on 15th May 2010 with 45 students on **vectors, matrices and determinants**. This was the 9th camp. The 10th camp on **limits, continuity and differentiability** started on 27th May 2010 with 26 students, only the ones who graduated could come because for others their regular classes started on 1st June 2010. The 11th camp on **Integrability and Integration** was conducted from 21st August to 30th August 2010. The 12th camp on **Probability and Random Variables** was

Professor Mathai distributing UG camp certificates

conducted with 43 participants from 23rd December 2010 to 2nd January 2011. Upon requests from students and their parents and popular demand, all the courses are given by Dr Mathai, from his teaching experience of over 50 years in the Indian and North American systems, whenever he is in station.

CMS is proud to announce the following achievements by our JRFs/SRFs during the past four years:

1. Best paper Award: **Shanoja R. Naik** (SRF at CMS) won the best paper award at the *8th Annual Conference of the Society for Special Functions and Their Applications* held at Palai, on 18th to 20th May 2007.

2. Best paper Award: **Dilip Kumar** (SRF, CMS) won the best paper award in the section on inter-disciplinary mathematics at the *National Symposium on Applications of Special Functions and the 12th Annual Conference of Vijnana Parishad of India* held from 25th to 27th October 2007 at Jodhpur, India. The award carried a certificate and a cash prize.

3. Best paper presentation Award: **Dilip Kumar** (SRF, CMS) won the second prize in the *all-India research scholars' meet* held at IIT Kanpur from 5th to 10th December 2008.

4. Young Statistician Award: **Nicy Sebastian** (SRF,CMS)'s paper won the Young Statistician Award at the *Kerala Statistical Association*'s annual conference held at Kanhangad, Kerala, India, from 12th to 14th February 2009.

5. Best paper presentation Award: **Seema S. Nair** (SRF, CMS) won the first prize for the best paper presentation award (first prize) at the *all-India research scholars' meet* held at IIT Roorkee on 18th to 23rd December 2009.

6. Young Scientist Award: **Dilip Kumar's** (SRF, CMS) paper won the Young Scientist Award (Mathematics) of the International Aademy of Physical Sciences Allahabad, India, at its meeting held on 20th to 22nd February 2010 in Allahabad, India. The award consisted of a certificate, cash award and a plaque.

Dilip Kumar receiving Young Scientist award 2010

**7. Best published paper from India of the year 2009-2010 award:** **Seema S. Nair** (SRF, CMS) won Professor A.K. Agarwal prize for the best published paper of the year 2009-2010 award for her paper "Pathway fractional integration operator" published in the international journal *Fractional Calculus & Applied Analysis*, **12 (3-4)**, 237- 252. This paper contains a new fractional integration operator based on the pathway idea of Mathai (2005) [*Linear Algebra and Its Applications*, **396**, 317-328].
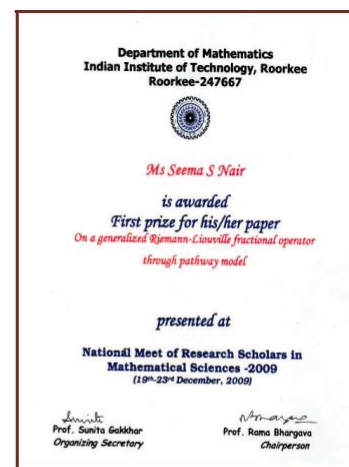
8. Indian Mathematical Society Prize (IMS Prize): **Dilip Kumar** (SRF, CMS) won the IMS Prize of the Indian Mathematical Society at its 76th Annual Conference held on 27th to 30th December 2010 in SVNIT, Surat, Gujarat, India. The award consisted of a certificate and a cash award.

Dilip Kumar receiving IMS prize
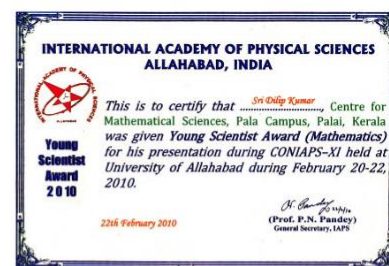
Nicy Sebastian and Seema S. Nair with their awards

Papers presented and lectures given by the faculty (2007 – 2010)

The Principal Investigator Dr. A.M. Mathai, as Director of CMS, gave the following talks: He gave the **keynote address** at the *8th Annual Conference of the Society for Special Functions and Their Applications*, held at Palai from 18th to 20th May 2007. He gave an **invited talk** and chaired the opening academic session on 1st June 2007 at the *150th anniversary celebrations of Mumbai University* from 31st May to 3rd June 2007. He gave one of the **keynote addresses** at the *Indian Mathematical Society's annual conference* at Kalasalingam University on 29th December 2009. He gave one of the **keynote addresses** at the 97th *Indian Science Congress* held at Trivandrum in January 2010 and also gave a talk at the Children's Congress at the Indian Science

Professor Mathai during his lecture at 97th ISC 2010

Congress (ISC). He organized one of the three symposia in the mathematical sciences section of the Indian Science Congress at Trivandrum, and chaired two other sessions also. He was also a panelist in the panel discussion in the mathematical sciences section there. He **inaugurated** the National Conference & Workshop on High Performance Computing & Applications held at BHU from 8 to 10 February 2010. He also **inaugurated** the Research Promotion Workshop on Introduction to Graph and Geometric Algorithms held at BHU from 8 to 13 February 2010. He also gave 6 hours of lectures in these two workshops. He also gave a 2-hour lecture in the Department of Statistics at BHU on 10th February 2010.

The Director, Dr A.M. Mathai, participated at the Planning Committee Meeting for the all-India Research Scholars' Meet. The meeting was held at IIT, Roorkee, on 1-2 August 2009. He also participated at the Research Scholars' Meet at IIT Kanpur in 2008 as a Planning Committee Member.

Dr A.M. Mathai also **gave all the lectures** in the 1st, 2nd, 3rd, 6th, 7th, 8th, 9th, 10th ,11th, and 12th undergraduate training programs of 10-day intensive mathematics training camps. He also gave one week each of lectures in the 2007 and 2008 SERC Schools. He gave two weeks lectures at the 2009 and 2010 SERC Schools.

Dr A.M. Mathai gave **two days of lectures** to the undergraduate/graduates/faculty at Mary Matha Arts and Science College Mananthavady on 14-15 July 2009, on the topic of elementary transformations and vector spaces, again **two days of lectures** on 21-22 July 2010 on limits and continuity to selected undergraduates from all colleges in Kannur and Wynad areas (over 200 participants)..

Dr A.M. Mathai **inaugurated** the Mathematics Association on 18th August 2007 at Union Christian College, Alwaye, Kerala, India and gave a lecture also. He **inaugurated** the research unit in mathematical sciences at Bharat Matha College, Thrikkakkara, Kerala on 12th September 2007 and gave **a lecture** also. He gave **two lectures** at Banaras Hindu University on 21st and 22nd September 2007. He gave **talks** at Mar Ivanios College, Trivandrum and the Statistics Department of Kerala University, Trivandrum on 1st October 2007. He gave 3 hours of **lectures** to the Statistics M.Sc students at St Thomas College Palai on 9-10 October 2007. He gave a series of **lectures** at the Staff Training College on 22-23 October 2007. He gave the **keynote address** at the *10th Annual Conference of the Society of Statistics, Computer & Applications* on 16th November 2007. The conference was held at Palai, Kerala, India from 16th to 18th November 2007. He **inaugurated** the 50th Anniversary Celebrations of the founding of the Department of Mathematics at Mar Athanasios College Kothamangalam, Kerala, India, on 7th December 2007. He gave an **invited talk** at the *National Symposium on Special Functions and Applications* held at Malavya Institute of Technology in Jaipur, Rajasthan on 15th December 2007.

Dr Mathai gave a 3-hour **lecture** at Maharaja's College, Ernakulam, Kerala, India on 21st November 2008. He **inaugurated** the *Mathematics Association of S.B. College, Changanacherry*, Kerala, on 22nd October 2008. He **inaugurated** a Research Methodology for Social Scientists course at St Thomas College Palai, Kerala, on 25th October 2008. Dr Mathai gave a five hour **lecture series** at Mary Matha Arts and Science College, Manathavady, Kerala, on 10th February, 2009, a one hour **talk** at Chemperi Engineering College on 11th February 2009, a one hour **talk** at Sir Sayed College, Thaliparambu, Kerala on 11th February 2009. He **inaugurated** the *Annual Conference of the Kerala Statistical Association* on 12th February 2009 at Nehru Arts and Science College Kanhangad, Kerala, and gave a talk also. He gave two weeks **lectures** at the 2009 SERC School held at CMS Pala Campus from 20th April until 22nd May 2009. He gave one and a half days of **lectures** at Mary Matha Arts and Science College Manathavady on 14, 15 July 2009. He gave one day **lecture series** at Newman College Thodupuzha on 11th November 2009. He gave one day **lecture series** at Government Engineering College, Trissur, Kerala, on 16th November 2009. He gave two days of **lectures** at Banaras Hindu University on 18-19 November 2009. He gave the **inaugural lecture** of the year long golden jubilee celebrations of the National Institute of Technology (NIT), Calicut, Kerala, India, on 31st August 2010. He also gave three days of lectures at Manathavady on 1-3 September 2010.

Dr A.M. Mathai is a member of the **Syllabus Committee of the new Central University of Rajasthan**. The first sitting to finalize the course contents of two programs, M.A/ M.Sc Math (Tech) and M.A./M.Sc Stats (Actuarial) took place at Jaipur, Rajasthan, on 19-21 June 2009. As a DST-nominated member of the organizing committee for **National Research Scholars' Meet** he visited IIT Kanpur twice, gave one lecture also, and IIT Roorkee on 1-2 August 2009. He was also DST-nominated member in selection committees to select JRFs at Cochin University of Science and Technology, twice and at Mary Matha Arts and Science College, Manathavady, twice.

Dr A.M. Mathai was the **chief guest and resource person** and gave the **keynote address** at the National Conference on Promoting the Applications of Mathematics in Engineering and Technology and the Symposium on Restructuring of Mathematics Syllabi in Engineering, held

on 16-17 April 2010 at Marudhar Engineering College, Bikaner, and Rajasthan, India. He gave more lectures and chaired several sessions also.

Dr A.M. Mathai gave a **plenary lecture** at the 9-th Annual Conference of the Society for Special Functions and Their Applications on 23rd June 2010 at Jiwaji University, Gwalior, India. In the same conference he also presented the award winning paper of Seema S. Nair since she was unable to be present due to delivery of her first child. He also gave a talk at the engineering college of the BSF (Armed Forces) on 24th June 2010.

Dr A.M. Mathai gave an invited talk, at the research level, at the National Institute of Technology (NIT), Calicut, Kerala, India on 31st August 2010, **inaugurating** the lecture series, seminars, conferences etc of their year-long golden jubilee celebrations. The scheduled one hour talk from 2.30 pm to 3.30 pm was extended to 7.30 pm upon request.

Dr A.M. Mathai **inaugurated** and gave the **keynote address** at the National Conference on Mathematical Models and Their Applications, on 23rd November 2010 at Deva Matha College, Kuravilangad, Kerala, India.

Dr A. M. Mathai gave a plenary talk on 14th January 2011 at the international conference held at Kannur University. He was also the chief guest at the valedictory session there.

International: Dr A.M. Mathai participated at the 2009 UN/ BSS & IHY Workshop held at Daegeon, South Korea, from 21 to 25 September 2009 and gave one of the three **keynote addresses** at the Workshop. His talk was on "Mittag-Leffler functions to pathway model to Tsallis statistics" showing the connection among the three current hot topics of research in astrophysics. Another **keynote session** was held in honor of Dr Mathai. He chaired one session also. He was one of the members of the International Scientific Organizing Committee for this Workshop. He was **honored by the UN** by presenting

him with a plaque for his contributions to the UN/ESA/ NASA/JAXA Workshops on Basic Space Sciences for the past twenty years. This very successful series of UN Workshops was conceptualized by Dr Hans J. Haubold of the UN and Dr A.M. Mathai in 1989 at CMS Trivandrum, Kerala, India, and the first Workshop was held at Bangalore, India, in 1991. Since then the Workshop has been held every year and in all continents. The UN Member States line up to hold this Workshop.

He gave the **keynote address** in the session on Non-extensive Statistical Mechanics at the UN/ESA/NASA Workshop held at Tokyo Japan, from 17th to 23rd June 2007. He gave an invited **talk** on 25th June 2007 at the Second Indo-US Joint Lecture Series on the Applications of Discrete Mathematics to Chemistry held at Kalpetta, Kerala, India from 22nd to 25th June 2007. He gave a colloquium **talk** at the University of Texas at El Paso, Texas, USA on 23rd October 2009.

He gave a **colloquium talk** at the University of Western Ontario, London, Ontario, Canada on 30th September 2010.

Honours received (2007-2010)

Dr A.M. Mathai was **honored by Bombay University** on 1st June 2007 for his contributions to Statistics by putting a ponnada (ceremonial gown) on him; **by the United Nations** on 18th June 2007 at its Workshop in Tokyo by presenting him with a citation and on 25th June 2007 by the Second **Indo-US Lecture Series** on the Applications of Discrete Mathematics in Chemistry. For the UN Workshop in Tokyo the invitation to participate was hand-delivered to Dr Mathai, by a UN representative, at CMS Pala Campus. UN had honored one from each UN zone. Dr

Mathai was selected for the Asia-Pacific zone. Dr Mathai was again **honored by the United Nations** at its Workshop at Daejeon, Korea, in September 2009 for his contributions to the very successful UN Workshops for the past twenty years. [This sequence of Workshops was conceptualized at CMS Trivandrum campus in 1989-90 by Hans J. Haubold and A.M. Mathai]. He was also **honored by the Kerala Statistical Association** at its annual conference held at Kanhnagad, Kerala, on 12-14 February 2009.

Dr A.M. Mathai is included as **one of the Chair Members** of Division XII /Commission 46 /Program Group Collaborative Programmes of the International Astronomical Union.

Dr A.M. Mathai accepted the invitation to the **Scientific Advisory Committee of the International Conference** "Analytic Methods of Analysis and Differential Equations" (AMADE-2009) held at the Belarusian State University and the Institute of Mathematics of the Belarusian National Academy of Sciences from 14th to 18th September 2009. He is also a member of the Advisory Board for the next international conference AMADE-2011 to be held in Belarus, in September 2011.

Dr A.M. Mathai is a **member of the International Scientific Organizing Committee** of the 2009 UN/ ESA/ NASA/ JAXA Workshop on Basic Space Science and the International Heliophysical Year 2007, called, 2009 UN BSS & IHY Workshop, held from 21st to 25th September 2009 at Daejeon, Korea. He was honored by the UN at its Workshop in Korea by presenting him with a plaque.

Organization of a session: As per the request of the **Indian Science Congress**, he organized a session on *Fractional Calculus and Statistical Distributions* at the Indian Science Congress, held from 3rd to 7th January

2009 at Shillong, India. At Shillong, he was elected to be the **regional representative** of the Southern Region in the Mathematical Sciences Division of the Indian Congress Association for the year 2009-2010. Professor A. M. Mathai organized one symposium on *Mathematics and Statistics. An Interdisciplinary Approach,* out of the three symposia in the mathematical sciences section, and was a panelist in the panel discussions at the 97th Indian Science Congress held at Thiruvananthapuram on 3-7 January 2010. As part of **IMY** (India Mathematics Year) CMS has organized one **National Workshop on Fractional Calculus and Statistical Distributions**, and it was held on 25-27 November 2009. CMS also organized another **National Workshop on Graph Theory Applied to Chemistry** on 1-3 February 2010.

Dr R. Natarajan, faculty member at CMS, participated in the **14th International Workshop** on Quantitative Structure Activity Relationships in Environmental and Health Sciences, **Montreal, Canada**, May 24-28, 2010. He and his co-workers presented several papers in the conference. Dr Natarajan participated and presented a paper in the Asia Pacific Bioinformatics Conference, Bangalore, India, January 18-21, 2010. Dr Natarajan received a **visiting fellowship** and made a visit to the Department of Chemical Engineering, **Lakehead University**, Thunder Bay, Ontario, Canada from 15th April to 31st July 2010.


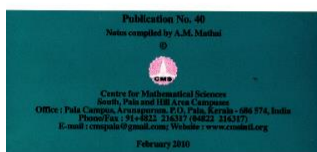**Professor Natarajan delivering a lecture**

List of Publications of the Project SR/S4/MS: 287/05 of DST (2007 - 2011)

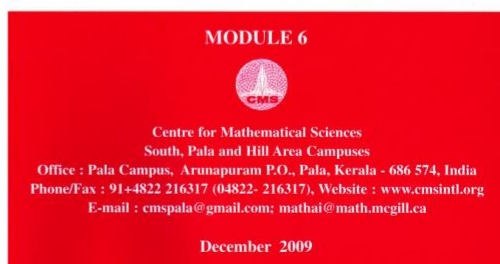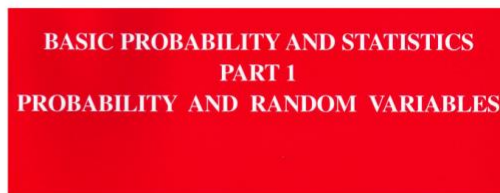### RESEARCH LEVEL BOOKS PUBLISHED

1. A.M. Mathai, R.K. Saxena and H.J. Haubold (2010): *The H-function: Theory and applications.* Springer, New York, pp.268+xiv [Revised form of CMS Publication No. 37]

2. *Proceedings of the National Workshop on Fractional Calculus and Statistical Distributions* [25-27 November 2009, edited by Shanoja S. Pai et al.], CMS Publication No. 41, 2010.
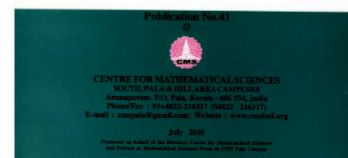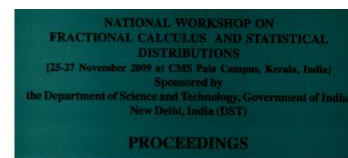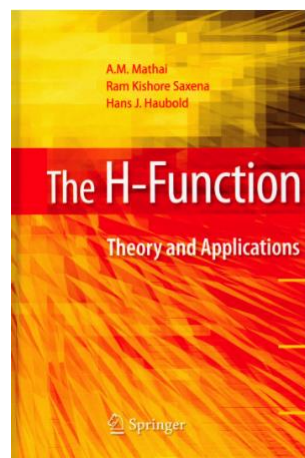
3. 2010 SERC School Notes [*Multivariable and Matrix-variate Calculus with Applications:* Model Building-Stochastic Models], CMS Publication No.40, CMS Pala Campus.

4. *Proceedings of the National Workshop on Graph Theory Applied to Chemistry* (Edited by B.D Acharya, K.A. Germina and R. Natarajan), CMS Publication No. 39, March 2010, CMS Pala Campus.

5. 2009 SERC School Notes [*Multivariable Calculus with Applications: Model Building*], CMS Publication No. 38, CMS Pala Campus.

6. A.M. Mathai and H.J. Haubold (2008): *Special Function for Applied Scientists.* Springer, New York, pp.464+xxv, [Revised form of CMS Publication Number 35].

7. H.J. Haubold, A.M. Mathai and R. K. Saxena (2008): *The H-Function: Theory and Applications,* CMS Publication No. 37, CMS Pala Campus.

8. 2008 SERC School Notes [*Matrix Variable Calculus and Statistical Distribution Theory and Applications in Data Analysis, Model Building and Astrophysics Problems*], CMS Publication No. 36, April 2008.

9. 2007 SERC School Notes [*Special Functions and Their Applications*], CMS Publication No 34, April 2007.

10. *Special Functions for Applied Scientists.* (Preprint form of the Springer book), CMS Publication No. 35, August 2007.

MODULES (BOOKS AT UNDERGRADUATE TO GRADUATE LEVEL)

[Modules are self-study materials on basic mathematics and statistics, written with lots of examples from day to day life to make the basic concepts clear and to generate interest in mathematical sciences in the young minds, and to make the study of mathematics enjoyable. CMS conducts four short-term courses every year based on these modules and there is a huge lineup to get into these courses.]
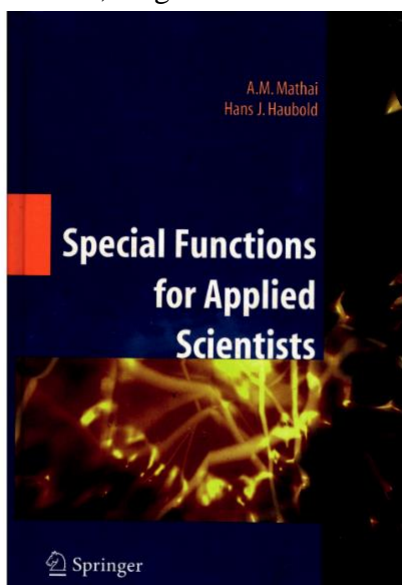

OLD MODULES UPDATED ANDREPRINTED

11. A.M. Mathai (2008): *Module I : Vectors and Matrices,* (Updated and reprinted in March 2008).

12. A.M Mathai (2008): *Module 2: Determinants and Eigenvalues,* (Updated and reprinted in June 2008).

13. A.M. Mathai (2009): *Module 3: Applications of Matrices and Determinants,* (Updated and reprinted in March 2009).

NEW MODULES PRODUCED

14. A.M. Mathai (2008): *Module 4: Limits, Continuity, Convergence and Differential Calculus,* (New Module produced, prepared in December 2007 and printed in June 2008).

15. A.M. Mathai (2008): *Module 5: Integrals and Integration,* (New Module produced, May 2008).

16. A.M. Mathai (2009): *Module 6: Basic Probability and Statistics, Part I: Probability and Random Variables,* (New Module produced in December 2009).

17. A.M. Mathai (2010): *Module 7: Basic Probability and Statistics, Part II: Statistics,* (New Module produced and printed in January 2011).

RESEARCH PAPERS (PUBLISHED/ACCEPTED) BYFACULTY, IN REFEREED INTERNATIONALJOURNALS

18. A.M. Mathai (2007): Random volumes under a general matrix-variate model, *Linear Algebra and Its Applications*, **425**, 162-170.

19. A.M. Mathai and H.J. Haubold (2007): Pathway model, superstatistics, Tsallis statistics and a generalized measure of entropy, *Physica A*, **375,** 110-122.

20. A.M. Mathai and H. J. Haubold (2007): On generalized entropy measures and pathways, *Physica A*, **385,** 493-500.

21. A.M. Mathai and H.J. Haubold (2007): On entropic, distributional and differential pathways, *Bull. Astr. Soc.* India, **35**, 669-680.

22. H.J. Haubold, A.M. Mathai and R.K. Saxena (2007): Solutions of fractional reaction-diffusion equations in terms of the H-Function, Bull. *Astr. Soc. India*, **35**, 681-689.

23. Seemon Thomas and A.M. Mathai (2008): On a matrix-variate generalized type-2 Derichlet density, *Advances and Applications in Statistics*, **8 (1),** 37-56.

24. A.M. Mathai and H.J. Haubold (2008): Pathway parameter and thermonuclear functions, Physica **A, 387**, 2462-2470.

25. A.M. Mathai and H. J. Haubold (2008): On generalized distributions and pathways, *Physics Letters A,* **372,** 2109-2113.

26. Seemon Thomas, Alex Thannippara and A. M. Mathai (2008): On a matrix-variate generalized type-1 Dirichlet model, *Journal of Probability and Statistical Science*, **6(2),** 187-200.

27. A.M. Mathai (2009): Fractional integrals in the matrix-variate cases and connection to statistical distributions, *Integral Transforms and Special Functions,* **20(12**), 871-882.

28. R. Natarajan and S.C. Basak (2009): Numerical characterization of molecular chirality of organic compounds, *Current Computer-Aided Drug Design,* **5,** 13-22.

29. Seemon Thomas and A. M. Mathai (2009): p-Content of p-Parallelotope and Its Connection to Likelihood Ratio Statistic*, Sankhya Series A*, **7 (1),** 49-63.

30. A. M. Mathai (2010): Some properties of Mittag-Leffler functions and matrix-variate analogues: A statistical perspective*, Fractional Calculus & Applied Analysis*, **13 (2),** 113-132.

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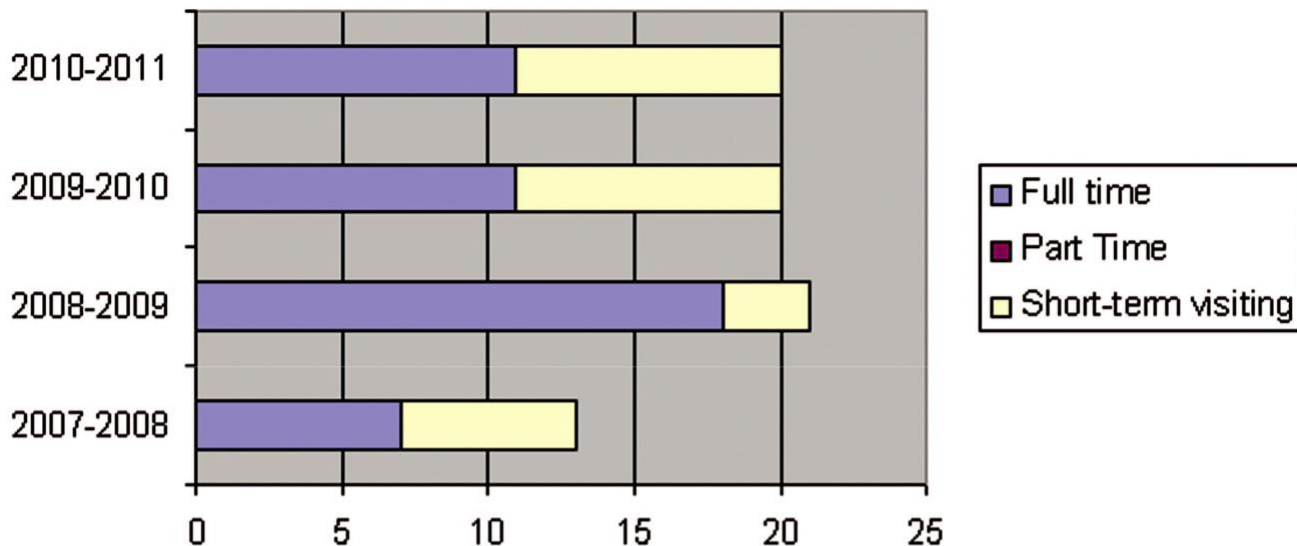
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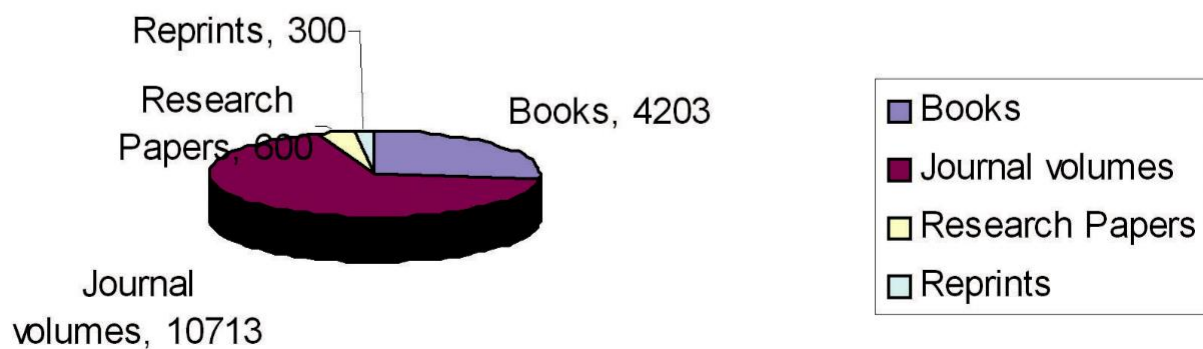
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Centre for Mathematical Sciences Pala Campus
Arunapuram P.O., Pala, Kerala - 686 574, India
Phone/fax: 91+ 4822 216317 (04822 216317)
E-mail: cmspala@gmail.com
Website: www.cmsintl.org

Projects running at CMS from 2005 onwards			
Project title	**Principal Investigator**	**Duration**	**Amount (lakhs)**
3-5 SERC Schools	A.M. Mathai	2005-2007	31.50
6-10 SERC Schools	A.M. Mathai	2008-2012	52.50
UG Training	A.M. Mathai	2009-2013	63.00
Development project	A.M. Mathai	2007-2011	372.50
Computer software	R. Natarajan	2009-2011	2.76

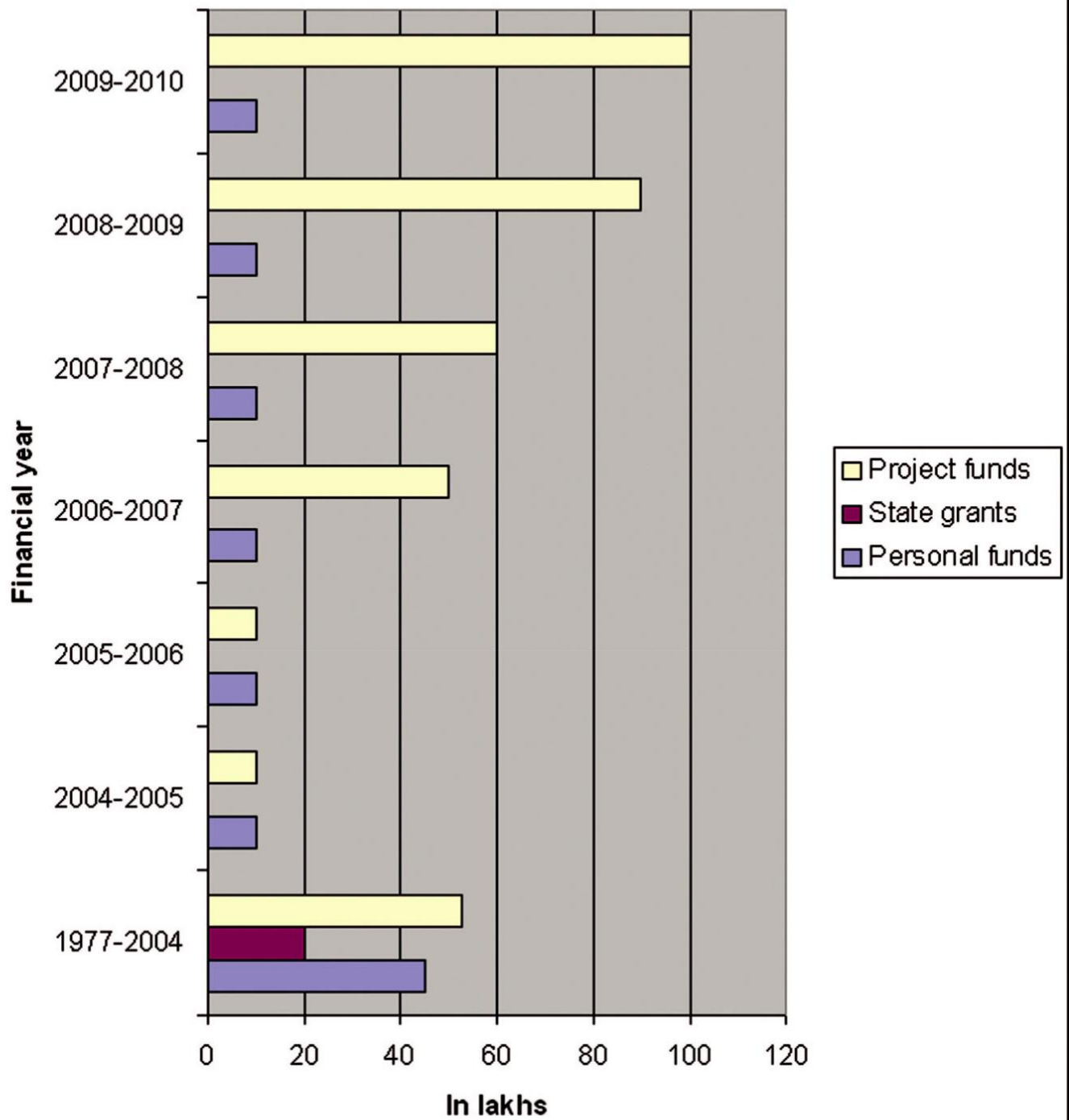

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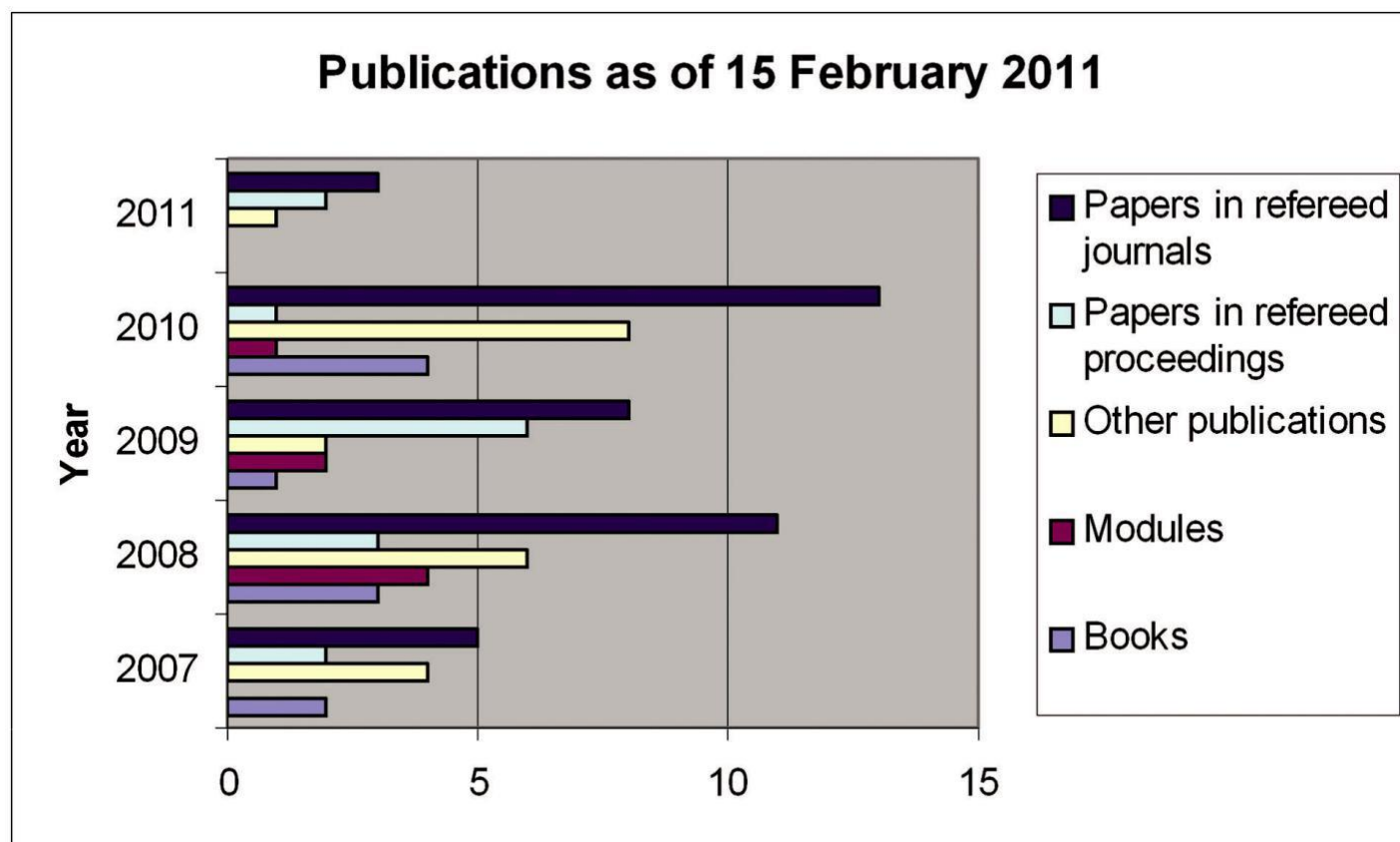
Number of Research Students(JRFs/ SRFs) as of 15 February 2011

Library Holdings in Mathematical Sciences as of 15 February 2011

Financial Support

Financial year (vertical axis)

- 2009-2010
- 2008-2009
- 2007-2008
- 2006-2007
- 2005-2006
- 2004-2005
- 1977-2004

Legend:
- Project funds
- State grants
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In lakhs (horizontal axis: 0, 20, 40, 60, 80, 100, 120)

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Since 1977 the Centre for Mathematical Sciences has kept a good balance in its research activities among various disciplines of mathematical sciences. In order to nurture the future generation, CMS will conduct more innovative and fruitful research programs which will meet the needs of the nation in its pace of growth. CMS will continue to contribute its intellectual resources for research and will maintain the standards to international level and will remain as a research institution of international class. The quality of research and publications will be at par with the international standards. The key focus will be given to the new and emerging areas of sciences which are useful to the society. Thus CMS will pave the way for the growth and progress of younger generations by its activities and will remain as a glory of the mathematical sciences community and to the nation.