BIBLIOMETRIC ANALYSES OF SCIENTIFIC RESEARCH OUTPUT OF INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE: 1947-2006

Thesis Submitted for the Degree of Doctor of Philosophy (Arts) at Jadavpur University

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Guided by

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2016


Dedicated
To My
Family members &
my respected Teachers

CERTIFICATE

Certified that the thesis entitled "**Bibliometric analyses of scientific research output of Indian Association for the Cultivation of Science : 1947 - 2006** " submitted by me for the award of the degree of Doctor of Philosophy in Arts at Jadavpur University is based upon my work carried out under the supervision of Dr. Sunil Kumar Chatterjee, Associate Professor , Department of Library and Information Science ,Jadavpur University and that neither this thesis nor any part of it has been submitted before for any degree or diploma anywhere/ elsewhere.

Supervisor: Dr. Sunil Kumar Chatterjee

Date :

Candidate: Sri Indrajit Pan

Date :

PREFACE

Scientific research usually culminates in scientific writing leading to research publications. Scientific literature is considered to be strong medium for promoting national and professional interest in one's field of specialization. Research publications are the embodiments of intellectual discoveries expressed in published writings /literature primarily aiming to transmit new ideas or information for bringing advancements in knowledge.

The Indian Association for the Cultivation of Science, kolkata is the oldest premier research organization in India in the field of pure sciences. It is a national institution for higher learning whose primary purpose is to foster high quality fundamental research in frontier disciplines of the basic sciences. Now it is an autonomous body funded by the Department of Science and Technology (DST) of the government of India and by the government of West Bengal

Science is a driving force of our modern society. Particularly excellent scientific work is the cradle of break through sin our knowledge of the nation as well as world. Therefore, evaluation of scientific research through bibliometric study is crucial for this research organization. It is true that in recent time's bibliometric and scientometric techniques are increasingly used for assessments of scientific research. The outcome of these studies helps in enhancing the visibility of institutions,trends of their research productivity ,research collaboration etc and as a consequences the funding agencies come forward to support their research. The individual and the team of researchers also get appreciations and inducement for their work. Such bibliometric studies influences the research of the institute. Still now, such type of comprehensive research work has not yet been done if a bibliographic list of scientific publication of IACS is already published for 1876 -1976 that has not evaluation of scientific research through bibliometric study .This study analyses scientific research output of the Indian Association for the Cultivation of Science, Kolkata published during 1947- 2006 only. The research work embodied in this thesis has been divided into following :

Chapter-1 : Introduction

Chapter-II : Bibliometric : An overview ;

Chapter-III : Indian Association for the Cultivation of Science : An introduction;

Chapter-IV : Data analyses & Interpretations ;

Chapter-V : Findings and Conclusion

This study seek to understand what kind of shift in research at IACS has taken place over time ,if any , and to identify factors that have come to influence research. In addition, it seeks to understand to what extent result from the study could be generalized to understand parameter that has potential to advance and promote research. Such a study is of great significance in societal. The association must draw out long-term and short term plans for R & D developments in the country with the help of bibliometric analysis. It needs to organize goal-oriented and need-based programmes at the national and institutional level. Beside these with the help of bibliometric analysis new programmes must be initiated to encourage greater institutional participation, greater collaboration of research at national and international level ,attract young talent into science and set-up sophisticated instrument facilities for S & T education and research in the country.

I hope this work will be of great help to the competent authority of the association to be made an excellent policy making and road map for further research activities of the association in all respects. At the same time, this will also helps to research scholars of concerned subjects for further study.

SRI INDRAJIT PAN
Research Scholars

Date

C O N T E N T S

ACKNOWLEDGEMENT

I would like to extend my thankful gratitude to the Hon'ble Vice Chancellor, Jadavpur University for allowing me to undertake this research. It is with real pleasure that, I record my indebtedness to my research Guide, **Dr Sunil Kumar Chatterjee,** Associate Professor, Head of Department of Library and Information Science, Jadavpur University, West Bengal for his counsel and guidance and patience throughout the periods.

I am grateful to the Hon'ble Director of Indian Association for the Cultivation of Science (IACS), Kolkata for necessary permission to use the infrastructural and other facilities available at library of the Association.I gratefully acknowledged to all scientist and researchers of the associations for giving their valuable inputs and suggestions.

I am also sincere thanks to my revered teachers Dr. Krishnapada Majumdar , Dr. Chaitali Dutta , Dr. Udayana Bhattacharya , Dr. Gautam Maity ,Dr. Subarna Kumar Das , Dr. Tarun Kumar Mukherjee and Mr. Satyabrata Ray for giving me tremendous encouragement ,support and appropriate suggestions.

I would be failing in my duties, if I do not express my sincere thanks to the persons who have extended necessary support for providing useful information and valuable suggestion. First of all, I wish to record

my sincere thanks to Mr.Chanchal Kumar Das Librarian in Charge ,Mr. Abhijit Das Gupta ,Assistant Librarian – I and Mrs. Gayatri Paul , Documentation superintendent and other professional of the Library of the Association for providing useful document & spending valuable time to enrich my research work. I also thankful to Chief Librarian, and all library professional along with support staff of Central Library as well as department Library of Library and Information Science ,Jadavpur University,Kolkata.

I am also indebted to the authority of Directorate of Library Services, Department of Mass Education Extension & library Services, Govt. of West Bengal.

I would like to acknowledge with great respect my beloved parents who always inspire me to complete the research work. I wish to express my sincere appreciation for the encouragement and support of my wife.

My thanks are due to Mr. Purajit Sautia who help to type setting the total dissertation in stipulated time.

Place : KOLKATA **INDRAJIT PAN**
Date :

LIST OF FIGURES

Note : The first number indicates the chapter number, the second number following the dot indicates the number of the table in that chapter.

LIST OF TABLES

note : The first number indicates the chapter number, the second number following the dot indicates the number of the table in that chapter.

LIST OF ABBREVIATION

Acoustic Letts.	:	Acoustic Letters
Acta.Cryst.	:	Acta Crystallography
Acta.Mat.	:	Acta Materioals
Adv.Mater.	:	Advanced Materials
Adv.Mol.Relax.and Int.Processes	:	Advanced Molecular relaxations and international Process
Adv.Quantum.Chem.	:	Advanced Quantum Chemistry
Adv.Synth.Catal.	:	Advanced Synthesis Catalysist
Anal.Biochem.	:	Annals of Biochemistry
Anal.Chem.	:	Annals of Chemistry
Anal.Chem.Acta.	:	Annals Chemical Acta
Ann. Phys.	:	Annals of Physics
Ann.Agr.Envirn.Med.	:	Annals Agriculture Environmental Medicine
Appl.Biochem.Biotech.	:	Applied Biochemistry and Biotechnology
Appl.Catal.	:	Applied catalysist
Appl.Organomet. Chem.	:	Applid Organometallic Chemistry
Appl.Phys. Lett	:	Applied Physics Letters
Astron & Astrophys.	:	Astronomy & Astrophysics
Astrophys.J.	:	Astrophysics Journal
Astrops and Space Sc.	:	Astrophysics and Space Science
Aust.J.Chem.	:	Australian Journal of Chemistry
Aust.J.Chem. Australian journal of Chemistry		
BARC	:	Bhabha Automic Reasearch Centre
Behring Res. Commn.	:	Behring Research Communication
Biochem.	:	Biochemistry
Biochem.Arch.	:	Biochemical Archives
Biochem.Biophys. Acta	:	Biochemical Biophysical Acta
Biochem.Biophys.Res.Comn.	:	Biochemical Biophysical Research Communications
BIOL. CHEM	:	Dept. of Biological Chemistry
Biol.Chem.Hoppe-Seyler	:	Biological Chemistry.Hoppe-Seyler
Biomat.	:	Biomaterials

Biomed.Lett.	:	Biomedicine Letters
Bioorg.Med.Chem.Letts.	:	Bioorg.Medicinal Chemistry Letters
Brit. Ceramic Trans	:	British Ceramic Transactions
Brit.J.Appl.Phys.	:	British Journal of Applied Physics
Bul.Pure and Appl.Sci.	:	Bulletin of Pure and applied Science
Bull. Amer.Phys.Soc.	:	Bulletin of American Chemical Society
Bull. Nat. Inst. Sci. Ind.	:	Bullitin of the National Institute of Science of India
Bull. Thermodyn.Thermochem.	:	Bulletin of Thermodynamics and Thermo chemistry
Bull.Chem.Soc.Jpn.	:	Bulletin of Chemical Society of Japan
Bull.Electrochem	:	Bulletin of Electrochemical
Bull.Laser Spec.Soc.	:	Bulletin of Laser Spectroscopy Society
Bull.Mater.Sci.	:	Bulletin of Material Science
CAM	:	Centre for Advanced Materials (CAM)
Can.J.Chem.	:	Canadian Journal of Chemistry
Cana.J.Phys.	:	Canadian Journal of Physics
Carbohydr.Res.	:	Carbohydrate Research
Ceram.Int.	:	Ceramic International
Ceram.Trans.	:	Ceramic Transactions
Chem. Edu.	:	Chemistry Education
Chem. Kinet. React. Mechm.	:	Chemical Kinetics and Reaction Mechanism
Chem. Mater	:	Chemical Materials
Chem. Res.Toxicol.	:	Chemical Research in Toxicology
Chem.&Ind.	:	Chemistry and Industry
Chem.Asain J.	:	Chemistry : An Asian Journal
Chem.Commumn	:	Chemistry Communications*
Chem.Eng.Sci	:	Chemistry and Engineering Sciences
Chem.Lett.	:	Chemistry Letters
Chem.Phys.Lett.	:	Chemical Physics letters
Chem.Phys.Scripta	:	Chemistry and Physics Scripta
Chem.Rev.	:	Chemical Review
Chin. J. Phys.	:	Chinese Journal of Physics
Clinl.Biochem.	:	Clinical Biochemistry
Colld. Ploym. Sci.	:	Colloid and Polymer Science

Colld. Surf.Biointerf.	:	Colloid Surfaces Biointerfaces
Collod. Surf. Physiochem. Eng. Aspect	:	Colloids and Surface : A Physiochem.Engineering Aspect
Comp.Func.Genomies.	:	Computer Functioning Geonics
Comput.Mater.Sci.	:	Computer Material Science
Coord.Chem.Rev.	:	Coordination of Chemical Review
Cryogen.	:	Cryogencis
Cryst.Eng.Comm.	:	Crystal Engineering Communications
Cryst.Res.Technol	:	Crystal Research Technology
CSIR	:	National Council of Science & Industrial Research
Currt. Sci.	:	Current Science
Cytobios	:	Cytobiosis
Czech.J.of Phys.	:	Czech Journal of Physics
Decm.	:	December
DST	:	Department of Science and Technology
Ecolgy. Env.	:	Ecology and Environments.
ENR RES U	:	Energy Research Unit
Environmental Entomology	:	Environmental Entomology
Eur J Med Chem	:	European Journal Medicinal Chemistry
Eur. J. Solid State and Inorg.Chem	:	European Journal of Solid State and Inorganic Chemistry
Eur.Phys.J.	:	European Journal of Physics
Euro Phys.Lett.	:	European Physics Letters
European Polymer Journal	:	European Polymer Journal
Europhys J.	:	Euro physics Jounal
Everyman's Sci.	:	Everyman's Science
Feb.	:	February
FEBS Letts.	:	FEBS Letters
FEMS Microbiol. Lett.	:	FEMS Microbiology Letters
Fishery Tech.	:	Fishery Technology
GP&X	:	Department of General Physics &X-Ray
IACS	:	Indian Association for the Cultivation of Science
ICDR	:	International Centre for Diarrheal Research in

		Banladesh
IISc	:	Indian Institute of Science
IJP	:	Indian Journal of Physics
IMCB	:	institute of Molecular and Cell Biology
Ind. J. Readiation Res.	:	Indian Journal of Radiation Research
Ind. J.Chem.	:	Indian Journal Chemistry
Ind.Eng.Chem.Res	:	Indian Engineering and Chemical Research
Ind.J.Appl.Chem.	:	Indian Journal of applied chemistry
Ind.J.Biochem.Bio-phys.	:	Indian Journal of Biochemistry and Biophysics
Ind.J.Chem.Technol.	:	Indian Journal of Chemical Technology
Ind.J.Cryogenics	:	Indian Journal of Cryogenics
Ind.J.Diary.Sci.	:	Indian journal of Diary Science
Ind.J.Engineers	:	Indian journal of Engineers
Ind.J.Environ.Ecoplanning	:	Indian journal of Environments and Eco planning
Ind.J.Exptl.Biol.	:	Indian journal of Experimental Biology
Ind.J.Gastroenteril	:	Indian journal of Gastroenteril
Ind.J.Luminescence	:	Indian journal of Luminescence
Ind.J.Phys.	:	Indian Journal of Physics
Ind.J.Pure and Appl.Phys.	:	Indian Journal of Pure and Applied Mathematics
Ind.J.Technol.	:	Indian Journal of Technology
Indian Acad.Sci.	:	Indian Academy Science
Indian J. Environ	:	Indian Journal Environments
INOR.CHEM	:	Dept. of Inorganic Chemistry,
Inorg.Chem.	:	Inorganic Chemistry
Inorg.Nucl.Chem.Letters	:	Inorganic Nuclear Chemistry Letters
Inorg.Reacn.Mechanism.	:	Inorganic Reaction Mechanics
Inorganica Chem.Acta.	:	Inorganica Chemistry Acta
Int.	:	International
Int. Cream.	:	International Ceramics
Int.Arch.Allergy Immunol	:	International Archives Allergy Immunology
Int.J.Cancer	:	International Journal of Cancer
Int.J.Chem.Kinet.	:	International Journal Chemical Kinetics
Int.J.Chem.Kinetics.	:	International Journal of Chemical Kinetics

Int.J.Heat & Mass.Trans.	:	International Journal Heat and Mass transfer
Int.J.Mod.Phys.	:	International Journal of Modern Physics
Int.J.Mol.Sc	:	International Journal of Molecular Science
Int.J.Plast.Tech.	:	International Journal of Plastic Technology
Int.J.Quantum Chem.	:	International journal of Quantum Chemistry
Int.J.Theor.Phys.and Nonliner Optics	:	International Journal of Theoretical and Non linear Optics
Int.Jour.Theore.Phys.	:	International Journal Theoretical Physics
Israel J.Chem.	:	Israel Journal of Chemistry
J Materials Education	:	Journal of Material Educations
J Mol. Spectros	:	Journal of Molecular Spectroscopy
J Plasma & Fussion Res.	:	Journal of plasma and Fusion Research
J.	:	Journal
J. Biomat.	:	Journal of Biomaterials
J. Chem. Cryst.	:	Journal of Chemical Crystallography
J. Chem. Phys.	:	Journal of Chemical Physics
J. Chin. Chem.	:	Journal of Chinese Chemistry
J. Fudan University	:	Journal of Fudan University
J. High Energy Phys.	:	Journal of High Energy Physics
J. Ind.Inst. Sci.	:	Journal of The Indian Institute of Science
J. Inland Fishr.Socs.Ind.	:	Journal of the Inland Fisheries Societies of India
J. Inorganic Biochemistry	:	Journal of Inorganic Biochemistry
J. Mat. Res.	:	Journal of Materials Research
J. Mat.Sci.Lett.	:	Journal of Material Science Letters
J. Megnetism and Megnatic Mat.	:	Journal of Magnetism and Megnatic Materials
J. Organomet.Chem.	:	Journal of Organometallic Chemistry
J. Peptide Res. and Therapeutics	:	Journal of Peptide Research and Therapeutics
J.A.C.S.	:	Journal of American Chemical Society
J.Acoust.Soc.Ind.	:	Journal of Acoustic Society of India
J.Alloys and Compds.	:	Journal of Alloys and Compounds
J.Am.Chem.Soc.	:	Journal of American Chemical Society
J.Appl.Cryst.	:	Journal of Applied Crystallography
J.Appl.Phys.	:	Journal of Applied Physics

J.Appl.Sci.	:	Journal of Applied Science
J.Bacteriol	:	Journal of Bacterial
J.Biol.Chem.	:	Journal of Biological Chemistry
J.Biol.Inorg.Chem.	:	Journal Biological Inorganic Chemistry
J.Biosci.	:	Journal of Bioscience
J.Chem. & Engg.Data	:	Journal of Chemistry and Engineering Data
J.Chem. Soc.	:	Journal of Chemical Society
J.Chem.Cryst.	:	Journal of Chemical Crystals
J.Chem.Edu.	:	Journal of Chemical Education
J.Chem.Phys.	:	Journal Chemistry and Physics
J.Chem.Res.	:	Journal of Chemical Research
J.Chem.Soc.Dalton Trans.	:	Journal of Chemical Society : Daltan Transaction
J.Chem.Thermodynamics	:	Journal of Chemical Thermodynamics
J.Chin.Chem.Soc.	:	Journal of Chinese Chemical Society
J.Clin.Microbiol	:	Journal of Clinical Microbiology
J.Coll.Int.Sci.	:	Journal of Collision International Science
J.Comp.Bio.	:	Journal of Computation Biology
J.Comp.Chem.	:	Journal Computation Chemistry
J.Coord.Chem.	:	Journal of Coordination Chemistry
J.Cryst.Growth	:	Journal of Crystal Growth
J.Electr.Chem.	:	Journal of Electronic Chemistry
J.Electr.Mater	:	Journal of Electronic material
J.Electrochem.Soc.	:	Journal Electrochemical Society
J.Fluorescence	:	Journal of Fluorescence
J.Heterocyclic Chem.	:	Journal Heterocyclic Chemistry
J.High Energy Phys.	:	Journal High Energy Physics
J.I.C.S.	:	Journal of Indian chemical Society
J.Ind.Acad.Forensic.	:	Journal of Indian Academy of Forensic
J.Ind.Chem.Soc.	:	Journal Indian Chemical Society
J.Indian Inst.Sci.	:	Journal of Indian institute of Science
J.Indian Ocean Studies	:	Journal of Indian Ocean Studies
J.Inland Fisheries Soc.of India	:	Journal Inland Fisheries Society of India
J.Inorg.Biochem	:	Journal of Inorganic Biochemistry

J.Inorg.Nucl.Chem.	:	Journal of Inorganic Nuclear Chemistry
J.Inst.Eng.(India)	:	Journal of Institutes Engineers (India)
J.Less-common Metals	:	Journal of Less –Common metals
J.Luminescence	:	Journal of Luminescence
J.Macromol.Sci.Chem.	:	Journal of Macromol Science Chemistry
J.Mat.	:	Journal of Material Science
J.Mat.Sc.Mol.in Electronics	:	Journal of Material Science :Molecules in Electronics
J.Mater.Res	:	Journal of Material Research
J.Mater.Sci.	:	Journal Material Science
J.Mater.Sci.Letts.	:	Journal of Material Science Letters
J.Materials Engineering	:	Journal of Material Engineering
J.Math.Phys.	:	Journal of Mathematical Physics
J.Mod.Optics	:	Journal of modern Optics
J.Mol.Liquids.	:	Journal of Molecules of Liquids
J.Mol.Struct.	:	Journal of Molecular Structures
J.Nanoparticle Research	:	Journal of Nanoparticle Research
J.Nanosci.Nanotech.	:	Journal of Nano science and Nanotechnology
J.Non-Cryst. Solids	:	Journal of non crystal solids
J.of Nuclear Medicine	:	Journal of Nuclear Medicine
J.Opt.Soc.of Am.	:	Journal of Optical Society of America
J.Org.Chem.	:	Journal of Organic Chemistry
J.Photochem.Photoboil	:	Journal Photochemical Photobiology
J.Photochemistry	:	Journal Photochemistry
J.Phys.	:	Journal of Physics
J.Phys. & Coll.Chem.	:	Journal Physics and Colloids Chemistry
J.Phys.:Condens.Matter	:	Journal of Physics : Condensed Matter
J.Phys.A.:Math Gen.	:	Journal of Physics A : Mathematics General
J.Phys.and Chem.of Solids	:	Journal Physics and Chemistry of Solids
J.Phys.B.:At.Mol.Opt.Phys.	:	Journal of Physics B: Atoms,Molecules, Optical Physics
J.Phys.C:Sloid State Physics	:	Journal of Physics C : Solid State Physics
J.Phys.Chem.	:	Journal of Physics and Chemistry
J.Phys.Chem.Solids	:	Journal of Physics and Chemistry : solids

J.Phys.Condens.Matter.	:	Journal of Physics in Condensed Matters
J.Phys.D:Appl.Phys.	:	Journal of Physics D : Applied Physics
J.Phys.E:Sci.Instrum.	:	Journal of Physics E : Science Instrumentation
J.Phys.F:Metal Phys.	:	Journal of Physics F: Metals Physics
J.Phys.G:Nucl.Phys.	:	Journal of Physics G : Nuclear Physics
J.Phys.in France	:	Journal of Physics in France
J.Phys.Org.Chem.	:	Journal of Physics : Organic Chemistry
J.Phys.Soc.Jpn.	:	Journal of Physical Society of Japan
J.Phys.Society of JPN	:	Journal of Physical Society of Japans
J.Physical Soc.Japan	:	Journal of the Physical society of Japan
J.Polym.Sci.Polym.Chem.	:	Journal of Polymer Science and Polymer Chemistry
J.Polymer Mater	:	Journal Polymer Materials
J.Polymer Sci.	:	Journal of Polymer Sciences
J.Polymer Sci.,Polymer Lett.	:	Journal of Polymer Science : polymer Letters
J.Polymer Sci.-Revs.Macromol.Chem.	:	Journal of Polymer Science Review : Macromolecules Chemistry
J.Polymer.Sci.	:	Journal of Polymer Science
J.Quant.Chem.	:	Journal of Quantum Chemistry
J.Sci & Engg.	:	Journal of Science and Engineering
Jan.	:	January
Jour.Raman Spect.	:	Journal of roman Spectroscopy
Journ.Ind.Chem.Soc.	:	Journal of Indian Chemical Society.
Journal of Magn.Mater.	:	Journal of Magnetic Materials
Jpn.J.Appl.Phys.	:	Japanese journal of Applied Physics
Jr.Sc.& Industr.Res.	:	Journal of Science and Industrial research
JU	:	Jadavpur University
Lett. Peptide Sci.	:	Letters in Peptide Science
Lett.Org.Chem	:	Letters in Organic Chemistry
Liq.Cryst.	:	Liquid Crystal
LIS	:	Library and Information Science
Low Temp.Phys.	:	Low Temperature Physics
Macroml.	:	Macromolecules
Macromol.Biosci.	:	Macromolecules Bioscience

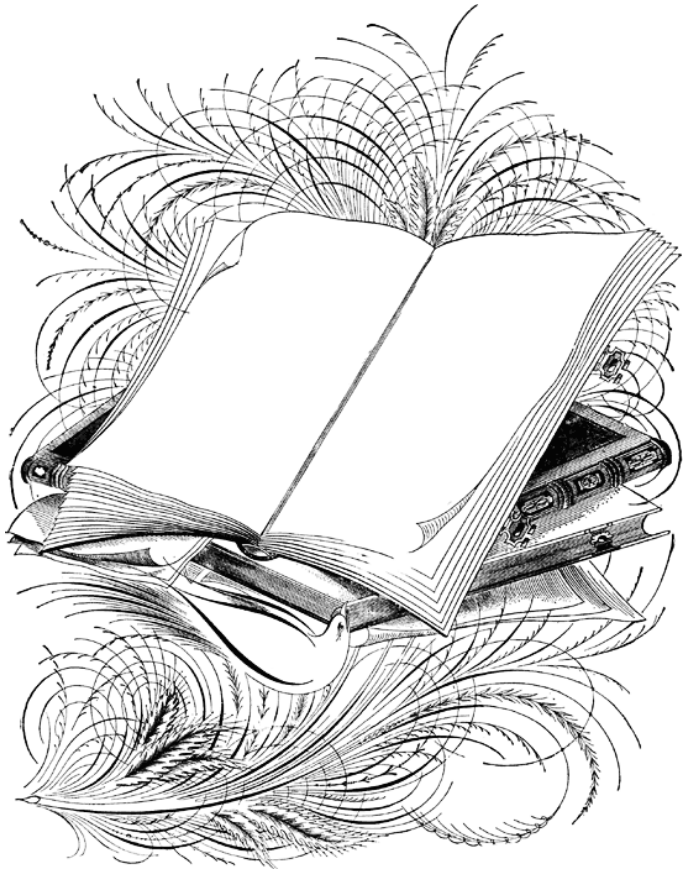
Macromol.Symp.	:	Macromolecules Symposiums
MAGT	:	Department of Magnetism,
Makromol Chem.	:	Macromolecules Chemistry
Markomol.Chem.Rapid Commun.	:	Macromolecules Chemistry : Rapid Communication
Mat Sc.Eng.B	:	Material Science Engineering
Mat. Phys.Rev.	:	Material Physics Review
Mat. Sci. Forum	:	Material Science Forum
Mat.Res.Bull.	:	Material Research Bulletin
MAT.SC	:	Dept of Material Science
Mat.Trans.	:	Material transaction
Mater.Lett.	:	Materials Letters
Math.Biosc.	:	Mathematical Bioscience
Metallurg.Trans.	:	Metallurgy Transactions
Micro-electronics J.	:	Micro-electronic Journal
Microprs and Mesoprs Mat.	:	Microporous and Mesoporous Mater.
MLS'S	:	MLS Research Unit
Mod.Phys.Lett.	:	Modern Physics Letters
Mol. Cryst. Liquid Cryst.	:	Molecular Crystals and Liquid Crystals
Mol.Cell.Biochem.	:	Molecular Cell Biochemistry
Mol.Immunology	:	Molecular Immunology
Mol.Materials	:	Molecular Materials
Mol.Struct.	:	Molecular Structure
Molecular Phys.	:	Molecular Physics
N Carbohd. Chem.	:	N-Carbohydrates Chemistry
Nano.Lett.	:	Nano Letters
Nanostruct. Mat.	:	Nanostructured Materials
Nat. Acad. Sci.Ind.	:	National Aca in Indiademy of Science
NCL	:	National Chemical Laboratory
NDRI	:	National Diary Research Institute
New J.Chem.	:	News: journal of Chemistry
News Lett.	:	News Letters
NICED	:	National Institute of Cholera And Enteric Diseases (NICED)

Non-Cryst. Solids	:	Non –Crystal Solids
Non-linear Dynams. and Comput. Phys.	:	Non-linear Dynamics and Computational Physics
Nov.	:	November
Nucl.Instr.Meth.B	:	Nuclear Instrumentations
Nuclear Phys.	:	Nuclear Physics
Nuclear Phys. & Solid St.Phys.	:	Nuclear Physics and Solid State Physics
Oct.	:	October
Opt. Mat.	:	Optical Materials
Optics	:	Dept. of Optics
Org.Biomol.Chem.	:	Organic Biomedical Chemistry
ORG.CHEM	:	Dept. of Organic Chemistry
Org.Lett.	:	Organic Letters
Org.Mag.Resonance	:	Organic Magnetic Resonance
Org.Proc.Res.Dev.	:	Organic Proceedings Research Developments
Organic Electronics	:	Organic Electronics
Paint Ind.	:	Paint India
Ph D	:	Doctor of Philosophy
Phil.Mag.	:	Philogphical Managements
Phosphorous Res.Bull.	:	Phosphorous Research Bulletins
Photochem.	:	Photochemistry
Photosci.	:	Photoscience
PHY CHEM	:	Dept. of Physical Chemistry
Phys.Chem.	:	Physics and Chemistry
Phys.Fluids	:	Physics Fluids
Phys.Lett.	:	Physics Letters
Phys.Repts.	:	Physics Letters
Phys.Rev.	:	Physics Review
Phys.Rev.Lett.	:	Physics Review letters
Phys.Stat.Sol.	:	Physica Status Solidi,
Phys.Teach.	:	Physics Teacher
Phytochem.	:	Phytochemistry
POLY RES U	:	Polymer Research Unit
Poly.Sci.	:	Polymer Science

Polym Bull.	:	Polymer Bulletin
Polym. Advanced Tech.	:	Polymers for Advanced Technologies
Polym. Engg.Sci.	:	Polymer Engineering Science
Polym. Ind.	:	Polymer India
Polym. Int.	:	Polymer International
Polym. Plast. Tech. and Engg.	:	Polymer Plastic Technology and Engineering
Polym.Comm.	:	Polymer Communication
Polym.J.	:	Polymer : An Journal
Polym.Lett.	:	Polymer Letters
Popular Plastic	:	Popular Plastic
Proc.Indian Acad.Sci.	:	Proceedings of Indian Academy of Sciences
Process Biochm.	:	Process Biochemistry
Prog.Theo.Chem.Phys.	:	Progress .Theoretical .Chemistry in Phys.
Prog.Theor.Phys.	:	Progress of Theoretical Physics
Pure & Appl.Chem.	:	Pure and Applied Chemistry
R&D	:	Research and Development
Rad. Effects Express	:	Radiation Effects Express
Rad.Phys.Chem.	:	Radiation of Physics and Chemistry
RCAM&O Sc.	:	Raman Center for Atomic Molecular& Optical Sciences,
REN. ENR	:	Centre for Renewable Energy Sources
Res.&Indus.	:	Research & Industry
Res.Chem.Interned	:	Research in Chemistry Interned
Res.J.Chem.and Envirn.	:	Research Journal in Chemistry and Environments
Res.J.Microboil	:	Research Journal in Microbiology
Reson.	:	Resonance
Rev.	:	Review
Rev. Fluresence	:	Reviews in Fluresence
Rev. Sold State Sci.	:	Review of Sold State Science.
RIKEN Rev.Japan	:	RIKEN Rev,JAPAN
Rub. Ind.	:	Rubber Ind.
Rub. News	:	Rubber News
Rubber Chem.Technol	:	Rubber in Chemical Technology

SCI	:	Science Citation Index
Sci & Cult.	:	Science and Culture
Sci. Repr.	:	Science Reporters
Scripta.Metall.	:	Scripta Metallurgy
Sept.	:	September
SL No	:	Serial Number
SMU	:	Strategic Management Unit
Solid State Commun.	:	Solid State Communications
SPECT	:	Dept. of Spectroscopy
SSP	:	Dept. of Solid State Physics
Syn.lett.	:	Synthesis Letters
Synth.Commun.	:	Synthesis of Communications
Tetrahedron Lett.	:	Tetrahedron Leters
TH	:	Dept. of Theoretical Physics,
Thin Solid Films	:	Thin Solid Films
TIFR	:	Tata Institute of Fundamental Research
Trans.Faraday Sco.	:	Transaction faraday Society
Trans.Ind.Ceram.Soc.	:	Transaction Indian Ceramic Society
Trends in Carbohydr.Chem	:	Trends in Carbohydrates Chemistry
Trop.Med.Int.Health	:	Tropical Medicine in International Health
UK	:	United Kingdom
Ultra Sci.	:	Ultra Science
USA	:	United States of America
WWW	:	World wide Web
Z.Anorg.Chem.	:	Zarnal of Anorganic Chemistry

Chapter 1



Introduction

CHAPTER – I

INTRODUCTION

1.0 Introduction

Scientific research usually culminates in scientific writing leading to research publications. Scientific literature is considered to be strong medium for promoting national and professional interest in one's field of specialization. Research publication is the embodiments of intellectual discoveries expressed in published writings /literature primarily aiming to transmit new ideas or information for bringing advancements in knowledge.

The Indian Association for the Cultivation of Science, Kolkata is the oldest premier research organization in India in the field of pure sciences. It is a national institution for higher learning whose primary purpose is to foster high quality fundamental research in frontier disciplines of the basic sciences. Founded by Dr. Mahendra Lal Sarkar, a philanthropist, the activities at the Association in the very early years were supported by generous public contributions. It was conceived and planned in the backdrop of the great cultural and intellectual awakening of the nineteenth century Bengal and was desired by its founder to be an institution 'solely native and purely national'. The original objective of the Association, which continues even today, was to cultivate science in all its departments both with a view to its advancement by original research and to its varied applications to the arts and comforts of life.Till the early decades of this century the Association was the only place in India where higher research in Physical Sciences could be carried out. As a result students from all over India began assembling at Calcutta to work in the creative atmosphere of the Association. Many distinguished scientists of modern India had carried out research here. This was the place where Sir C V Raman did his monumental work, on Physical Optics leading to the discovery of the celebrated effect which bears his name and won for him and India the first Nobel Prize in Science. K S Krishnan, S Bhagavantam, K Banerjee, L Srivastava, N K Sethi, C Prosad and M N Saha are some illustrious names out of scores of other eminent Indian Scientists who also worked here and enriched the research culture of the Association in the early decades. In 1946 the Association embarked upon a new development plan under the dynamic leadership of Dr. Meghnad Saha envisaging the creation of an active research school for investigation on the problems continuing with the fundamental studies in X-rays, Optics, Magnetism, and Raman Effect in which the Association had specialized in early years. A new campus was opened at Jadavpur which became a sprawling complex of

educational research and industrial establishments, where the laboratories were shifted from Bowbazar Street**.**

Now it is an autonomous body funded by the Department of Science and Technology (DST) of the government of India and by the government of West Bengal. A number of specific projects raised by individual scientists or groups of scientists are being supported by different funding agencies such as CSIR, DAE, DNES, DST, DOS, DSIR, ICMR, INSA, NSF, UGC and UNDP. The Institute has dynamic programmes for the pursuit of research leading to thedoctoral degree and for post-doctoral work andhas Visiting Scientists Scheme.

Science is a driving force of our modern society. Particularly excellent scientific work is the cradle of breakthroughsin our knowledge of the nation as well as world. Therefore, evaluation of scientific research through bibliometricstudy is crucial for this research organization. Still now, such type of comprehensive research work has not yet been done if a bibliographic list of scientific publication of IACS is already published for 1876 -1976 that has not evaluation of scientific research through bibliometric study . This study seek to understand what kind of shift in research at IACS has taken place over time ,if any , and to identify factors that have come to influence research. In addition, it seeks to understand to what extent result from the study could be generalized to understand parameter that has potential to advance and promote research. Such a study is of great significance

1.1 Review of literatures

A number of quantitative studies based on scientometric techniques have been reported to evaluate the research productivity of individuals, institution, countries,etc. Studies are also available to verify the fitness of classic laws of bibliometrics , factors of productivity and impact of research conducted in various countries. These studies are very much helpful to assess the developments of science as well as in their application to library and information resources management also. In recent timesbibliometric and scientometric techniques are increasingly used for assessments of scientific research. The outcome of these studies helps in enhancing the visibility of institutions, trends of their research productivity ,research collaboration etc and as a consequences the funding agencies come forward to support their research. The individual and the team of researchers also get appreciations and inducement for their work. Such bibliometric studies influences the research of the institute.As scientists publish their research findings in variety of sources, the study of publication trends viz. authorship pattern, literature growth and degree of collaboration etc. helps a lot to organize

and deliver the need based information services. Keeping this perspective in mind the present study has been carried out. A good amount of literature on bibliometric/scientometrics analysis of research is available in India as well as abroad. Such research has been reviewed as under:

Lee (2002) made ascientometric study to find out research performance of the institute of Molecular and Cell Biology (IMCB), Singapore of first ten years since its establishments. The findings shows that in the ten years IMCB produced 395 research papers ,33 book chapters,24 conference papers and 4 monographs, graduated 46 PhDs and field 10 patents. In order to become world class, IMCB researchers have been publishing in selected journals. It is found that 95.6 % of the articles were published in ISI journals. **Hirsch and Singleton(1986)** showed that the amount of multiple authorship in a subject field is closely related to the amount of financial support available to the scientists. Shaw observed that co-authorship establishes a relation among authors which is a measure of the extents to which they communicate directly and that the strength of this relationship between any two authors may be computed by counting the number of papers they produce jointly. **Akakandelwa (2009)** did an informatics analysis of 220 papers published by an academic faculty at the University of Zambia from 2002 to 2007.**Benamer,Bredan and Bakous (2009)** studies and analysed in publications record of Libyan Medical Schools in international journal indexed in pubMed between 1998 and 2007.**Oyedokun(2001) analysed** scientist's activities in the agricultural research institutes in Nigeria and reported that activities of scientists in agricultural research institutes span through technological development and delivery. **Bennell (1987)** analysis of publications output, during the period 1973-82 of sub Saharan African decrease in the number of crop science publications by government researchers. **Thorp's (1990)**made a study of agricultural research activity which was developed to assist in the evaluation of the knowledge transfer component of an agricultural research network involving the six southern core countries of South America (Argentina, Bolivia, Brazil, Chile, Paraguay and Uruguay.Dizon and Sadorra(1995) showed that pattern of publications by the staff of an International Fisheries research centre. **Klaic (1990)**also analysed of research activities of chemist from the RugjerBoskovic Institute (Yugoslavia) from 1976-1985.**Kim and Kim (2000)** have studied on bibliometric analysis of publications by the chemistry department,Seoul National University,Korea,1992-1998.**Okafore and Dike (2010)** analyzed the research output of academics in the science and engineering faculties of Federal Government –owned universities in Nigeria.**Minor and Dostatni (1991)** reviewed and evaluated the research publications of the French National Institute for Health and Medicalo

Research (INSERM).Yankevich (1982) also analysed of publications and invention productivity in some Soviet academic institute.Besidesthese ,**Zachos (1991)**$_{evaluated}$ research output of two university departments in Greece with the use of bibliometric indicators and Schubert & Braun (1981) showed some scientimetric measures of publishing performance for 85 Hungarian Research Institutes.

In India also several such studies have been made to assess the authorship pattern, degree of collaboration and scientificproductivity etc in specialized areas of research such as oilseeds (Kumar and Kumar), food technology (Dasgupta, and Gupta), Physics (Chakrabarti and Pal), fossils (Bhargava), Biology(Kannappanaver and Vijaykumar), Chemistry (Kannappanaver, Swamy and Vijaykumar) and many more. Subramanyam introduced methods for measuring author collaboration and observed that the degree of collaboration varies from one discipline to another **Lal (1993)** prepared a ranked list of journals from the view points of soil scientists working in India. A similar study was conducted by **Sharma and Singh ((1993)** to the study the characteristics of soil science literature used by Indian scientists to find out the major contributing authors, ranking the Indian soil science journals, seepage and obsolesces of literature. **Sivasubramanian (2000)** has analyzed to identity the nature and pattern of authorship and the degree of collaboration in coffee research and reported the publication trends among coffee scientists centered on single authorship with high degree of collaboration in coffee research. **Kumar and Gupta (2003)** reviewed the different approaches for studying the growth of scientific knowledge, as reflected by publication, and explored the applicability of selected models in the growth of world research output in the forms of articles, patent and books in the field of chemical science. **Yadav(1986)**studied the communication trends of potato scientists and found that research journals are the main instrument of communication among them.

Siwach and Kumar(2015) shows that the invstigates the research contributions of Maharshi dayanand University ,Rohtak in terms of its publications output during 2000-2013 as reflected through scopus database.The study analyses the year –wise research productivity its citation impacts national and international collaborations ,top collaborating institutions,subject wise distribution of papers,journal used for communications,most preferred journal of publication,most prolific authors of the university during the period under the study. **Nagarkar (2014)** shows The bibliometric parameters have been used to carry out the analysis of the research contribution made by the faculty members of the department of chemistry at University of Pune.The data set was collected from the web of

science datsbase for the periods of about 14 years (1999 -2012) .The data reveals that thirty faculty members have published 811 papers in 258 journal with 8948 citations.Most of paper are published in peer reviewed international journal having high impact factor.The study reveals that there is a continuous growth in publications and authorship pattern indicates that highest mumber of citations are received for papers written by four author in collaborations.Aswathy and Gopikuttan (2013) analyses the publications pattern of faculty members of three universities in Kerala viz.. University of Kerala, Mahatma Gandhi University and University of Calicut. Authorship pattern ,degree of collaborations, the appropriateness of Lotka 's inverse square laws and yearwise and designation wise distribution have been published.The year wise distribution of publication indicates that there is a growth in the number of publications.It is found that multi authorship dominates among the university teachers. The Lotka 's inverse square laws seems to be rejected for the present data set. **Sudhier & Priyalakshmi(2013)** conducted a study based on research publication trends among the scientist of Central Tuber Crops Research Institute (CTCRI),Thiruvananthapuram . A total 1076 research articles published by the scientists of CTCPRI during 2000 -2010.It was found that the highest number of 169 papers was published in the year 2006 and the average number of publications peryear was 97.82.Most of the contributions were multi authored(87.68%).The degree of collaborationof scientist of CTCRI was 0.87 and most of the articles published by the scientists were in the foreign journals (51.89%).Applicability of Bradford's Law in the journal distribution pattern of the CTCRI scientist does not fit the Bradford's distribution pattern.**Baskaran(2013)**analysed the author productivity ,discipline-wise and institution-wise collaboration and rankings of authors in research contributions of Alagappa University during 1999-2011.Relating growth rate (RGR) was found to be fluctuating tend during the periods. Degree of collaborations is found be 0.96.**Maharana and Sethi (2013)** analyzed a bibliometric study on the research output of Sambalpur University's publication in the web of Science between 2007-2011.**Kausik(2012)** identified various bibliometric aspects of scientific contributions of the researchers and faculty of National Diary Research Institute (NDRI)Karnal published during 2001-2011. The average number of authors per contribution was 3.61 and degree of collaboration 0.98. The NDRI scientist had foreign collaboration with nineteen countries and collective research trends are predominant among the scientist. **Baby and Kumaravel(2012)** studies research productivity of Periyer university faculties in India using the scopus database for a periods of thirteen years from 1998 to 2010.The results indicate that the grouth of research has steadily increased from a single articles in 1998 to 102 articles in 2010.The Relative growth rate and

doubling time is 0.45 and 2.27 respectively. It was found that three –authors publications predominates amongst the pattern of authorships.Journal articles accupy the entire place among sources of publications.

Jeyshankar ,RameshBabu and Rajendrarn(2011)analysed bibliographical details of 1282 research articles published by scientist of CECRI during the periods 2000-2009. It was found that 2009 was most productive year with 194 articles and collaborative research was dominant with the highest degree of collaboration 0.98 in the year 2005 and he also analysed quantitatively of research publications of Raja Ramanna Centre for advanced technology ,Indore : A bibliometric study from 1995-2004. **Sudhier and Abhila(2011)** analyses the research productivity of social scientists at the centre for Developments studies (CDS) , Thiruvananthapuram during 1998-2008 . There were 599 research papers published during the periods , including 38.23 % journal articles and 15.03 % working papers. More than 66% journal articles were published in Indian Journals. **Sahu, Goswami and Choudhury(2011)** analyzed R&D publication growth and its characteristics with reference to the National metallurgical Labaratory, an R& D institution under CSIR based on data obtained from science citation index. It was found that the hightest number of 120 papers was published by the laboratory in the year 2010 out of which 28 papers received 62 citations during the same periods. The average number of publications per year was 88.1 and average citation per paper was 5.02.

Bhatia(2010) analyzed quantitatively the research publication published by the scientists of National Institute of Occupational Health (ICMR) ,Ahmedabad ,India during 2002-2006. **Sudhier(2010)** in his scientometric study analysed the publications of physics research era at the Indian Institute of Science (IISc), Bengaluru. There were 267 papers published during 1999-2003 and the highest number of papers was in the year 2001. The average number of authors per article was 4 and the degree of collaboration was 0.94.**Kaur and Aggrawal (2010)** brought out the result of a bibliometric study of research publications of department of Chemistry ,Gurunanak University ,Amritwar for the periods 2002-2006. **Mahbuba ,Rousseau and Srivasta(2010)**did a scientometric comparison between two health and population research organizations, namely the International Centre for Diarrheal Research in Banladesh (ICDDR) and National Institute of Cholera And Enteric Diseases (NICED) in India during the period 1979-2008.

Girap and others(2009) conducted a scientometric analysis of the publications of Thecnical physics and Prototype Engineering Division at Bhabha Automic Reasearch Centre.

There were 704 papers published during 1986-2006 scattered in diveres domains like crystals (192), thin films (173) and glasses and ceramics (102).The average number of publications per year was 33.52 and the most prolific authors were: S.K. Gupta (215), G.P.Koyhiyal (171) and S.C. Sabharwal (151).**Varghese and Ranjan (2009)** analysed of 632 publications of Rajib Gandhi Centre for Biotechnology (RGCB) scientist during 1995-2006.The year 2005-2006 with 112 articles(25.87%) published is the most productive year in the case of journal articles. The productivity of the scientist of the centre shows substantial growth both quantitatively and qualitatively with the development of the institute.**Maheswaran, Kumar and Sridharn (2009)** conducted a study based on the research publications generated by Structural Engineering Reasearch Centre (SERC) during the year 2002-2006. A bibliometric study of research publication trend among scientists of Central Potato Research was studied **by Sharma (2009)**. A total of 2603 research articales published by the scientists of CPRI during 1991 to 2007 were collected by scanning of annual reports and *Journal of the Indian Potato research Assopciation.***Bala and Gupta(2009)** studidgroth and impact of research output of Government Medical College and Hospital, Chandigarh.

Kumbar ,Gupta and Dhawan(2008)described the growth ,contribution and impact of research carried out by the scientists of University of Mysore in S & T. **Mukherjee (2008)**analyzed the authorship pattern of scientific productions of the four most productive Indian academic Institutions for the eight year period from 2000 to 2007. **Sevukan and Sharma(2008)** in their bibliometrics analysis studies the research output of biotechnology faculties in some Indian universities.**Jeevan and Sen (2007)** conducted a studies based on the journal publications generated by the inter Universities Accelerator Centre , and the Accelerator Group at the Tata Institute of Fundamental Research (TIFR) during 1997 -1999. The data was collected from the annual report and the impact was examined using data from SCI. Out of three specialization in NSC, material science was more productive in terms of publication whereas higher percentage qualitative papers originated from nuclear physics. Radiation biology had a very nominal presence. **Dhawan and Gupta(2007)** studies the institutional performance, based on publication output of physics research from India. Scientometric analysis of 1044 papers published by the scientists of radiochemistry division at Bhabha Atomic Research Centre (BARC) during 1985-2005 in diverse domains were conducted by **Kademani and others(2007)**. The highest number of 64 publications was produced in 2005 and the average number was 21.75. Publication concentration was 6.06 and

publication density was 5.27.**Gupta ,Kumar and Khanna (1999)** evaluated performance of CSIR laboratories based on the productivity profile of scientist.

Several studies have been reported in the area of scientrometrics on institutional productivity, particularly in the Indian context and a few of them were: **Angadiand others (2006)** on the Tata Institute of Social Science during 2001-2004, **Kademaniand others(2006)** on the Analytical Chemistry Division of BARC during 1972-2003, **Kademaniand others (2005)**, in the Bio-organic division of BARC, **Mehta (2005)** on National Chemical Laboratory (NCL), Pune, **Gopikuttan (2004)**on the Science Department, Faculty of Science, University of Kerala during 1980-1999, **Jeevan and Gupta(2002)** on IIT, Kharagpur, **Gupta and others(1999)**. on the National Council of Science & Industrial Research (CSIR) and **Garg and Rao(1998)** in the Indian Physical laboratory.

In West Bengal,limited such studies have been made to assess the authorship pattern, degree of collaboration and scientific productivity etc in specialized R&D organizations such as **Jeevan and Gupta (2002)** suggested to a methodology for studying the quantities profile of IIT ,Kharagpur , with a view to get idea about performance and impact of research produced in each departments and comparison of the impact of research in various departments.In the light of performance of various departments through individual performance measure ,It is observed that Three departments namely department of Chemistry ,Physics & Meteorology and Electronics & Electrical Communication Engineering have overall performed better in terms of quality than other departments.**Nandi and Bandhyopadhyay (2009)** studies the research contributions in chemistry from the University of Burdwan during the periods of 1960-2000 and found total mumber of 979 papers published under study and the maximum number of papers (283) were published between 1991 and 1995.Highest number of theses (30) was submitted during 1986-1990 and 1991-1995.Maximum number of theses (58) was submitted in inorganic chemistry followed by nuclear and analytical chemistry(34).Rabindranath LalDutt supervised height number of theses (17). The most prolific author was A K Das with 82 papers followed by G.S .De (54) and R L Dutt (53). About fifty three percenr papers (522) are published in Indian Journals.Other countries of preference for publishing papers are Netherland (15.32%),UK (11.64%) and USA (10.01%).The study reveals that the university has a strong base in inorganic chemistry research.

Many scholars have studied the institutional productivity of scientists and researchers of several institutions but few studies have been conducted in such basic science research institute/laboratories under Department of Science and Technology (DST),Govt. of India. Hence this study has been undertaken on IACS, one of the prestigious institutions of DST, Govt. of India.

1.2. Objectives

The main purpose of the study is to analyze and access how scientific research at IACS has progressed over time using quantitative and qualitative indicators. The main objectives of the present study are

1. Growth and decline of research at IACS in the main areas of its research ;
2. To identify the type of communication channels preferred;
3. To study the department /research unit / research centre -wise breakup of publications
4. To study the subject-wise breakup of publications.
5. To find out year wise publication productivity;
6. To determine the authorship pattern among scientists and research scholars of IACS.
7. To identify most productive authors.
8. To prepare a rank list of India and Foreign journals.
9. To identify the country-wise distribution of journals.
10. To study the application of Braford's Law.
11. Identification of research trends and growth of knowledge of different scientific discipline in IACS
12. Ranking the guide doctoral research ;
13. To study the department /research unit / research centre -wise breakup of doctoral research of IACS
14. To find out year wise publication of doctoral research ;
15. Use pattern of different Sources ;
16. To estimate the share of collaborative research

1.3 Scope of the study

The present study mainly covers primary document such as articles of research journal and conference proceeding, patent, standard etc during 1947-2006. This study analyses publication output of the Indian Association for the Cultivation of Science, Kolkata published during 1947- 2006 .This study analyses the research contributions of IACS both qualitatively and quantitatively. The qualitative assessment looks at impact of IACS publications manifested in citations and quantitative assessment looks at number count of its publications.

1.4 Methodology

For the present study exhaustive data have been collected from different sources such as annual report, institutional repository and other different grey literature, books etc.For thispurpose "Data Slip" has been used for each article/seminar paper / doctoral research etc. All bibliographic details of publications in hardcopy form were thoroughly scanned. All bibliographic details of each articles seminar paper / doctoral research etc were rightly incorporated and simultaneously all the data elements were also transferred to spread sheets application for statistical analysis. Separate spread sheet were preparedfor assembling all homogeneous data elements of each different form of publication or research output suchas journal articles, doctoral research, seminar, books, patents etc. After validation, allrevalidated data are presented in the form of a table. Each tabular form has been derived according to the specific purpose. Actually it is the prerequisite for analysis and interpretation of data. Then all data in different table have been presented in the form of different graphs for better analysis and interpretation.

1.5 Limitations:

Data have been collected mainly from annual report, institutional repository and other different grey literature, books etc. Some required data which were not available in annual report and other literatures have been collected from human sources. Some problems faced during collection of data under study are given below:

1. In 1986, Department of General Physics & X-Ray, Magnetism, Optics and Macromolecules have renamed into Material Science, Solid State Physics, Spectroscopy, and Biological Chemistry respectively. All data under old

department also have been incorporated in respective new departments during analysis & interpretation under study.

2. All research outputs under Director Research (1961-1982) have been incorporated in respective particular departments under study ;
3. Only one name of the journal of a particular article entitled "Execiples emission from hydrocarbon TMPDA System" published by D Basu and K .Chakroborty in 1982 was not found in annual report of respective year.
4. Volume no and issue number of some particular journal articles were not found from annual report or any other sources.
5. Name of the supervisor of some old theses have been collected with the help by human sources from respective departments.
6. Only 21 tittles of the theses out of 1116 have not been collected from /annual report or any other sources. But it is true that theses were done in respective periods that has been collected from a book entitled "**A Century**" published by IACS, Kolkata in the year 1987.

1.6 Conclusion

The Indian Association for the Cultivation of Science, Kolkata play a significant role in the R & D development in the country since 1876. It is the oldest research organization in the country. The main aim of the association is to strengthen and basic science based research and ensures overall development Science and Technology in the country. Over the long period, The Association has come to develop several new technology of strategic, societal national importance. The association must draw out long-term and short term plans for R & D developments in the country with the help of bibliometric analysis. It needs to organize goal-oriented and need-based programmes at the national and institutional level. Beside these with the help of bibliometric analysis new programme must be initiated to encourage greater institutional participation, greater collaboration of research at national and international level ,attract young talent into science and set-up sophisticated instrument facilities for S & T education and research in the country.

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Chapter 2

Bibliometrics: an Overview

CHAPTER – 2

BIBLIOMETRICS: AN OVERVIEW

2.0 Introduction

This is worthwhile to say that much attention is being paid to problems of scientific methodology all over the world. There are new approaches to settle scientific models, searching for new research model prospects with the task of giving theoretical maturity and solid grounds. This aspect of methodological research is especially constructive. It requires critical estimation of theoretical and experimental research result, extraction of weak points and make over or enrich upon them.

In different disciplines there are now large mass of experimental data. It is high time to arrange theories, improve methods and forms of their acquaintance, standardise the system of main ideas. It is almost universally recognised that the methodology of scientific branch is an integral, inseparable part of that scientific branch along with its history and organisation.

2.1 Bibliometrics

Bibliometrics is that branch of information theory that attempts to analyses quantitatively the properties and behaviour of recorded knowledge.Through this technique ,we can study only the recorded knowledge , not knowledge itself. It has also become a standard tool of science policy and research management in the last decades. All significant compilations of science indicators heavily rely on publication.In addition, many extensive bibliometric studies of important science fields appeared during the last two decades. Aim of these studies was to measure national research performance in the international context or to describe the dd with the help of bibliometric means (for intense, *Braun* et al., 1987).

It is a common misbelieve that bibliometrics is nothing else but publication and citation based gauging of scientific performance or compiling of cleaned –up bibliographies on research domains extended by citation data. In fact, scientometrics . Structural scientometrics came up with results like the re-mapping of the epistemological structure of science based, for instance, on co-citation, “bibliographic coupling” technique or co-word techniques. Dynamic scientometrics constructed sophisticated models of scientific growth, obsolesce, citation processes, etc. These models are not only of theoretical interest but can also be usefully applied in evaluation and prediction.

Beyond policy relevant applications of bibliometric results, there are recently important applications in the context of studying the linkage between science and technology, or

applications of related fields such as library and information science and most recently Webometrics. Examples for such latter ones are the larger ongoing projects EICSTES (European Indicators, Cyberspace and the Science-Technology-Economy-System) and WISER (Web indicators for scientific, technology and innovation research).

Today, bibliometrics is one of the rare truly *interdisciplinary researches* fields to extent to almost all scientific fields. Bibliometric methodology comprises components from mathematics, social sciences, engineering and even life sciences.

2.2 Genesis of Bibliometrics

The historical review says that F.J.Cole & Nillie B. Easte presented the first recoded study on bibliometrics in 1917 in science progress. The History of Comperative Anatomy Pt. 1 : A Statistical Analysis written by F.J.Cole & Nillie B. Easte is considered to be the first bibliometric study where the expression 'Statistical Analysis' has been used. They studied the contributions in the field of anatomy by counting the number of publications produced by different countries, covering periods more than three hundred years (1543-1860). This count included only books and journal articles.

In 1923 , E.W. Hulme introduced the phrase 'Statistical Bibliography' to describe the study of use and non use of information. He studied the author and journal entries in the international catalogue of scientific Literature , ranked the results according to the country of origin and resulted that Germany ranked at the top position in the production of scientific literature during the periods of 1900 -13.

In 1938 , The term of ' statistical Bibliography'was again used by Heckle in his paper entitled 'The Periodical Literature of Bio-Chemistry.' In 1943 by Gosnell also used in his dissertation and later in 1948 in his article. Later the term of statistical Bibliography was used in 1948 and 1949 by Fusilier ,in 1962 by Raisig,in 1966 by Baker ,in 1969 by Prichard.The term was considered very clumsy ,not so descriptive and can be confused with statistics itself or bibliographies on statistics.

In 1948 , Dr. S.R. Ranganathan coined the term 'Librametry ' to connote the use of statistics to evaluate an existing or proposed library service and resources. This term is a wider term which includes in it the concept of bibliometrics. But this term did not take its place in library science and was forgotten for many years. Latter it was called 'Lirametrics'.

In the book entitled “Little Science-Big Science”(1963), *Derekj deSolla Price* analysed the recent system of science communication and thus presented the first systematic approach to the structure of modern science applied to the science as a whole.

The Russian word “naukometriya” (first translated as Science metrics) was coined by V.V. Nalimov (1910-1997) in 1969, although this field was not his main concern. In the work of this multifaceted and intriguing scientist and scholar, scientometrics was only of central concern for a short period of time. Nevertheless, it is no coincidence that Nalimov is regarded as one of the founding fathes of scientometrics. Nalimov wrote his basic book, Scientometrics: Studying Science as an Information process, explaining that, “scientometrics is a complex of quantitative (mathematical and statistical) methods, which are used to investigate the processes of science”.

The termn “Bibliometrics” was first coined by Alan Pritchard in 1969.He defined it as, “. . . the application of mathematical and statistical methods to books and other media of communication.”During 1970s, bibliometrics developed into a scientific tool for literature assessment and now it has been based mainly on the principles of mathematical statistics. As Fairthorne says, “The field of bibliometrics is the quantitative treatment to the properties of recorded discourse and behaviour pertaining to it.”

Ravichandra Rao defined that, define4d that, “ Bibliometrics is understood to cover the study of statistical distribution of the process relating to the activities od library staff and readers.” While J.M Britain defines it as, “The study if nature, use and non-use of documents only. It deals only with the document, that is the unit of analysis is the document and its characteristics. It does not deal with the user and his needs.” Simpson expressed that bibliometrics now include computer databases, databanks and view data systems and also embrace statistical relating to user.

Bonitz defined it as “Bibliometrics is a methodological sub-discipline of library science, including the complex of mathematical and statistical methods, used for analysis of non-scientific documents, library networks, indexing language, information systems, etc”.

It is considered that ‘Bibliometrics’ is analogous ‘Librametrics’, Russian term ‘Scientometrics’, FID’s term ‘Informetrics’ and also to some other established sub-disciplines such as’ Econometrics, “Psychometrics,” ‘Sociometrics,’ ‘Biometrics’ where mathematical and statistical methods have been systematically applied to analyse and solve the problems in

the field of library science, history of science, information science, economics, psychology, sociology biology respectively.

In 1982, the term 'Informetrics' was suggested by German Scientists Blackest and Stegel as a branch of science, using mathematical and statistical methods to investigate scientific and technical information on theoretical level and practical information activities.

In short, the Bibliometrics is a formed scientific sub-discipline including the complex of mathematical and statistical methods used to analys bibliographical characteristics of documents. While, Scientometrics is a formed structural part of methodology, including the complex of mathematical and statistical methods used to analyse the quantitative characteristics of science as an enterprise. Further, informatics is a scientific sub-disciplinenot yet formed. The problem of its research objective to be formed on the concept 'infomation' is not solved yet.

2.3 Scope of Bibliometrics

Ptitchard (1969) emphasized that the purpose of bibliometrics is "to shed light on the process of written communications and of the nature and course of development of a discipline(in so far as this is displayed through written communication), by means of counting and analyzing the various facts of written communication".

Sengupta(1985) stated that bibliometrics study lies between the broader areas of the social science and the physical science. Borgman(1989) indicated the scope of bibliometrics by mentioning that scholarly communication can be studied by bibliometrics methods using one or more three theoretical variables; procedure of communication, artifacts of communication, and communication concepts. Nicholas & Ritche (1978) provided the scope of biblometrics more clearly. They divided bibliometrics studies in two or more broad groups: One describing the characteristic feature of a body of literature (i.e. descriptive studies) and the other examining the relationship formed between components of a literature (i.e. behavioral studies). It is also mentioned that both descriptive and behavioral studies are complementary to each other.

Descriptive Studies: The descriptive studies are also known as **productive counts** and have following fields of study.

1. Bodies i.e. authors or organizations responsible for the production and transmission of information.

2. Forms of transmission (i.e. journals, monographs, etc.)
3. Medium of communication (i.e. article, letters, etc.)
4. Nature of information conveyed (i.e. how much literature exits on various language and subjects.)
5. Timing and frequency with which information is conveyed.
6. Amounts of information conveyed by various individuals, groups, organizations, countries, etc.
7. Geographical distribution of documents.

Behavioral studies: The other type of study, which is commonly referred as to "citation studies", relates to what authors cite. Citation analysis reflects two major themes that is use of citation as tools for librarians to evaluate the library collections and services and use of citations as tools to analyze the research activity. However, citation analysis is concerned with the following phenomena:

1. Which authors are most cited?
2. Which journals are most cited?
3. Which linkage exits between the citing and the cited works (i.e. self-citation)
4. Language of documents selected for use as citation.
5. Type of documents used for citation.
6. Subject distribution and how quickly the literature on some subject becomes out of date i.e. obsolesce study.

Similarly, Potter(1988) also divided bibliometrics studies into two categories. Firstly, **descriptive**, which attempts to study the body of a literature by counting its contributing countries, authors, journals, year of publications, and discipline. The second categories of more **evaluative** and attempts to study the use of a body of literature by using citation analysis. Another important study under bibliometrics is assessing **productivity of authors** and impact of research on existing field of study. This type of study is referred to as **"Evaluative Bibliometrics".**

2.4 Applications of Bibliometrics

The sub discipline of bibliometrics are statistics, operation research, bibliometric distribution and bibliometrics laws, citation analysis, circulation theory, information theory and theoretical aspects of information retrieval.

The bibliometrics study besides the theoretical content has various practical applications in library management and helps in deciding science policy on researches. Some of these practical applications of bibliometrics are as follows:

1. The bibliometric study aims to improve the bibliographical control because bibliometric analysis helps to know the character of literature of different fields. The volume and growth of primary literature has a direct effect on structure of secondary lilterature. Therefore, the computed growth rates and direction of change may be of considerable assistance to editors of secondary services in determining their future approach and coverage.
2. A major area of bibliometric study is to determine statistic literature relating country of origin, subject, and forms and language distribution of documents as well as their incidence of translation. These data will provide use full information determining the scope of work, and can suggest weakness in the coverage or areas of possible improvement of secondary services.
3. Bibliometric study derives the subject relationships, which suggest desirable general patterns of secondary service coverage. Such studies can also help to establish the framework for a service in a particular subject area.
4. The citation data analysis and the volume of publication in year-wise can be used in planning retrospective bibliographics which will provide some indication of both the age of material used in a discipline and to the extent which more recent publication supersede the older ones, if at all.
5. The bibliometric analysis helps in comparative assessment of the secondary srvices, particularly when related to overall figures on size of literature and to subject link. This may helps the publishers in getting an idea of their achievements and compactions and could be useful for marketing purpose.

6. The bibliometric data also helps in taking some management decisions. For examples, it is useful in selecting specific primary and secondary journals and helps in planning future staff, building needs and in improving library services.
7. The citation data also determines the list of highly cited journals or books, which can be used in taking decision while discarding the stock of the library.
8. Citation analysis can find out subject relationships which help in suggesting titles of journals relevant to a given discipline in a particular library
9. Bibliometric study also provides information about the structure of knowledge and pattern of communication. Analysis of the size and growth of literature can identify the development and declining areas of literature over a time and trends of literature growth.

On other hand, In general Sengupta(1985) determined that bibliometric has the following applications:

1. Quantify research and growth of different areas of knowledge;
2. Estimate comprehensiveness of secondary periodicals;
3. Identify users and authorship of documents of various subjects;
4. Measure usefulness of adhoc and retrospective SDI services.
5. Design experimental models correlating or by-passing the existing models.
6. Identification of core journals in different disciplines and formulates a need based acquisition policy within the limited budgetary provisions without detriment to the research interest of the parent organizations.
7. Intimate effective multilevel network system.
8. Regulate inflow of information and communication, and
9. Develop norms for standardization.

So we can say Bibliometric studies and research are being used in different spheres of library and information science. Some of the areas where bibliometric techniques are basically applied are:

i) Estimation of comprehensiveness of secondary periodicals.

ii) Identification of users and authorship of documents relating to various subject to identify users of different subject; to identify authorship and its trends of various subject.

iii) Development of norms for standardization.

iv) Determination of core journals in different discipline in order to

a) formulate an need-based acquisition policy within the available budgetary provisions.

b) help in the physical organisation to back volume of periodicals.

c) provide a basis for taking decisions regarding binding or weeding out.

v) Identification of research trends and growth of knowledge of different scientific discipline.

vi) Comprehension of the forms and structure of scientific communications.

vii) Regulating of in-flow of information and its communication.

viii) Understanding the growth of publications/literature.

ix) Measurement of the usefulness of adhoc and retrospective SDI services.

x) Forecasting past, present and future publishing trends.

xi) Initiating effective multilevel network system.

xii) Designing automatic language processing for auto indexing, auto abstracting and auto classification.

xiii) Predicting productivity of publishers, individual authors, organisation and country.

2.5 Citation Analysis

Referencing to earlier works and citing previous authors is an integral part of scientific communication, and in fact an important feature of knowledge growth. Citation represents a relationship between the cited and citing documents. The study of this relationship in all aspects in the function of citation analysis; an important area of bibliometrics. Citation deals with two types of data:

This refers to empirical, observational and applied studies of outcome of citation is various aspects. Most of the studies is citation analysis depend upon the data produced in

citation indexes. It is the research activity which deals with reference and citations as its subject matter.

Reference of cited	:	An item designing the source unit; thus it is always pre-dated with reference to the citation.
Citation or citing	:	An item designing the receiving unit; thus it always post-dated in relation to the reference.

2.5.1 Techniques

The prominent technique of citation study are citation counting, bibliographic coupling and co-citation analysis.

(i) Citation Counting

This technique involves counting the number of citations received by a given documents over a period of time from a particular set of citing documents.

(ii) Bibliographic Coupling

A pair of documents having a common reference or number of common references are said to be bibliographical coupling.

(iii) Co-citation

Co-citation is complementary idea to bibliographical coupling. It shows how much time (sequence) a pair of documents has been commonly cited. Two documents are co-cited if both of them are commonly cited in paper published subsequently. Co-citation links two or more documents published earlier in relation to a later documents.

2.5.2 Application

Citation analysis has been applied extensively to study various aspects of documents in their subject context and use environment. The use of the technique (Smith,1881; Narine and Moll, 1977) broadly fall into the following categories:

(i) Collection development, user studies.
(ii) Information retrieval
(iii) Development and growth of subjects and their literature.
(iv) Historical and research standing studies.
(v) pattern of research communication.

2.5.3 Obsolescence

Obsolescence is defined as the "decline over time in validity or utility of information" (Line and Sandison,1974). The same applies to documents. Assessing decline is subjective and not easy. The criteria generally employed to measure the decline are:

1. Age of the document
2. Citations to the document in subsequent literature.
3. Utilization of the document

2.6 Other Concepts

The term bibliometrics has a very recent origin. It is analogous to Ranganathan's 'Librametry', Russain concept 'Scientometrics'; FID's informatrics and also to some other well established sub-disciplines like 'econometrics', 'Psychometrics', 'Sociometrics' and biometrics.

2.6.1 Librametry

Though the term librametry was coined and discussed by Ranganathan,yet he did not prescribe extract, pinpointed definition of the term. Ranganathan suggested as early as 1948 at the Aslib Conference in Leamington Spa "that it is necessary for librarians to develop librametry on the line of biometry, econometry and psychometry, since many of the matters connected with library work and services involves large number."

Scope and Purpose

The scope of librametry covers the different services and problems of the library as well as the fundamental units comprising them (i.e. with the micro and macro documents in the library). Some of the aspect falling within librametry's scope are as follows:

i) Readers' statistics
ii) Statistics of used documents
iii) Statistics of incoming documents
iv) Calculation of shelf space in the library
v) Annual cost of purchased materials
vi) Circulation statistics
vii) Inter library loan statistics
viii) Statistics of footnote and references
ix) Statistics of annual man-hour needed for each item of library work for developing of standard staff formula
x) Statistics of developed man-hour in different sections of the library during different library hours

xi) Distribution of library documents according to authors or subjects

xii) Different structural aspects of the library.

All the above activities are quantifiable. It is evident that statistical methods would be effective for analysing the data provided by them.

Applications

Some areas where librametry can be effectively applied are enumerated below:

i) Determine optional strength of library staff in different sections and their distribution.

ii) Deploying library staff to dispose of reference queries during different library hours.

iii) Systematising circulation of library documents

iv) Developing and organizing local, state, regional and national libraries.

v) Determining the optional size of service library.

vi) Designing library buildings along with fittings and furniture.

vii) Distinguishing service and dormitory.

viii) Analysing readers queries.

ix) Streamlining acquisition system by analysing library documents.

x) Determining the most helpful sequence for classification of macro and micro documents.

xi) Testing the accuracy of catalogue entries by samling techniques.

xii) Ensuring accurate selection of library documents.

2.6.2 Informtrics

The term 'informtrics' was first introduced by Prof. Otto. Nacke in 1979. Egghe & Russean state that "informtrics" deals with the measurement hence also the mathematical theory and modelling of all aspects of information and the storage and retrieval of information. It is mathematical meta information i.e. a theory of information on information. Morales also has given great importance to informatrics and it's application.

Applications

Areas of application of 'informatrics' are:

(i) Quantitative growth of literature.

(ii) Obsolescence and scattering of information.

(iii) Efficiency in information products and services in science and technology and production.

(iv) Efficiency of the information systems and information establishment in general.

(v) The role of different kinds of documents as a means of scientific communication.

(vi) Information pertinent and relevance.

(vii) Ranking of periodicals and serials by various parameters.

(viii) The role of information channel in scientific communication.

(ix) Overlapping of subject contents between periodicals and serials.

(x) Citation habits of scientists and the growing role of citation analysis and

(xi) Finally interdisciplinary and intradisciplinary relations as determined on the basis of biographical reference.

2.6.3 Scientometrics

Scientometrics may also be treated as an analogous concepts to bibliometrics. It is emerging in the new areas of research. Perhaps Dordror and Korennor was first coined the term "Scientometrics" . They defined it as 'the measurement of information process'. According to Morasevic "Scientometrics" is so called interdisciplinary field, not the same it is concerned with a narrow subject that happens to form between two traditionally disciplinary but in the sence of involving a large number of traditional disciplines because of the breadth of the scope. According to Vinkler Scientometrics is a scientific discipline devoted to all qualitative aspects of science & scientific research.

Objectives

I.N.Sengupta recently has outlined the objectives of "Scientometrics" as to evaluate quantitatively growth of any basic scientific discipline and the factors responsible for the steady increasing research activity in that areas of knowledge in the post war period.

Derek J.desolla Price asserted that the major aims of 'scientometrics' is to do scientific analysis of science mathematically.

So we can say The term bibliometrics and scientometrics were almost simultaneously introduced by Ptrichard and by Nalimov and Mulchenko in 1969. While Pritchard explained the term bibliometrics as "the application of mathematical and statistical to books and other media of communcations", Nalimov and Mulchenko defined scientometrics as "the application of these quantitative methods which are dealing with the analysis of science viewed as an information process". According to these interpretations the speciality scientometrics is restricted to the measurement of science communication, whereas bibliometrics is designed to deal with more general information processes. The anyhow fuzzy borderline between the two specialists almost vanished during the last three decades, and nowadays both terms are used as synonyms. Instead, the field informatics took the place of

the originally broader speciality bibliometrics. The term informatics was adopted by VINITI (Gorkova, 1988) and stands for a more general subfield of information science dealing with mathematical –statistical analysis of communication processes in science. In context of the original definition of bibliometrics, informatics also deals with electronic media and thus includes topics such as statistical analysis of the (scientific) text and hypertext systems, library calculations, and information measures in electronic libraries, models of Information Production Processes and quantitative aspects of information retrieval as well.

2.7 Bibliometric Laws

The three major bibliometric laws- of Zipf, Lotka and Bradford-have been discussed in the following section along with their ramifications.

2.7.1 Zipf's law (or frequency of occurrences of words in a text)

In 1916, Estoup had observed a relation between a rank of a word and the frequency of its appearance in a long text. Zipf (in 1949) developed and extended this observation into an imperial law. According to this law, if r is the rank of a word and f is the frequency of its appearance then.

$Rf = c$

Where c is a constant.

In arriving at this law, Zipf drew from the general principle of least effort. Words with a small cost of usage or whose transmittal requires the least effort, are the ones used most frequently ina long text.

B.Mandelbrot (1952) showed that under quite general conditions the word frequencies should follow a law of the type:

$P(r) = (B-1)\ V^{B-1}\ (r+v)^{-B}$ where B and V are constants. The equation can now be written in the following form: $p(r) = c(r-a)^{s}$ where c,a and s are constants.

In this formula r is the rank of a word and p® is the relative frequency of words.

This is, practically the Zipf's law where the equation is slightly modified by introducing two small constants, a and s to suit various classes of data. The constants a improves the fit for common words of low rank and the exponenet s improves the result for items with low rank.

The behaviour of Zipf's Law establishes (i) a hyperbolic relation between r and f and (ii) a straight line between log r and log f.

Zipf-type distributions arise in many fields and the corresponding relations can be utilised necessarily either denying or endorsing the least effort principle.

Zipf's law has its main application in information retrieval especially in generating automatic/semi-automatic indexes to a text. It also provides a measure of an author's richness in vocabulary. This law is extensively used for searching high frequency words for learning languages.

Limitation

The law may not hold good satisfactorily for word frequency in a short text.

2.7.2 Lotka's Law (or productivity of authors in terms of scientific papers)

A.J.Lotka, in 1926 published his classic paper on the frequency distribution of scientific productivity, presenting an analysis of the numer of publications tested in *Chemical Abstract* fro 1907 to 1916 with the frequency of publications by particular authors. The names of corporate authors were excluded, and only the name of authors beginning with A and B (as listed in the index) were considered. A similar study was made in physics. He applied the same process to the name index of Auerbach's Geschtichstafelder Physic which covers the entire range of history upto the year 1900. From these two sets of data Lotka calculated the theoretical freauencies of publications of authors using the least square method. He proposed the *inverse square law of scientific productivity:*

Where X = 1,2,3 ….

$\alpha > 0$.

Y_x is the relative frequency of authors publishing x number of papers. The value was found to be 0.2 for physicists and 1.89 for chemists. This difference, it is felt, could have been due to sampling error.

In this equation, if N is the total number of authors, NY gives the number of authors having published a single paper each. If we take $\alpha = 2$ for any scientific author, then Lotka's formula may be written as

Application

On the basis of Lotka's law there has been a number f studies on scientific productivity from different point of view – e.g. relationship of quantity of publication of individuals and recognition, identification of elites in science on the basis of their publication output, impact of social change on productivity and comparison of scientific productivity.

Limitations

i) As Lotka had neither adopted a sampling design nor computed a sampling size by using scientific methods , his law is based on too scanty a set of data. Besides, it has not been tested statistically. In this respect, the critics of Lotka's law would not perhaps be vary far off from the truth in saying that it is more a conjecture than a law.

ii) Lotka's law is less effective now due to the present tendency towards interdisciplinary approach leading to joint authorship.

iii) This law totally ignores the *potential authors* who have not published any article so far.

2.7.3 Bradford's law (or the Law of Scattering)

In 1934, Bradford described a scattering pattern of journals in applied geophysics and lubrication. He plotted the partial sums of references against the natural log of the partial sum of the number of journals and obtained a straight line graph. On the basis, Bradford suggested the linear relation.

$F(x) = a + b \log x$

Where F(x) is the cumulative number of references to articles contained in the first x most productive journal; a and b are constant.

Bradford discovered an interesting relation between the number of journals and the number of articles published by their journals in specific subjects. According to him if scientific journals are arranged in order of decreasing productivity of articles on a given subject (decreasing number of articles published in the subject area), they may be divided into a nucleus of periodicals more particularly devoted to the subject, and several groups of zones containing the same number of articles as the nucleus, where the number of periodicals in the nucleus and succeeding zones will be as

$$1: n: n^2: n^3 \ldots.$$

Bradford's law is one of the several statistical expressions which try to describe the workings of science by mathematical means. The law derives its universality from the basic unity of science i.e. every scientific fields is related, however remotely, to every other field.

Bradford's law has been shown to be applicable to bibliographies as well as larger aggregates of literature. It has been applied to the studies of dispersion of literature, mostly in the fields of science, engineering and medicine.

Bradford's law helps to perform a number of library activities. Some of these are:

i) Acquisition

ii) Storage and maintenance

iii) Mode of acquisition (e.g. whether core journals should be brought in by air mail)

iv) Binding and weeding

v) Citations from core journals could determine obsolescence of journals

vi) Estimating comprehensiveness of indexing and abstracting services

vii) Measuring effectiveness of retrospective and current awareness service

viii) Prediction of publishing trends

ix) Planning multilevel (e.g. national and local) library system and network

Limitations

i) Groos found that the scatter of research papers among physics journals (as studied by Bradford) deviated from the law's prediction

ii) Chonez, in his study of fifty bibliographies, found that only six were found to confirm with the law's predicted behaviour. In fact, this led Chonez to call Bradford's law pseudo-scientific.

iii) The law depends rather heavily on the judicious section of source journals. Defective selection invariably has an adverse effect on the outcome. As selection factors are predominantly subjective, e.g. one's experience, expert's opinions, recommendations of books etc., there is obviously the possibility of some injudicious selection.

iv) Bradford's law is not reliable in predicting the productivity of individual journals. It is a statistical law which relates only to large collection of journals or to major subjects of such collection.

2.8 Other Empirical Laws

An exponential growth of literature on bibliometrics has been noticed during the last five decades mostly based on these laws. Some of the new empirical laws are : Price's Square Root Law of Scientific Productivity, Garfield's Law of Concentration, Sengupta's Law of Bibliometrics etc.

1. The Square Root Law of Price States:

"Half of the scientific papers are contributed by the square root of the total number of scientific authors".

2. Garfield in his law of Concentration argues:

"A basic concentration of journals in the common core of nucleus of all fields."

3. In his new bibliometric law, Sengupta Comments:

"During phases of rapid and vigorous growth of knowledge in a scientific discipline, articles of interest to that discipline appears to increasing number of periodicals distant from the field." That is during that phases, the small groups of journals accounting for the larger part of significant literature in the subject contains a relatively larger proportion of unrelated journals.

2.9 Bibliometric Softwares

After the introduction of computer technology computerized data processing has become common among the researchers . This has prompted to develop bibliometric softwares. Here details of four softwares developed are given. Out of the four softwares, two of them are freeware; the other two packages are commercial products.

2.9.1 The Bibliometrics Toolbox: The Bibliometric Toolbox was first bibliometrics programme

package. It has been developed Terrence A. Brookes to assist bibliometricians in preparing statistics from down loaded data. It comprises a set of computer programs written in Turbo Pascal that measure the bibliometric aspects of a literature such as Bradford's law and derivation of core journals, productivity ranks, degree of clustering, and indices of concentration. Bibliometrics Toolbox has been reviewed by McLain(1990) and is freeware available.

2.9.2 Dataview bibliometrics software for analysis of downloaded data: Dataview is commercial software. It has been developed by the *Centre de Research Retrospective de Marseille(CRRM*), at the *Faculte Saint Jerome in Marseille*(France). The software does not provide a new bibliometrics method; rather it provides bridge between information sources and the various data analysis methods. Data view is designed as a software tool for experts of scientific and technological information processing. The scientists by analyzing can use the software to built their own suitable statistical techniques. In order to reach this purpose, dataview accepts various formats of information funds such as : on-line database edition or CD-Editions, allows the use of several types of bibliometric items in the same study and provides numerical data for various statistical techniques. Dataview provides the main necessary issues and formats used for bibliometric analysis.

2.9.3 **Bibexcel:** Bibexel is a toolbox developed by Olle Persoson,Inforsk,Umea Univ.(Sweden). This software is designed to assist a user in analyzing bibliographic data, or any data of textual nature formatted in a seminar manner. This idea is to generate data files that can be imported to MS Excel, or any programme that takes tabbed data records, for further processing. This toolbox includes a number of tools, some of them are visible in the window and other hide behind the menus. Many of the tools can be used in combination to achieve the desired results. Multi-Dimensional-Scaling techniques. A map is made by first calculating the number of time pairs of units, for example of authors, co-occur in the document records. Then resulting co-occurrence matrix is taken as input to a Multi-Dimensional-Scaling program that finds the best fitting two-dimensional representation of the input values. The distance between units of maps is inversely proportional to the number of co-occurrences, which means that the more two units co-occur the closer they will be located to the map. The co-citation maps and collaboration among authors of different institutions in research productivity can very well be presented by the use of this software program(Persson,2000).

2.9.4 BioTechMon: It is a commercial product developed at the Austrian research Centre Seibersdorf(Austria). BioTechMon can be used for documentation and structuring of external information from patent and bibliographic database, from the Internet or other external or internal sources. The software has the following main features. It supports the process of building literature databases as well as designing knowledge maps and analyzing of the content by

- Reading in documents for building up an internal database.
- Automatic indexing for identification and classification of relevant key-terms.
- Calculation of knowledge maps.
- Analysis of the maps using an interactive surface or browser.
- Direct access to the document in a database.
- Database search functions.

The software can be used to draw co-word analysis maps(Widhalm et al.,1999)

2.10 Problems and Limitations of Bibliometric Methods

Bibliometrics like any other technique is not free from criticism (Lancaster, 1991). Some of the major problems and limitations of the bibliometrics are:

i) Bibliometric study does not include the informal publications and communications. Therefore, the scientific development cannot be predicted properly.

ii) The bibliographic references, which are taken for citation analysis study, are not alaways standardized. This causes problem while ranking the authors on the basis of the frequency of their getting citations. For example, the author S.R.Ranganathan has been cited variously as Siyali Ramamrita Ranganathan, S.Ranganathan and S.R.Ranaganathan. this may cause scattering of citations of same persons works. There may be more than one author under the same name and it may be difficult to distinguish them.

iii) In case of collaborated authors, the cited articles appear only under the name of the first author listed in each article. Here one must determine the names of individual contributors who have collaborated the work to get the actual rank of the authors. This is vary difficult and tedious process.

iv) Citation Index is also not free from limitations. As already discussed under the SCI major limitations of citation index, is the coverage of journals in SCI.

v) Self-citation is another limitation of citation analysis study. Although the case of self-citation of single author publications can be determined and eliminated but in the case of collaborated works it is difficult to find out the self-citation of authors specially for authors in second or later positions.

vi) A serious problem of citation study is "Hello citation" (Mahapatra, 1992), where author intentionally cite another author as only goodwill. It is not easy to estimate such citations while ranking the authors on the basis of their citations.

vii) Another problem of citation analysis is that in some cases the citation itself is not proper to the context of the citing articles. In some cases the citations are also incomplete.

viii) Occurrences of "Implicit Citations" is one more problem with bibliometric study. Some of the established scientists are not acknowledged for their work, although the work has been preferred in thousands of articles. The articles referring the work do not provide bibliographical details of the sources where the referred articles appeared first. For example, the work of Einstein is no longer felt necessary to acknowledge although many of the present work are study based on Einstein's work. As a result of this, the citation count that is carried out to find out the rank of authors does not give proper weightage to the contribution of many such well-established contributors in different field.

In spite of the limitations of bibliometric study, it is observed to be one of the best may in getting knowledge of scientific productivity of individual authors/scientists,

institutions and journals and to study the pattern of growth of literature and nature of research publications, age of literature used, information needs of scientist, etc.

2.11 Conclusion

Literature and information was assumed to grow exponentially, but individual research disciplines the growth can also be linear or logistic. Finally, the logistic model has been widely accepted since both exponential and linear growth can be considered special phases within the logistic model. The concept of ageing or obsolesces is intimately linked with the growth of science. In information science and bibliometrics, changing frequency of citations given or received over time is assumed to reflect ageing of scientific literature. Some authors have been downright considered growth and obsolescence inverse functions, the faster growth of literature in a field, the faster it ages and literature become obsolete in a shorter time bibliometrics is *the application of mathematical and statistical methods of books and other media of communication.* This basically comprise books, monograph, reports, theses, papers in serials and periodicals, and nowadays, also e-books and e-journals as well as –in the broadest sense-the WEB. Nevertheless, periodicals have played the most important part in communication in the sciences. As mentioned above, books, monographs, reports, theses and papers in serials and periodicals are units of bibliometric analysis. Since certain standard are postulated for such units, the scientific paper published in refereed scientific journals proved to be the unit most suitable for bibliometric studies. Among the common standards, we find the reviewing system, the criterion of originality of research results, the availability of literature and more or less transparent rules. The scientific paper has become the basic unit of bibliometric research. Publications can be assigned to the journals in which they appeared, though the corporate addresses of their authors to institutions of countries, references and citations to subject categories, and so on. Under given conditions, specific sets of elements can thus be defined; these form *units* Basic measures are simple counts such as publication counts or the number of co-authors or the number of citations received by a set of publications or the number of given bibliometric units. From the mathematical viewpoint, these measures can be represented by "natural counting measure", namely, the cardinality of the intersection or union of bibliometric units.

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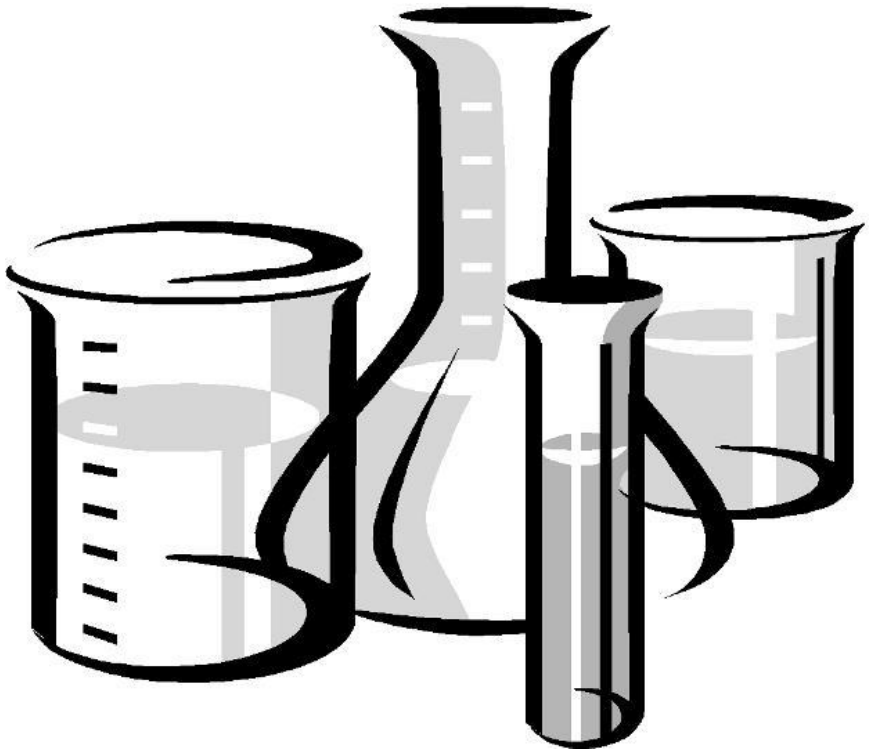
Chapter 3



Indian Association for the Cultivation of Science (IACS) : an introduction

CHAPTER – 3

INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE (IACS) : AN INTRODUCTION

3.0 Introduction :

The contacts with Europe led to a deeper inquiry of our own heritage at the turn of the last 19th century as well as to an interest and admiration of the sprit and achievements of the European civilization. Ram Mohan Roy, the pioneer of these movements directed his major thrust towards social and religious reforms. Side by side grew increasing curiosity towards the achievements and the spirit of science. The intellectual ferment led to realization of the importance of the science not only as a curiosity but as a social and national force. Dr. Mahendra Lal Sircar and his associates imbued with this appreciation of the importance of founded the Indian Association for the Cultivation of Science (IACS) in 1876. Thus this association came into existence in 1876 as an embodiment of the desire of Dr. Mahendra Lal Sircar to create an institution where Indian could do scientific research work independently. 1876 was a landmark year in the annals of Asian science.

3.1 The Background :

The Indian Association for the Cultivation of Science (IACS) , established at the beginning of the last quarter of the nineteenth century , owed its inception to the spirit of self determinism generated by the cultural ,educational ,religious ,social and political movements of the times. The thoughtful article entitled 'On the desirability of a national institution for the Cultivation of Sciences by the native of India' which its founder Dr. Mahendra Lal Sircar wrote in the August 1869 issue of the *Calcutta Journal of Medicine* , as a preamble to his proposed institution, clearly reflected this spirit. In this article,Dr. Mahendra Lal Sircar dwelt at length on the achievements of the ancient Indians in various branches of learning , particularly the positive sciences ,argued against the contention that the Hindu mind pre-eminently metaphysical ,coolly analyzed that the country's underdevelopment was basically due to her backwardness in sciences and unhesitatingly advocated that her salvation lay in the cultivation of sciences by original research. Such *insistence* on the role of science in the developments of a country, normal and natural as it may appear today, was doubtless amazing in the condition prevailing in India 128 years ago.

In his article in the Calcutta Journal of Medicine ,where Dr. Sicar first proposed the establishment of such an Institution ,he wrote as fallows :

"……We want an Institution which will combine the character, the scope and objects of the Royal Institution of London and of the British Association for advancement of Science. We want an Institution which shall be for the instruction of the masses, where lectures on scientific subjects will be systematically delivered and not only illustrative experiments performed by the lectures, but the audience should be invited and taught to perform them themselves . And we wish that the Institution be entirely under native management and control……"

Dr. Sircar's article and the project for the establishment of an association for the cultivation of science received wide appreciation from the enlightened section of public .Encouraged by the response , he published a prospectus in the Hindoo Patriotdated January 3,1870 and invited all well-wishers of progress of India to contribute their quota in furtherance of the project.The paper ,in its editorial columns, supported the great venture of Dr. Sircar and regularly published notices and reports of activities of the association as long as it was an circulation.The first subscription account opened on January 24,1870 with a contribution of Rs. 1000/- from Babu Joykissen Mookherjee of Uttarpara and Rs. 2000/- from Raja Kamal Krishna Bahadur, followed by similar contributions from Raja Digambhar Mitra ,Babu jageshwar singh ,Pandit Iswar Chandra Vidyasagar ,Maharaja Jatindra Mohan Togore ,Hon'ble Dwarka Nath Mitter ,Kumar Girish Chandra \Singh ,Hon'ble Ramesh Chandra Mitter,Hon'ble Anukul Chndra Mukherjee and several others.The project was kept before the public eye for the five years for accasional debates and discussion about its scope and purpose and for attracting sufficient funds for its materialization. By early 1875 a new interest in science was generated by Reverend Father E.Lafont's project of building a spectro-telescopic observatory at the St.xavier's College ,Calcutta. This great Jesuit teacher & lover of science was one of the most enthusiastic supporter of Dr.Sircar's scheme and helped the Association in its developments in various way. In the mean time, The new Lieutenant Governor of Bengal ,Sir Richard Temple ,who was keen to encourage science teaching in the educational institution ,expressed his appreciation and support to the proposed scheme of Dr.Sircar when he heard about it.

The first meeting of subscribers was held on April 4, 1875 at senate house of the Calcutta University in the presence of about forty gentlemen. Hon'ble Digambar Mitra was voted to the chair.At this meeting; Dr.Sircar gave a fresh exposition of his scheme and

explained the object and the modus operandi of his proposed Institution. Here we find him stating very clearly that the need of science education is not to be met unless competent science teachers are produced in the country in adequate numbers, that science teaching and learning are a process which must be accompanied by original research and that science is a part of culture which must be cultivated for its own sake. Another significant feature of the scheme was that the proposed Institution was to be founded, organized and managed with the country's own resources without seeking Government aid. Dr. Sircar believed that to foster the growth of scientific research in an Institution be contemplated, sturdy independence and freedom from Government interference were a *sine of qua non*. This was the basis of his original scheme. The first meeting of subscriber endorsed the projector's exposition of the aims and object of the proposed association and directed that immediate steps be taken for its establishment.After seven months, the second meeting was held on November 20,1875 at the same senate House of the Calcutta University Rev. Father E.Lafont ,S.J. ,Rector of the St. Xavier's College presided over meeting.In this meeting , A provisional committee of 25 person, with Father E.Lafontas Chairman and Dr.Sircar as member secretary ,was appointed to drew up a plan for the organization of the Science Association.The provisional Committee meet on December 16,1875 at 3 P.M. in the Library room of the Sanskrit College , under chairmanship of Rev. Father Lafont. In this meeting Dr. Sircar stated the object as follows :

" The object of the Association is to enable the Native of India to cultivate Science in all its departments with a view to its advancement by original research, and (as it will necessarily follow) with a view to its varied applications to the arts and comforts of life."

Regarding the branches of science to be pursued, the scheme suggested 1. General Physics; 2. Chemistry; 3. Astronomy; 4. Systematic Botany; 5. Systematic Zoology; 6. Physiology and 7.Geology. A rough estimate showed that a sum of Rs.1 lakh would be needed for starting all the sections proposed in the scheme. Babu Nilmonin Mitter ,engineer and member of the committee estimated that Rs 50,00.00 /- would be required for a building consisting of a lecture theatre to accommodate about 300 persons and three adjoining rooms to serve as laboratories , and for a piece of land about a couple of bighas in area whereon to erect the building. All this was clearly not possible, to start with, with the sum of Rs. 80,000/- subscribed up to that time. The Committee therefore recommended that, instead of waiting for a full fledged institution , a beginning should at once be made with only three sections,e.g. General Physics ,Chemistry and Physiology. These three subjects were given preference because these are the only branches of science which have received permanent professorship

at the Royal Institution of London. It was estimated that these sections would be require about Rs. 30,000/- for the purchase of books, instruments and furniture.That was haw the sum of Rs. 80,000/- was proposed to be spent for starting the institution ,leaving nothing monthly expenses. The most conservative estimate showed that a sum of Rs. 500/- to Rs. 300/- for the three head workers and Rs. 200/- for experiments , publication of transaction and other current business ,would be necessary each month for running the institute. The Committee recommended that this sum should be raised from monthly subscriptions fixed at a minimum sum of Rs.1/- and believed that it would not be difficult to raise it 'from our enlightened millionaires who have already so very nobly come forward with donation to found the association, and who would, we are sure be very glad to help on its continuous after it has come to existence.'

Thus The Association was formally established at the third meeting of subscribers to the projected Science Association, held on January 15,1876 at 4 P.M. in the Senate House of the Calcutta University. Lieutenant Governor Sir Richard Temple presided over the meeting. A large number of subscribers and several invited guests which included prominent men like Mr. H.Woodraw, Director of Public Instruction, Mr. J Stacliffe ,Principal of Presidency College and Registrar of Calcutta University and Prof. Alexander Pedlar ,Professor of Chemistry at Presidency College , were present. This was crucial meeting not only because the Association was formally established and launched into its career of engaging in fundamental studies and researches in science but because it survived the attacks of the protagonist of technical education who wanted to convert the association into a technical institution.

For some time past, the Indian League, a sami-political organization which became defunct later on had been agitating for technical education and had prepared a scheme for the establishment of a technical college on the model of technischen Hochschulen such as then existed in Switzerland and Germany. The league argued that a technical college would provide the same facilities for training in science as were being --contemplated by Dr. Sircar's projected Association and would at the same time create the much needed employment opportunities among educated young men. A vigorous press campaingn for attracting support for the scheme had also been started, in the course of which Dr. Sircar's merely for the mental pleasure it afforded. Suggestions were made for the amalgamation of both the projects into a single institution undertaking teaching in science as well as instructions in the mechanical arts. The Government was approached for its encouragement

and patronage, and the records show thatv Sir Richard Temple was somewhat sympathetic to the technical education scheme. Dr. Sircar had anticipated all this. Hev briefed the Governor about the aims , objects and the proposed organization of his institute.His supporters among them Raja ramnath Tagore ,Dr.Rajendralal Mitre, Babu Digamber Mitter ,Raja Jatindra Mahan Tagore ,Raha Kamal Frishna Bahadur, Babu Rajendra Dutta and Bramhananda Kesab Chandra Sen came fully prepared a debate should there be one. Some of the members of the league e.g Babu Kalimahan Das ,its secretary and Babu Sambhu Chandra Mukherjee were also present.at the request of Governor , Sambhu Charan Muhherjee and Babu Kalimahan Das of the Indian League spoke on their scheme for the Technical College.

At last, thanks to the skilful conduct of the meeting by Sir Richard temple who, despite his sympathy for technical education, supported the object and plan of the Association, the meeting ended happily with the establishment of the Association, the meeting ended happily with the establishment of the Association with aims and object as recommended by Provisional Committee. A committee of management was appointed with Sir Richard Temple as president and Dr. Mahendra Lal Sircar as secretary.

Events moved fast after the establishment of the Association. In a minute dated February 21,1876 ,the Lt. Governor offered to the association for occupation free of all charge of an eligible building with its premises at 210 Bow Bazar Street at the junction of the College Street & Bow- Bazar. The condition attached to the offer were that at least Rs.70,000/- should be actually obtained by donation , of which a sum of Rs. 100/- should be promised for two years. The minute also conveyed the decision of the Government to leave the association unfettered in the managements of its own affairs. The offer was readily accepted . The Committee of Management ,however,requested the Governments to make over the building and premises as a free gift to the association , to which Govt. did not agree but allowed occupation of the premises ‘so long as the association obtains a monthly income of Rs. 100/- in addition to interest of the Rs. 50,000/- to be invested in Government securities.’At last , in this premises , the association was formally inaugurated on July 29, 1876, and its work practically began from the date.

3.2 Development work other than research activity (including building,library , workshop, equipments etc.) :

The building of the association obtained from the Government was old and incommodious. Under conditions of temporary occupation and without rights to the property,

it was neither possible to build new structures nor make addition to the existing building for the development of the laboratory ,preservation of the instruments ,accommodation of practical classes and the holding of lectures and demonstration. Urgent need was felt for a commodious Lecture Theatre so that the room then being used for the purpose could be utilized for purposes of laboratory and practical classes. On August 19,1880, The committee of management decided to apply to the government, proposing to purchase the house and the premises at a price not exceeding Rs.30,000/- . In a letter dated December 3,1980, the Government agreed to sell the house outright to the association for Rs.30,000/-. The Government securities worth Rs.30,000/-were sold and a deed of conveyance was completed by September 1881.

Soon after purchase of the house and the premises , the committee of the management appointed a special committee, wity Dr. Rajendra Lal Mitra chairman ,to look after the question building a suitale Lecture theatre. The special committee met on February 13, 1982 and recommended that a large Lecture theatre capable of accommodating about 500 person should be built. The recommendation also included a proposal for the construction of a tower the upper part of which was to be used as an astronomical observatory. Babhu Nilmony Mitra and Babu Khetter Mahan Bose were requested to draw up the plans & estimates.After a great deal of discussion, two plans were prepared by these two engineers members of the committee. The plan provided for a Lecture Theatre ,a verandah on the south and a tower , estimated to cost about Rs.30,00/-. At the request of the Governor , the president of the association ,the plans were referred to Colonel Trevor & Mr. Martin for opinion. Mr. Martin made several costly suggestion to improve upon the architectural appearance of the building ,which could not be accepted financial reason and the association had to be satisfied with good acoustic properties and desired internal accommodation. Messrs Mohendra Lal Chunder and Co were appointed as contractor for constructing the building. The foundation stone was laid by Lord Ripan ,Viceroy of India on March 13 ,1882,and new lecture Thetre was inaugurated by him two latter at the 7th annual meeting held on March 12,1884before a large gathering of about 700 persons.

Four years later, the need for contracting a new laboratory building became urgent. The old building had become so dilapidated that it threatened to came down any moment. At the annual meeting held on April 30,1988, Dr. Sircar forcefully advocated the need for a new laboratory building and again appealed to the members for funds.In 1889 ,The Maharaja of Vizianagram came to the rescue by making a princely offer of Rs.25,000/- in aid of the

building ,of which he paid Rs. 5000/-immediately to enable the association to start the work. Next year ,on March 27,1890,on the occasion of laying the foundation stone of the new building by Marquess of Lansdowne ,Viceroy of India ,the Maharaja generously offered a further sum of Rs.25,000/-,as plan and estimates involved an expenditure of about Rs.50,000/-. It was unanimously decided to designate the new laboratory after the name of the benevolent donor. The Vizianagram Labaratory was completed in 1891.The Lecture Theatre was the finest auditorium in the city. The Laboratory remained an ideal place of scientific work for many years to come. With the increase in research activities, there was need of scientific instruments, journal and workshop facilities. The financial position of the association at that time was far from satisfactory. Donations from time to time were obtained for organizing the laboratories of the association. In 1917 Rai Bahadur Dr. Durga Dass Bose made a gift of Rs. 5000/- and two years latter a special donation of the same amount was also received from an anonymous donor. In 1921, Rai Bahadur Onkermal jatia made a gift of Rs. 2,000/- for laboratory equipments and Mr. M.S.I. Chari donated Rs. 3,000/- for workshop. Dr. Rasik Lal Dutta organized the library and framed rules for its use in 1917.In the years 1925 and 1927 Govt of India sanctioned a non – recurring grants of Rs.10,000/- towards renovation of the laboratories. With this amount arrangements were made for separate rooms for studies on X-ray ,light scattering , magnetism, sound ,chemistry and for the library and the reading room. In 1927 Govt. of India increased the annual grants to Rs.20, 000/- for periods of five years. After a couple of years, a liberal donation of rupees one lakh by Rai Bhahadur Veharilal Mitra helped the association to create an endowment professorship in the name of its founder.

The committee of management of the association during 1943-46 also realized the supreme need of re-organizing the activities of the Association so that it might to play an increasingly important part in the tropical problems of scientific research in the post-war period. The committee very rightly felt that it must not be satisfied with any plan of mere rebuilding and extension of the laboratories or of improvement of its equipments, but that the planning must be reorganize the new trends in scientific research.During this existing transition periods , the association was fortunate to have as its president Perofessor Meghnath Saha ,architect of many scientific organizations in India and a firm believer in the important role of science in the national developments plan. He steered the implementation of the developments plan of the association with all his natural vigour and enthusiasm. Since the old building and space available at 210 Bow Bazar Street ,Calcutta ,proved inadequate ,plan

were accordingly made for the acquisition of a large plot of land and construction of a new building at an estimated capital cost of Rs.30,25000/- . In 1947, the Govt of India provided with an annual recurring grant of Rs.2,66,700.00/- towards implementation of new plan and during the ensuing four years the association established the six research departments as envisaged in the developments plan.The grant was gradually increased as the development plans progressed. Later on ,the Governments of West Bengal agreed to provide matching recurring and non – matching recurring grants,in the ratio of 1 to 6 and 1 to 2 of the respective central governments grants. Each research departments was in charge a Professor or a reader and was staffed with lecturers, technical officers,assistant and senior & junior scholars.The library which had perhaps one of the best collections of scientific journals pertaining to physical science in india, was considerable expanded. The workshops were also substantially developed.

The new building plan of the association materialized through the handsome grants of Rs.4.32 Lakhs by Govt. of India ,Rs.7 laks by the Govt. of West Bengal ,and an interest free loan of Rs.5.8 lakhs from the Govt. of India. Later on ,a sum of 7 lakhs was obtained from the sale of proceed of the old building of the association at 210 Bow Bazar Street. A plot of land covering nearly 9.54 acres ,opposite to the Jadavpur University campus and near the Central Glass and Ceramic Research Institute was acquired in 1947. The foundation stone of new building of the association for the cultivation of science was laid at this site on Sunday the 26th September ,1948 by Dr. B.C. Roy ,Chief Minister of West Bengal. A respectable gathering of distinguished scientists , reprentatives of local Industry and the elite of the town attended of the function. Dr. Shanti Swarup Bhtnagar ,the secretary of the Govt. of India, Department of scientific research came from Delhi to join the celebration.Messages of goodwill were received from all parts of India from different persons including the Governor – General, Prime Minister Pandit Jawaharlal Nehru , Sadar Vallabhbhai Patel, Dr. Syamaprasad Mokherjee ,Sarder Baldev Singh,Shrii Joiramdas Doutatram ,Shree N Gopalashami Ayyanger, Maharaja of Coochbehar etc.Professor Saha ,President of the Assiociation ,Presided over the function.The construction of the new building of the association was taken up early in 1949.and by the end of 1950 the ground floor,the assembly Hall ,the library ,the workshop,the Cryogenic Laboratory and several minor construction works were completed. The Laboratories,Library,and the iety workshop were shifted in stages to the new building since the beginning of 1951 and were made ready in good working environment by the end of the year for the August visit to the Primr Minister Pandit

Jawaharlal Nehru in January ,1952.From the year 1951,the six research departments ,the library ,the workshop and the administrative office continued to function actively in the new building of the Association at Jadavpur.In 1952,The Govt. of India sanctioned the post of a whole time salaried Director, which was offered to Professor M.N. Saha. He joined the association on January 1,1953 in succession to Professor P.Roy who had been acting as an honorary Director of the Association since 1947.The Association was also fortunate to receive the valuable services of Professor P.Roy as its first professor in Inorganic Chemistry.

Soon after the assumption of his office, Professor Saha set about the herculean task of equipping the laboratories with research apparatus and instruments which were necessary to continue work in the rapidly developing fields of the fundamental researches in Physics and Chemistry.Hitherto the Association had received capital grants towards construction of the laboratory buildings,but little or nothing for equipping the laboratories along modern lines. The building program of the association as originally planned in 1946 , could also be carried out only partly by the end of 1952-53.Pursuant to a memorandum giving details of the association's original plan of development with financial implication,which was accepted in 1946 by the Government of India ,the association was asked by the Governments to prepare a Five –Year plan of the association. A plan submitted to the Govt. of India was subsequently revised in view of the reduction in the available resources. The revised five year plan of the association which coincided with the second five year plan period Govt. of india,envisaged non-recurring expenditure of Rs.17.23 lakhs on building and Rs.21.4 lakhs on staff, laboratory, workshop and library and general charges covering the years 1956-61.During this transition periods, the association suffered a grievous loss at the sudden and untimely death ,at Delhi on February 16,1956 of Professor M.N.Saha. During this period Prof. M.N.Saha gave practical shape with his characteristic energy and drive. It was mainly through his effort that funds were secured from Government of India and Government of West Bengal for purchase of land and construction of building at Jadavpur.It was again through his persuasion that the Governments of India's annual recurring grants was raised from 20,000 per year to over Rs.500,000 by 1955. Since 1953, as the full time Director till the day of his death ,he worked ceaselessly for consolidation of the first phase of developments of the association and completed plans for the second phase of its developments. In short, Professor Saha gave us a new outlook and purpose to the association in consonance with new role that he envisaged for science in society and in the state. Thus it was largely thoroughly his effort that the dream of

Late Mahendralal Sircar ,the founder of the association ,of making it a leading research Institute was realized.

After the death of Professor Saha, Professor Ray was appointed Officiating Director of the Association in which capacity he continued still the end of the 1958.Professor S.C Sircar, the MLS Professor of Physics ,succeeded professor Ray as the acting Director.

The continuance of the economy drive of the Government of India forced the association to curtail some of its development plans included in second Five-Year Plan. In fact, in the entire plan periods of 1956-61,actual receipts fell far short of the provision made in budget estimates prepared accordingly to the five year plan and submitted to the Government of India. This led to only partial fulfillment of the development of the research activities of the association as envisaged in the plan.

During the year 1956-57,a new Department of Magnetism was curved out from the parent department of General Physics ,X-ray and magnetism. The Departments of applied Polymers,later on renamed as Macromolecules was created in 1957-58.The construction of the first floor of the main research building undertaken towards the end of 1956-57,was completed during this plan periods. The first floor of the workshop building was also completed and housed the newly created department of Macromolecules during the second plan.

At a special general meeting of the association in November 1958,a reviewing committee was appointed to review its work and to make recommendations on the plan of expansion and developments of scientific research activities of the association in all its existing departments keeping in view the main objectives and tradition of this institute of carrying out fundamental research. The committee was constituted as follows : (i) Sir Harry Melville ,FRS ,Secretary, Department of Scientific and Industrial Research ,UK (Chairman) (ii) Professor M S Thacker, Director General, Council of Scientific and Industrial Research ,New Delhi (iii) Professor K.S Krisnan,FRS ,Director ,National Physical Laboratory and National professor (iv) Professor D.S. Kothari, Head of the Departments of Physics ,Delhi University and (v) Professor K Banerjee ,Head Departments of physics ,Allahabad University (Secretary). The committee meet in January ,1959 and submitted a report which was considered by the council of the Association at its meeting held in March,1959 and by a special general body meeting of the association held in May ,1959. In its general remarks the committee stressed the fundamental character of the association as: “The tradition of the

association is to continue to undertake pure research. It is felt that this should continue. Therefore the condition of work and an atmosphere must be developed to maintain this tradition" Steps were taken to implements gradually the more urgent matters incorporated in that report in the existing set up of the association.

Professor K Banerjee who had a record of distinguished services to the association as the M.L.S Professor of Physics, assumed the Directorship of the Institute by the end of 1959.Following a request from Govt. of India in 1959-60, the association prepared and submitted its proposal on development and expenditure during third year plan periods 1961-62 to 1965-66. An initial plan proposal for a sum of Rs. 1,38,11,336/- apportioned between the Government of India and Government of West Bengal was later reduced and revised according to an indication from the Government of India to a sum of Rs.80,71,379/- and Rs.16,51,386/-as the shares from the Government of India and Government of West Bengal respectively. The actual receipts during the Third plan period from the Government of India and Government of West Bengal in the background of this proposal were Rs.68,06,963/- and Rs.14,68,305/- respectively. Thus, the national emergencies of 1962 and 1965 obliged the association to introduce severe cuts in its budget estimates and lag behind progressively from the plan targets. For a greater part of the plan period most of the new posts provided for were held in abeyance, and expenditures on all items reduced as far as possible. Considering the inflationary trend during this period not much development could be achieved in the Third plan beyond making up of the short –falls of the second Plan and consolidation of the activities proposed in that plan period.

The central Scientific Services Section was started during the Third year plan period with the purpose pf providing centralized facilities of various sophisticated and costly equipments to the different research Departments.Facilities for the Director's research was separated from those of the Central Scientific Services. During this plan period a long needed hostel was also constructed within the campus with an accommodation capacity of about twenty research Fellows of the Association.

By the end of 1965 Professor K Banerjee retired from the post of Director and Professor B.N Srivastava, Head of the Department of General Physics at the Association was appointed as the acting Director. He continued his office up to the end of 1968 when the present Director, Professor D.Basu ,Head of the Department of the Theoretical Physics succeeded him on January 1,1969.

Second Reviewing Committee: In June, 1968, the Union Education Ministry appointed the Second Reviewing Committee to review the activities of the association during the period 1958-68.The final committee consisted of the following members , (i) R.C Majumder , Pro-Vice –Chancellor,Delhi University (Chairman) , (ii) Dr. R. Ramana ,Head of the Nuclear Physics Division ,Bhaba Atomic Reserch Centre ,Bombay (iii) Professor R.C Mehrotra , Head of the Department of chemistry,university of Rajashtan,Jaipur (iv) Professor N.R. Tawde,Vice –Chancellor,Marathwade University,Aurangabad and (v) Professor S K Bhattacharyya , Head of the Department ,Chemistry ,IIT ,Kharagpur. The Committee held a number of meetings in Calcutta and Delhi during 1969-70 and submitted a report to the Government of India in 1970 which was approved by the Government of India. The report was received by the association in 1971 and was placed before the council of the association has adopted a member of amendments and alternations to the regulations and Bye – laws of the association based upon the various recommendations of the review committee, and a special committee appointed by the council.

The Fourth Five Year Plan of the Association was first drafted and submitted to the Government of India in 1964, mainly with a view to strengthening those research subjects in which good degree of success had been already achieved and also to intimate new lines of research in a few chosen rapidly growing modern fields particularly of inter-disciplinary types. The total size of the plan in financial terms was Rs. 3,24,93,781/-which was revised in 1968,keeping the original projects un altered and taking into consideration increased price of structure of scientific instruments and equipments, various materials and revised rates of allowances. The total revised estimate came to Rs.3,76,66,021/- with the Government of India share at Rs. 2,89,93,579/-and the Govt. of West Bengal share at Rs. 86,72,442/-.In July, 1968 a working group set up by the Government of India recommended ,among others , an annual plan growth by 25% of the amount provided by the Government of India for plan expenditures during 1968-69 taken as the base year. For the non-plan expenditures an annual increase by 3.5 % of the amount provided during 1968-69 taken as the base year, was allowed. In accordance with these recommendations and also on the basis of the later discussions with the Government of India, the plan proposals were reworked to total financial requirement Rs. 2,29,90,053/- including the non-plan establishments and the plan development with the Government of India's share Rs. 1,79,91,764/- and the share of the Government of West Bengal at Rs. 49,98,289/- . Against this original budget the total sum received during the Fourth Plan Period,1969-70 to 1973-74 were Rs. 13,86,835/- and

Rs.2,31,141/- in the recurring and Rs. 9 Lakhs and Rs. 4 lakhs in the non-recurring accounts respectively from the Government of India and the Government of West Bengal. The economy measures had to be enforced in the wake of the war in Bangladesh during this plan period and this again led to the curtailments of some of the Fourth Plan Projects as well as the project taken up from the Third year Plan ,during this period,the long standing difficulties in the setting of the scales of pay of the non-academic and academic staff were settled.Also some of the basic analytical instruments such as a 60 MHz NMR Spectrograph,a granting Infrared Spectrometer, an Analytical Gas Liquid Chromatograph and an Analytical Ultracentrifuge were procured. A liquid Nitrogen Plant was also purchased and commissioned during these periods.

The association, through the five year plans, had always endeavoured to keep abreast of the modern trends in research. In spite of many unforeseen difficulties during this plan period's substantial progress was made in many field of research.

In 1973, the association formulated the Fifth Five year Plan proposals for the years 1974-75 to 1978-79 keeping in view the fact that to put this institute at the forefront of scientific research, it would be necessary to make a large investment in personnel and modern equipments during this plan periods. The initial proposal submitted to the Government of India in May 1973,envisaged a capital expenditure of Rs.65,13,000/-during the plan period. A committee appointed by the National committee for Science & Technology at its meeting held on June 29, 1973 had preliminary discussions regarding the activities of the Association with special reference to the programmes which this Institute would take up during the Fifth Plan periods. To examine in details the various programs drawn up by the Association, a team consisting of the following members visited the association in August ,1974: (i) Professor C.N.R Rao (Chairman), (ii) Dr.V.G. Bhide (iii) Dr. Nitya Nand , (iv) Dr. A.K. Rao and (v) Dr. R.S. Deshpande. They discussed in details with the Director and the Academic members of the association and forwarded their recommendation to the Department of Science and Technology, the Government of India. The committee was generally of the view that the reorientation of the research activities of the Association was necessary so as to enable the Association to achieve excellence in chosen fields during the Fifth Plan. In accordance to their recommendation the original Fifth Plan project have been received, reoriented and their being pursued. During the First year of the Plan (1974-75) Government of India allocated Rs. 5,00,000/-for the recurring (Plan) , Rs.21,66,000/- for the recurring (Non-Plan) and Rs. 7,00,000/- for the non-recurring (Plan) expenditures. The grants received

from Govt. of West Bengal during the period are Rs. 1,80,000/-for recurring (Non-Plan) and Rs. 41,666/- for recurring (Plan).

Since the Third Plan period , in addition to the Director's Research Unit , the following research departments have fully active : (i) General Physics & X-Rays (ii) Magnetism (iii) Optics (iv) Theoretical Physics (v) Physical Chemistry (vi) Organic Chemistry (vii) Inorganic Chemistry (viii) Macromolecules ;

The service departments on the technical side include good workshop, the central scientific services which houses sophisticated equipments required by more than one department, a well-organised library having about more than 1,00,000 volumes of books and journals.

3.3 Research Activity :

3.3.1 Pre-Independence (1876-1946):

3.3.1.1 Period (1876-1907)

At the 3rd meeting of the committee of management held on August 10,1876 , Rev. E. Lafont , Dr. Mahendra Lal Sircar and Dr. Kanai Lal Dey were requested to delivered the lectures free of charge ,- Rev. E. Lafont and Dr. Sircar on Physics and Dr. Dey On Chemistry. A monthly recurring expenditure of Rs. 148/- towards lecture assistant (Rs.25/-) ,Clerk (Rs.20/-), Lecture expenses (Rs.30/-, Lighting expenses (Rs.15/-) ,Proter,bearer,sweeper and petty contingency was passed. The work was started with sum of Rs.92/- advanced by Dr. Sircar for the purchase of chemical apparatus.In 1978 , the donation of Babu Kally Kissen Tagore came as a great relief and it possible for the association to equip a good laboratory.The teaching work of the association ,as we have seen , began shortly after the inauguration ,with the appointment of Father Lafont and Dr. Sircar as honorary lecturers in Physics and Dr. Kanai Lal Dey as an honorary lecturer in Chemistry. Father Lafont started his course on 24.08.1876; Dr. Sircar did not start his course before 1878; Dr.Kanai Lal did not lecture at all. The Chemistry lectures were actually started by Tara Prasuna Roy in 1879. The progress of research work in the first two years was rather halting due to the repair work of the building ,the illness of secretary and Father Lafont's leave of absence in France due to indifferent health. The period was ,however , utilized in purchasing equipments and instruments. A sum of Rs. 4000/- was advanced to Father Lafont for importing from france an assortment of instruments and apparatus for illustrating lectures on thermotics, acoustics, electricity and optics. Beside these laboratory was enriched by a

sympalmograph,a phonograph, and a Caitellet's machine for the liquefaction of Oxygen.The physics departments was further equipped by fresh installments of instruments ,chiefly thermotics,acoustics,electricity and The Chemistry Departments was also equipped by a pretty nearly complete set of chemical apparatus.It was needless to emphasize that for the early history of science teaching in this country , the activities of the association during this periods are of great significance , and it will be more convenient to discuss them subject wise.

Physics and Mathematics:

Rev. Father F. Lafont who started the first course of lectures in physics in 1876 continued still 1893. He lectured on light , General Physics and sound averaging between 20-30 lectures per year. His discourse on light included an exposition of the nature of light on the undulatory theory ; photometry ; law of reflection and refraction with practical demonstration ; spectroscopy and its new role in the discovery of new elements and unraveling the composition heavenly bodies; the phenomenon of dispersion of clour ;the human eye ,its defect and remedies; optical instruments like the telescopes and microscopes.In General Physics ,the subject treated were forces and levers; gravity and law of failing bodies ; pendulum;the balance ;pPhysical properties of gases and their practical application such as liquefaction of gasses etc.After Father Lafont , Rajendranath Chaterjee taught optics and general physics from 1894 for amumber of years.

Dr. Sircar first started his lectures on static and dynamics Electricity and Magnetism latter on added Heat to his subject of discourse.In Electicity ,he used to proceed from the principle conversion of energy through the fundamental phenomenon of statical electicity ,Leydon jars and powerfull electrical machine to the history of voltaic or dynamical electricity with emphasis on its chemical origin.Marked by great lucidity ,Dr. Sircar's lectures were rendered all the more attractive through his habitual exposition of the subject from a historical point of view .

In 1885, Dr. Jagadish Chandra Bose ,Professor of Physics ,Presidency College offered his services to the association to hold practical classes in Physics.He started his lectures on production of magnetic cruve,magnetization process,experiments of static electricity and thermo-electricity . Dr. Bose held these demonstration only for a few years.His own preoccupation with experimental investigation on electrical waves at the Presidency College soon made it difficult for him to continue his work at the association.

In 1887 ,Sir Asutosh Mookerjee who delivered lectures on physical optics, Mathematical Physics and pure mathematics. His lectures were of exceptionally high standard . Asutosh Mookherjee delt with the subject from the theotical point of view, introducing the elastic solid and electromagnetic theory of light.Neverthless Asutosh Mookherjee introduced a new course of lectures under the little of the Mathematical Physics to deal with Hydro-Kenetics and the theory of potential.In Mathematics , Asutosh Mookherjee's course of lectures dealt with analytical geometry ,Boole's Theorems on linear transformation ,Generak Cartesian equationof lines of the second order in relation to their foci,theorem of central conics and non-central conics,hyperbolic function and gamma function etc.Asutosh Mookherjee taught at the association up to 1890.After him ,Mahendra Nath Roy delivered some lectures on pure mathematics and Syamadas Mukherjee on Geometrical ,Physical Optics and Mathematical Physics.

Astronomy :

Astronomy had a very brief existence at the association.Father Lfont's Spectro-telescopic observatory at the Xavir's college was expected to arouse a great deal of interest and enthusiasm for the subject .In 1880, Kumar Kanti Chandra Singh Bahadur presented to the association a valuable Equatorial of seven inches aperture made by the reputed German MakerM.Merz with a stand made by Mr.Browing of England. A number of appliance to demonstrate astronomical phenomena such as the changes of seasons, the eclipse, the progression and retrogression of planets etc. Lectures on astronomy were started in the year 1880 by Rev. Father A, de Peneranda ,superintendant of the observatory at St. Xavir's College.He lectured on earth in space and time, planetary system,Keplar's law and Newtan's principle etc.

Chemistry :

Dr. Kanai Lal Dey , medical graduate of Calcutta Medical College to whom fell the first choice of starting the Department of Chemistry at the association ,had a special study of chemistry and taught it first to the student of the Campbell Medical College and afterwards in the Calcuuta Medical College where he also carried on the duties of the Chemical Examiner to the Government for some time. But eventually he could not take up the classes and Tara Prasanna Roy who later on become the Assistant Chemical Examinerwas persuaded to start the classes in 1878. He carried on his work with great devotion till 1885, deliverning on an average 25 lectures, besides taking practicval classes. In 1885 ,Ram Chandra Dutta took over

for him the responsibility of conducting practical classes and Dr. Rajani kanta Sen agreed to delivered the theoretical lectures.Rajani Kanta continued till 1887,and thereafter we find Ram Chandra Dutt taking both theotical and practical classes till he died in 1898.From 1899 ,Dr. Chunilal Bose volunteered to assume the responsibilities of this department and discharged them with great ability for many years. He also started a new class for commercial Chemical analysis.He laid greater stress on physical Chemistry,history of important of chemical discoveries and on industrial Chemistry. By a letter dated March 12,1900 ,the submitted a scheme for the opening of a class for commercial analysis with the idea of producing trained chemical analysts who could be gainfully employed in paper mills,by the iron manufactures , the soap manufactures and the custom houses in Calcutta ,Madrass and Bambay . The proposal was readily accepted and the commercial class was opened during the session 1902-1903.The results of analyses performed at the analytical laboratory were published for several years in the annual reports of the association beginning from the year 1906.

Geology:

In 1887 , Dr. Pramotha Nath Bose who distinguished person in the field of geology offered to teach geology at the association . In that year ,he delivered a course of six lectures on the scope of geology ;rocks and their classification ,denudation;deposition ;stratification and physical condition of Earth. That was the beginning and end of a subject whose importance in our educational curriculum was not realized until many years later.

Life Science, Physiological Chemistry, Biology and Botany

The year 1894 is important inasmuch as it witnessed the opening of life science as subject of instruction of the association. Dr. Nilratan Sarkar who had already set up an extensive practice as a physician agreed to give gratuitous lectures on Physiological Chemistry. He held classes for about two years, lecturing on the proteids, their reaction and classificationetc. The same year Mr.Banwari Lal Chaudhuri ,a graduate of Ediburgh University where he specialized in Biological Scence offered his honorary services to take charge of the Biological section and deliver courses of lectures to the student of the association.On November 27,1894 ,Dr.Sircar opened the Biological courses with an admirable historical introduction and discussion of its importance, various divisions and relation to other sciences. Dr. Lal lectured on nature and origin of life, comparison and contrast between plan and animal life.B.L Chaudhuri's emphasis was on Zoology.A more comprehensive course of Botany was started by Giris Chandra Bose from 1897,coverning vegetable cells , tissues,

structure of the steams, root and leaves ,chemistry of plantchemical process within the plant etc.Under the able guidance of these two distinguished teachers,Biology and Botany classes continued and remained popular for several years.

Dr. Mahendra Lal Sircar died on February 23.1904. His son Dr.Amrita Lal Sircar was elected next honorary secretary and it was during his time that association turned a new leaf in its history when in 1907 young Chandra Sekar Venkata Raman started his work in its laboratories.

3.3.1.2 PERIOD (1907- 1933)

In 1907, Chandrasekar Venkata Raman came to Calcutta as an officer in the finance department, Govt. of India, at the Accountant General's office.Though P.C.Roy and J.C Bose were conducting original researches at that time in individual capacity there was very little scope of doing research in India in an organized manner. In August 1907 ,Raman enrolled himself as a member of the Indian Association for the Cultivation of Science and obtained permission for carrying out researches at its laboratory in his spare time. Within a short time he was able to communicate a large numbers of research papers in many journals of international repute. A new era of scientific research activity dawned and workers from the rest of the country began assembling at the association. The years between 1907 and 1933 saw a continued and vigorous growth of scientific research under the leadership of Raman and may justifiably be called *The Raman Periods.*The general activity of the association in the field of teaching of physics, chemistry and botany which started at the beginning of the century continued. The class of commercial Chemical analysis drew a large number of students and a monthly report on the meteorological observations was being published in "The Empire",'The Bengaland "The Indian Mirror". In early stages, occasionally, some scientific papers could be discussed in annual general meeting in addition business transaction of the association. With the increased the research activities,arrangement were made for holding regular scientific meeting for the reading and discussion of scientific papers. The scientific meeting in 1914 had three different section ,namely the Physico-mathematical section ,the Chemical section and the Biological section with Dr. Ganesh Prasad ,Sir P.C Roy and Dr. B. Chowdhury respectively in chair.The scientific meetings soon developed into an Annual Science Convention ,the first of which was held in November ,1917,with an opening addressed by sir Asutosh Mookherjee. Nine paper of Physics ,four on Chemistry and seven on Biological sciences were presented in this convention.By 1926 ,the research activities greatly expanded and consequently it was imperative to make

arrangements for regular and prompt publication of research result within the country. As a result , the Indian Journal of Physics made its appearance in the same year with which incorporated the proceedings of the Association. It may be of interest to note that between 1928 and 1933 more than sixty papers ,dealing with Raman's discovery of the modified radiation in light scattered by various substances ,subsequently known as Raman's Effect were published in this journal. In 1913 , Raman was offered Palit Professorship of Calcutta University and he joined the university in July 1917. Since research facilities were not available there ,Raman was allowed to continue his work at the association laboratories. In 1919, Dr. Amrita Lal Sircar ,the Honorary secretary of the Association passed away and Raman was immediately elected the honorary secretary ,which position he held during the entire period of his stay in Calcutta. Thus the laboratory of the association and the University College of science came under direction of Raman and those who worked with him had the facilities of both these laboratories. In July 1921, Raman went to Europe as a delegate of Calcutta and Baneras University to the University Congress held at Oxford ,England. During his voyage the' mystery of the blue colour of the sea' drew his attention and soon after his return he undertook a comprehensive programe of research on the molecular scattering of light by solid,liquid and gaseous media. In execution of these programmes ,many young and gifted workers from all part of india collaborated with him and this laid foundation of the great discovery a few years later. Raman was elected as a fellow of the Royal Society ,London in 1924 in recognision of his outstanding researches in physical optics,molecular diffraction of light, X-ray scattering by liquids and on molecular anisotropy.In june 1924, he was invited to Canada to inaugurate the discussion on "The scattering of light" and visited a numbers of laboratories in Canada and USA. Again in September 1925, he went Russia as a representative of Calcutta University at the Bicentury Celebration of Russian Academy of Sciences.In Moscow, he delivered a lecture on "the structure of benzene"at congress of Chemistry.

The work on the molecular scattering of light by Raman and his school of workers at Calcutta, led to the discovery of a new light effect. The discovery of the new radiation was published in an issue of Indian Journal of Physics. Following the publication of the discovery, further investigations were taken up in the laboratories of the association by Raman and his associates which included names of K.S. Krisnan ,S. Bhagavantam, L.A. Ramdas , S. Venkateswaran, A.S. Ganesan,S.C. Sarkar , S.Parthasarathi and others. The new light effect was subsequently called "The Raman Effect" and this terminology was latter universally

accepted. The discovery of this effect brought honours to Raman from many quarters and firmly established the name of India in the scientific map of the world.In june 1929 Raman was knighted by the British Government. In the same year he was invited to England to open a discussion on "Molecular Structure and Molecular Spectra" arranged by Faraday Society. In 1930, he was awarded the Nobel Prize in Physics for the year for great discovery and he went to Stockholm the same year to receive the Nobel Prize.

The entire period of Raman's stay at Calcutta may be broadly divided into two phases. In the first phase from 1907-1917, work was done solely in the laboratory of the Association and the second phase from 1918-1933 corresponds to the period when the scientific researchers were carried out jointly in the Association and in the laboratories of the University college of science. During the First phase, he conducted researches mainly on sound and vibration, theory of musical instrument, viscosity, colloid studies, wave optice.In these efforts he was assisted by A. Dey of the Association, who later collaborated with Raman in some of his investigations on sound and vibrations. S.K.Banerjee made intensive theoretical investigation on aerial waves generated by impact and experimental studies with ballistic phonometer.S.Appaswaiyar carried out investigation in acoustics. In the second phase , after Raman joined the University College of Science ,as Palit Professor of Physics ,he was provided with the combined resources of the Palit laboratory and laboratory of the Association. Workeres from different institutions outside Calcutta came to the Association to join the school of Raman. Among them ,mention may be made of C Prasad ,N.K. Sethi K.R.Ramanathan ,L Srivastava,and V.S Tama.The number of research workers increased further ,as Raman introduced new line of investigation on molecular scattering , X-ray diffraction,Electroand magneto –optics. During these two phases ,Raman and his scholars initiated and undertook researches in as many as fourteen different branches of Physics and published a large number of research papers in different scientific journals abroad and in India.

Though the scientific activities during the period were concentrated mainly on Physics, some original works in chemistry were also conducted.Two research scholars Manindranath Banerjee and Jagadindranath Lahiri carried out interesting investigation in chemistry under Prof.Rasik Lal Dutta, during these periods.

3.3.1.3 PERIOD (1933-1946)

When Professor C.V Raman left Calcutta to join the Indian Institute of Science, Bangalore in 1933 as its First Indian Director,a whole time researches Professorship with power of administration over research laboratories, Library & workshop,under the name of Mahendra Lal Sircar professor of physics was created at the association by combining donation from Raja Veharilal Mitra with the Mahendra Lal Sircar memorial funds and other funds. This action of the association partially fulfilled the long cherished desire of the Founder, to establish full time research professorships.

The choice of the first appointment to the professorship fell on Dr.K.S Krishnan who had collaborated with professor C.V.Raman in his celebrated works on molecular physics ,Raman effect,magneto-and electro-optics. Professpr krisnan joined in 1933 and started work on crystal magnetism with dia-and paramagnetic systems. This phenomenon was first investigated by Faraday but its great importance and implication in crystals physics were not felt till Krishnan received the interest in the subject. Apart from this line,works on Raman effect, crystal optics,X-ray Crystallography , and absorption spectra were also continued.The publications at that time from the association on crystal magnetism drew the attention of the scientific world and its great fundamental importance in elucidating crystal structure and energy states was soon realized. International recognition came to professor Krishnan for his work and he was elected to Fellowship of the Royal Society, London in 1938.In these research activity ,he received very active collaboration with A Bose,B.C.Guha and N.C. Chakrabarty. Prof. Krishnan in collaboration of A. Bose was also the pioneer in India to start work on low temperature physics and cryogenics.

In 1942,as a precautionary measure against the treat of the air rapid,part of the library consisting of rare books and some journals and other valuable apparatus were removed from Calcutta to safer place at Nadia.Professor kirsnan left the association the same year and joined the professorship at the Allahabad University.When Books ,Journals and other apparatus were later brought back to Calcutta,research associates of Frisnan resumed their work on crystal magnetism and other problems.Dr. K Banerjee ,Reader in Physics, University of Dacca, was offered in MLS professorship and on joining the post in 1943, he initiated studies on the crystal and molecular structure of organic substances and law angle scattering of X-rays. Dr. Sircar who latter succeeded Prof. Banerjee as the MLS Professor and other carried out the work on Raman and fluorescence spectra and X-ray analysis of jute fibres.In this periods , research work mainly confined in physics and allied subjects.

Towards to end of this period, Professor P.Roy became Honarary Director of the Association. During this periods, When the world war II was drawing to an end and India was on the threshold of attaining independence, a need for reorganizing work of the association was felt. The association was fortunate to have as its President ,Professor Meghnath Saha who set out to draw a new development plan for the Association . Soon after the independence in 1947, the history of the Association entered new phase.

3.3.2 POST-INDEPENDENCE (1947- 2000)

The remarkable and striking achievements of science during and after the world war - II brought radical changes in the methods of scientific research. Untill then , methods and techniques which traditionally centered round individual workers proved increasingly inadequate as science assumed the character of co-operative and multi disciplinary character.The scientific research became costly ,depended more and more on highly sophisticated equipments ,the high cost of which demanded carefully planning for successful and optimal utilization of limited resources.

The eight research departments namely (i) General Physics & X-Rays (ii) Magnetism (iii) Optics (iv) Theoretical Physics (v) Physical Chemistry (vi) Organic Chemistry (vii) Inorganic Chemistry (viii) Macromolecules ; along with Director's research unit represent broad areas of Physical and Chemical researches. Some specific lines of work pursued have been briefly outlined under the respective heads.

3.3.2.1 DIRECTOR'S RESEARCH:

A research unit for the Director to carry out researches in his own field of interest started sometime after Professor K.Banerjee joined the Association as its Director. Initially he began his work by utilizing the facilities and equipments available in the Central Scientific Services in the investigation of problems related to crystal structure by X-ray technique. During 1962-63, the Council of the Association decided to provide separate facilities for the Director's Research and made available some research staff and fellows.

Professor B.N.Srivastava, who worked as the Acting Director, after the retirement of Professor Banerjee, from the end of 1965 to 1968, continued his research work in the field of transport phenomena, low temperature physics etc. by utilizing the facilities of the Department of General Physics and X-rays, of which he was the Professor and Head since 1953.

Under the present Director, the research workers of this unit are engaged in carrying out theoretical investigation in the fields of atomic scattering nuclear physics and cosmic radiation.

3.3.2.2 GENERAL PHYSICS & X-RAYS :

Work on the properties and structure of matters, X-rays and Magnetism has been continued for a long time ever since the time of Professor Raman and Professor Krishnan in the old Laboratory of the Association, then called the "Vizianagram Laboratory". The name "Department of General Physics, X-rays and Magnetism" was adopted in 1953 since Professor B.N.Srivastava joined as the Head of the Department. In 1956, the Magnetism Section was developed into a new department , and the old department continued under the name General Physics and X-rays. The major field of research in the department of General Physics and X-rays are structure of organic crystal, X-rays diffraction study of alloys, low temperature physics, transport properties of gases, atomic and molecular collision processes, intermolecular forces, statistical mechanics and properties of thin films etc.

3.3.2.3 MAGNETISM :

The Department of Magnetism, as stated in the forgoing section, was started in 1965 under Dr. A.Bose, first as a reader and later as the Professor, who was associated with Professor Krishnan from his early days in the Association and retired in 1975 after a long and valuable service to the department.

The research workers in the field of magnetism are engaged in the investigation of solid state materials (para-, dia- and Ferro-magnetic) both non-conducting and conducting and cryogenics.

3.3.2.4 OPTICS :

Research in optical spectroscopy, scattering of light and related studies have going on since the days of Professor Raman. The Department , under the name of Department of Optics, came into being during 1948-49 under Professor S.C.Sirkar, a student of Professor Raman, who retired in 1963 after his long and valuable service to the department and the Association as an Acting Director.

Investigations on various aspects of molecular conformations, molecular interactions and absorption, emission and scattering of radiations by matter in different states are being carried out in this department.

3.3.2.5 THEORETICAL PHYSICS:

The Department of Theoretical Physics formally started in 1950 with the joining as Reader of Dr.Basu who later became Professor and continued in that capacity till 1969 when he assumed the post of the Director.

The theoretical physics group at the Association is pursuing investigations on scattering of electrons by atoms, electron capture phenomena, scattering of nuclear by nuclei, Moller scattering, weak interaction and elementary particle physics.

3.3.2.6 PHYSICAL CHEMISTRY

The Department of Physical Chemistry was created in 1947 with the appointment of Professor S.R.Palit, Head of the Department, who continued to render his valuable service to the department until his retirement in 1975.Ùnder Professor Palit pioneering work on various aspects of polymerization was carried out.

The work now being done in the areas of Physical Chemistry covers fields of polymer chemistry, co-solvency, non-aqueous tradition, thermodynamics and electrochemistry.

3.3.2.7 ORGANIC CHEMISTRY :

The Department of Organic Chemistry was given a start with the appointments of Dr.S.M.mukherji, as the Raeder and Mr.P.Bagchi, as the Research Officer in 1949. Towards the end of 1951 the Reader –in –Charge left the Association. In 1953 Prof. P.C.Dutta took over charges as the Head of the Department.

Research in Organic Chemistry has been concerned, since its very inception, with the developing of stereo specific methods of synthesis for multiasymmetric centered physiologically active complex molecules of carbocyclic systems, mostly of terpenoid family.

3.3.2.8 INORGANIC CHEMISTRY :

The Department of Inorganic Chemistry was formally started in 1951 with Dr.P.C.Banerjee as the Research Officer, and research work was started in 1952, when Professor P.Ray, formally Palit Professor of Chemistry, Calcutta University, joined the Association as the Professor and the Head of the Department. After his retirement Professor N.K.Dutta joined the Department as the Professor and Head of the Department and continued in this post up to 1975, when he retired.

Research work in Inorganic Chemistry has been carried out in two of its main branches, viz. Chemistry of Co-ordination Complexes and Analytical Chemistry. Under the Chemistry of Co-ordination Complexes researches have been conducted on preparative and structural aspects of metallic complexes, of non-transitional and transitional metals including the rare-earth metals. In the analytical field, new reagents have been developed for the estimation of trace elements in industrial samples like ores, minerals and petroleum. At present work is being done in the fields of bio-inorganic chemistry and thermal decomposition studies in the solid state.

3.3.2.9.MACROMOLECULES :

The Department of Macromolecules started functioning fro 1956 under Mr.P.Bagchi, Reader and the Head of the Department. He left the Association in 1959 and was succeeded by Professor S .K.Mukherjee , who served the Association for about one year. The Department was under a Reader for some time and presently it is under a Professor.

The Department of Macromolecules, since its inception, is carrying out the work on the isolation and elucidation of structures of natural polysaccharides, and vulcanization of rubbers. Later on researches on synthetic polymer chemistry, nucleic acids, immunochemistry and humic acids were also taken up.

3.3.3 Recent Research Work carried Out in various Departments / Units/Centers During the Year 2000 -2006

In the Materials Science Department, a complete theoretical study of multiphoton dissociation of the simplest one-electron polar molecule in ultrashort, highly intense laser fields has yielded new information on the dynamics of such processes and also on the dependence of such a process on the controllable parameters. The basic mechanism of population transfer by stimulated hyper –Raman nonadiabatic passage has been elucidated through extensive calculations. The effects of strong laser light on photoassociation spectrum of ultracold atoms and mechanisms of long- and short-range interactions in different geometries of ultracold atomic Fermi gases have been investigated. Electronic structure and molecular dynamics calculations have been carried out using state-of-art density functional based simulation techniques. Hydrogen storage materials with optimum absorption as well as desorption have been designed both in bulk and nanostrstructures. 3d transition metal doped diluted magnetic semiconductor and diluted magnetic oxide systems depicting high Curie temperature, relevant for spintronics applications, have been investigated. A general

methodology based on self-consistent band structure calculations has been worked out for determining and analyzing the spin-induced transport in ferromagnets. A state of the art experimental facility for research in surface science and nanoscale science has been set up. This facility involves a molecular beam epitaxy (MBE) growth system, an ultrahigh vacuum variable temperature scanning tunneling microscope, a photoemission electron microscope and scanning tunneling spectroscopy to investigate geometric structure, morphology and electronic structure of the MBE-grown nanostructures. A new nonlinear optical material L-valine has been synthesized for the first time and second harmonic efficiency of this material is found to be comparable to urea. Ionic conductivity of polymer electrolyte nanocomposites has been investigatedLarge magnetoresistance and structural phase transition of ferromagnetic shape memory alloys have been observed. Novel organic-inorganic hybrid mesoporous silica has been synthesized by grafting atunable chemosensor in their pore-walls, which shows excellent luminescent, ion–exchange and metal ion sensing properties. A new mesoporous all organic cross-linked polymer has been synthesized by surfactant templating route. The energy transfer mechanism between CdS nanoparticle and dye has been investigated. Self-assembled semi-circular cubic CdS nanowires and Mn doped ZnSe nanocrystals have been synthesized. Dilute magnetism in single crystalline ferroelectric BaTiO3 has been reported. The validity of Altshuler-Aronov theory has been probed in the disordered double perovskite Sr2FeMoO6. Electrical properties of low dimensional organic semiconductors and metals have been studied.

In the Solid State Physics Department, the Novel CuO based giant dielectric materials for microelectronic applications are developed. Low temperature magnetic and transport properties of rare earth based CMR and GMR materials and Cd-Cr-X (X=Se,S,) type magneto-ferroic materials are investigated. Transport and magnetic studies on mixed-valent perovskites and magnetic nanostructured materials indicate exchange bias effect, glassy magnetic behaviour, improved magnetic propertiesfor the potential applications in memories and spintronics applications. The research activities also include the investigation of bulk intermetallic alloys showing first order magneto-structural transition. It focuses on various functional aspects of the materials including magneto-caloric effect, giant magnetoresistance and magnetic memory applications. Investigated the role of defects in oxide based diluted magnetic semiconductors both in the bulk and nanocrystalline form and electronic structure of lowdimensional quantum spin systems to understand and explain their novel magnetic properties. Electricalbistability with large conductance switching has been observed by

Scanning Tunneling Microscope in a monolayer of CdSe nanoparticle. High-density memory devices with one bit per particle has been successfully prepared. Conductance switching induced by carbon nanotubes has been observed in devices based on organic thin films. Nanodiodes based on a p-type and an n-type ZnO nanoparticles has been formed. ZnO-based undoped and doped thin films, heterojunctions, nanostructures have been grown and their structural, morphological, electrical, optical and optoelectronic properties have been studied to investigate the prospects for optoelectronic applications. Nanowires of high aspect ratio were developed in glass-nanocomposite matrices and their tansport mechanism was investigated. Relaxation dynamics of charge carriers in superionic glasses, polymer- and glass-nanocomposites was studied in a wide temperature range. Ab-initio structure determination of complexes exhibiting in vivo anticancer activity, has been accomplished from X-ray powder diffraction data. Structural study of a symmetrical dipeptidyl urea, having four molecules in the asymmetric unit was established using synchrotron radiation.

The Spectroscopy Department, was mainly involved in both experimental and theoretical research investigations in the frontier areas of basic and applied sciences. Broadening of Electromagnetically Induced Transparency (EIT) window has been controlled by controlling the incoherent pumping rate in three level system with homogeneous and inhomogeneous broadening when both the spontaneously generated coherence and the dynamically induced coherence interfere with each other. Ground state and Dynamical properties of atomic BEC studied analytically are in very good agreement with numerical results. Cluster calculation was proved to be very successful in predicting the spectra of alkali atomsunder liquid helium environment. Development of method to study the spectroscopic properties of weakly bound molecules and its application to molecules containing heavy halide atoms was successfully made. Preferential appearance of cis and trans anionic conformers in different non-ionic micelles due to structural influence of the micelles on the excited state proton transfer photophysics of 2-hydroxy 1-naphthaldehyde has been established on the basis of theoretically calculated barrier height of formation and time-resolved emission results. Concentration dependent orientational changes of 2 Amino-2-thiazoline molecule adsorbed on silver nano colloidal surface has been investigated by SERS and DFT. Adsorption of 4-Methyl-4H-1, 2, 4-Triazole-3-Thiol molecules on silver nano colloids has been studied using FT-IR, Raman, SERS and DFT. Nanoparticles and nanoflowers of different phthalocyanines were grown on suitable substrates at room temperature and the surface morphology, optical properties and the fractal dimension of the

nanostructured phthalocyanine thin films were studied. Some potential organic-inorganic nanocomposite systems by combining novel synthesized organic dyads with semiconductor TiO2 nanoparticles along with artificial molecular ON-and-OFF devices have been built. An induced alignment of ZnO nanomaterials has been achieved in LC medium and with the applications of electric field a perfect ON-and-OFF states have been observed under crossed polarizer.

In the Theoretical Physics Department, the Randall-Sundrum braneworld model has been generalized to arbitrary number of warped dimensions. The model provides a possible resolution to the fermion mass hierarchy problem in the standard model.Also various aspects of a slowly rotating dilaton black hole have been studied in an anti-desitter spacetime. Problems of stabilizing moduli of the type—IIB string theory on toroidal orientifolds of a six-torus, in presence of worldvolume fluxes on various D-branes, have been considered. For actions, introducing either O9 or O3 planes, we rule out the possibility of moduli stabilization in a wide class of models with N=1 supersymmetry, characterized by the type of fluxes turned on along D-brane worldvolume. In the context of supersymmetry the consequences of moderate or large negative values of the common trilinear soft breaking parameter have been studied. It is shown that in this region several processes including lightest supersymmetric particle (LSP) pair annihilation, LSP - lighter tau slepton co-annihilation and LSP - lighter top squark co-annihilation contribute to the observed dark matter relic density.As an experimental signature for extra dimensional theories, PVLAS results on birefringence and dichroism is shown to put severe restrictions on the axion mass and modulus if Randall-Sundrum model of observing sneutrino-antisneutrino oscillation in the context of LHC is being analyzed. Chiral phase transition of compact U(1) lattice gauge theory in the deconfined phase and the higher energy states of the flux tube / hadronic string formed between a quark anti-quark pair in pure Yang-Mills theory are being studied. The formation of antihydrogen in the ground and excited states (2s, 2p) via positrons has been demonstrated. Cold hydrogen-hydrogen scattering has also been investigated using non adiabatic close coupling approximation model.The problem of electron in a magnetic field on the two dimensional lattice has been studied. A powerful software to identify some of the unconventional tRNAs has been developed. Also experimental verification of prediction of overlapping tRNAs is being investigated. Bogoliubov-de Gennes equations have been solved self consisitently with strong correlation effect. The result is consistent with the experimental findings. By studying Ginzburg-Landau theory, a crossover temperature at which pairing

transforms into spin-triplet or spin-singlet only has been predicted. The spin-Hall conductivity is shown to resonate for a disordered system when spin precission length matches with the wavelength for variation of the electric field.The issue of travelling and standing waves in a circular hydraulic jump was explored to bring out the close connection between the radius of the jump and the radius of a white hole. We looked at the question of persistence infinite geometry for an order parameter field when it is quenched from a high temperature to the critical temperature.

In Energy Research Unit, the Nanocrystalline silicon films were developed in RFPECVD by changing various deposition parameters e.g., applied rf power, hydrogen dilution, separation of the electrodes, etc. Compressive and tensile stresses in the films and changes in the microstructure were measured. Silicon quantum dots (Si-QDs) in controlled size and distribution were prepared in nano-crystalline Si structures by precise seeding of the nuclei on various substrates, by proper control of the grain size and grain boundary states. In addition to the use of hydrogen, as the diluent of silane, argon and helium are also tried to enhance nano-crystallization at high growth rate. Utilizing the two-phase structure of silicon-oxide, nano-crystallization to the Si-network was initiated within the silicon-rich

phase of the material, while oxygen-rich barrier layer was used to control the growth of crystallites within nano-dimensions. Silicon carbon alloy material developed in our lab was found to possess very high ultra violet sensitivity. Using a modified plasma CVD technique films of silicon-germanium alloy with band gap of 1.4 eV was deposited with diffusion length (LD) of 100 nm. An industry-Institution research project on polymorphous silicon material has started involving our laboratory and two other French laboratories together with a French industry. Aluminum doped ZnO films have been developed as antireflection coating using reactive sputtering technique. Amorphous Si/ nano-Si double junction solar cells were fabricated. Current-voltage characteristics and quantum efficiencies of the cells were measured. Degradation studies have been made on microcrystalline cells having different crystalline fractions. Using protocrystalline Si films stable single junction cells with more than 7% efficiency have been developed. A project has been started to develop a calibration facility for testing of the reference solar cells and modules centered at IACS and involving several other laboratories. Our indigenously developed one-dimensional electrical-optical model ASDMP (Amorphous Semiconductor Device Modelling Programme) has been applied to simulate the experimentally obtained dark J-V, light J-Vand spectral response characteristics of micro-crystalline silicon (?c-Si:H) PIN solar cells of different degrees of

crystallinity. The novel “Heterojunction with Intinsic Thin layers” or “HIT” solar cells, of the variety N-a-Si:H / P-c-Si, fabricated in Sanyo, Japan, have been modeled using ASDMP. Effort is being made to introduce direct tunneling into model ASDMP.

In the MLS Professor’s Unit, several nanocomposites have been synthesized and their properties delineated. Ag2S nanoparticles in a silica matrix exhibited a resistivity hysteresis signifying melting of the cation sublattice. Multifunctionality was developed in a silicate glass containing nanophases nickel and barium titanate respectively – These showed optical nonlinearity, high dielectric constant and ferromagnetic behaviour. Zinc sulfide nanocrystals doped with iron were synthesized. They exhibited ferropmagnetic behaviour arising out of a one-dimensional magnetic system.

In the Biological Chemistry Department, the immunomodulatory activity of methylglyoxal, also a potent antitumor agent, has been observed and studied. A novel Glyceraldehyde 3 phosphate (GAP) binding protein from mice muscle has been identified and partial characterization to ascertain its biochemical and molecular properties in biological system has been made. A yeast strain has been isolated from soil which can grow in whey and the production of â- galactosidase by the organism has been investigated. The ultrastructural changes of the cell wall along with the formation of layered structures upon interaction of chromium with the chromate resistant Aspergillus versicolor strain has been studied by atomic force- and transmission electron microscopies. The catalytic efficiencies of the oxidoreductase enzymes, e.g., horseradish peroxidase (HRP), were improved at the reverse micellar interface in presence of simple non-ionic surfactants. The inhibiting role of unsaturation on the activity of surface-active enzymes that overwhelms the activating effect of ‘space’ is observed at the interface of reverse micelles. Also, the role of headgroup size/hydrophilicity in controlling the catalytic efficiency of lipase was explored and it was found that it is the headgroup size that primarily regulates the lipase activity in micellar enzymology. A series of novel cationic amino acid as well as dipeptide based amphiphiles, by changing both the head group architecture and alkyl tail length of the amphiphiles, which are excellent gelator in plain water, has been developed. The structural effects of two cancer drugs on dsDNA were studied at the single molecule level. The trinuclear platinum cancer drug BBR3464 led to severe DNA aggregation while the antibiotic, antitumour nogalamycin, an anthracycline intercalator resulted in tight plectonemic supercoil formation. One mixed polymeric construct was developed for application in biosensing using the cantilever array platform technology. The applicability of scanning probe microscopy based methods in

providing high-resolution structural information on protein structure was evaluated using ferritin protein and the iron core of the protein could be resolved. Research effort towards the functional study of non-muscle myosin II-C2 is under progress.

In the Inorganic Chemistry Department, a number of mixed valence complexes of iron, manganese and copper have been synthesised and characterised. They show interesting magnetic and electronic properties. For example, the copper variety displays NMR at room temperature and EPR at low temperature. Crystal engineering has been a major area of activities which include syntheses of various 1D, 2D and 3D coordination polymers. Studies in biological inorganic chemistry include interactions of inorganic/organic species with DNA. Syntheses and characterisations of complexes that mimic biological activities of various metallo enzymes are being pursued. One notable study in this area is abiological activation of molecular oxygen. Anion recognition, chemistry of heavier elements like Ru, Os etc. and design of various chemo-sensor have been other notable areas of research.

In the Organic Chemistry Department, the allelopathic sesquiterpenes heliannuols and helianane have been accomplished employing by ring closing metathesis. Advanced intermediate for the bioactive sesquiterpenes, dihydrocalamene have been accomplished by the cleavage of a cyclopropane ring in a cyclpropane fused benzoxepane ring system. A total synthesis of alboatrin, a phytotoxic metabolite has been accomplished by intramolecular ketene-alkene cycloaddition followed by an oxidative ring enlargement. An enantiodivergent approach to the synthesis of both enantiomers of epi-norcandensolide, nor-canadensolide and canadensolide has been developed. A novel approach using a domino metathesis sequence involving ROM-RCM-CM has been developed to construct densely functionalised ring systems present in anticancer diterpene umbellactal. Titanocene(III) chloride mediated radical-induced synthesis of C-3 substituted 3,4-dihydroisocoumarins has been achieved including a natural product Hydrangenol. Synthesis of 7- and 8-membered cyclic ethers by radical cyclizations has been accomplished. Ionic liquids have been used as catalyst for the synthesis of highly substituted pyridines, dithiocarbamates and cleavage of aziridines and epoxides, and halogenations of carbonyl compounds. Metal nanoparticles have been exploited for catalysis in Heck reaction, Tsuji- Trost reaction, aryl-sulfur bond formation and Hiyama coupling. A sodium bromide/bromate couple has been used as a green brominating agent for stereoselective bromination of alkynes and alkenes. Allylindium reagents have been used for the synthesis of terminal alkynes and trisubstituted alkenes by coupling reaction. A mild and efficient chemoselective deprotection of acetonides of diacetone glucose derivatives

and deprotection of cyclohexyl protected diols have been developed using CAN. A mild and efficient methodology for the preparation of a-methylene-g-butyrolactones has been developed via titanocene(III) chloride promoted radical reaction. A carbohydrate-based synthesis of both cis- and trans-fused bicylic ethers has been achieved. a-Dehydro-b-amino esters have been synthesized from Baylis-Hillman adducts catalyzed by CAN. The usual ketene formation was observed from (7-oxobicyclo[2.2.2]oct-2-ene-2,3-diyl) bis(phenylmethanone) derivatives on irradiation by photoinduced electron transfer mechanism. Quantum chain process for one of the photoproducts was identified from the photoreactions of rigidd-keto-b,g-enones. Electron transfer reaction from naphthyl anlogue of chalcones has been used successfully to prepare copper nanoparticles. Functional monolayers have been created on gold, silica or glass surfaces using alkene metathesis or click' chemistry to introduce a Fischer carbene moiety on the exposed terminus. Such a surface readily immobilizes protein and other biologically relevant molecules through a covalent linkage mediated by the organometallic functional group.

In the Physical Chemistry Department, the weak molecular interactions and energy re-distribution are studied using dispersed fluorescence spectra in a supersonic jet. Extended Born-Oppenheimer theory is applied to elucidate photo-dissociation and molecule surface scattering. Parallel Genetic Algorithm based methodology has been developed to obtain single particle density in polythiophenes. A theory of temperature compensation of Circadian rhythms has been developed. Magnetic field effect on electron transfer in a reverse micelle has been shown to involve mutiple exciplexes. Femtosecond dynamics in different regions of an organized assembly is studied through excitation wavelength dependence.

In the Polymer Science Unit, the Poly(3- thiophene acetic acid) – ds DNA and poly(o-methoxyaniline) RNA hybrids are prepared, the former system exhibit a slow aggregation of the polymer on DNA surface and the later system exhibit slow uncoiling of POMA chain on RNA surface. The kineticresults of riboflavine-melamine gel indicate three steps for the hydrogel formation: (i) supra molecular complexation between riboflavine and melamine, (ii) conformotional ordering of the R-M complexand (III) aggregation of the complex to produce fibrils which entrap water producing hydrogels. Thinfilms of poly(3-hexyl thiophene)- Ag nanocomposites are prepared, while thin films of pure hexadecyl amine capped silver nanoparticles exhibit switching behavior, the nanocomposite thin films exhibit characteristics of light emitting diode. The rheology of PANI-CSA- m-cresol gel and its nanocomposite with MMT clay indicates that the shear viscosity exhibits Newtonian behavior for low shear rate

and power law variation for higher shear rate. Hybrids of polyhedral oligomeric silsesquioxane (POSS) and polymer (such as PMMA, polystyrene, PBzMA) have been prepared by using thiol-mediated polymerization and ionic polymerization techniques from the surface of the POSS moiety. Polygonal gold and dendritic silver nanostructures have been prepared by modified citrate reduction technique. These metal nanostructures were successfully used as effective catalysts towards the borohydride reduction of p-nitrophenols and aerobic oxidation of different hexoses. A series of newly deigned redox active amphiphiles containing either tyrosine or tryptophan residue of varying carbon chain length have been synthesized and were used to generate gold and silver nanoparticles by an in situ reduction approach at basic pH.

The Raman Center for Atomic Molecular and optical Sciences is a newly formed collaborative platform at IACS. Its primary objective is to develop a world class research center on AMO sciences. Presently it comprises of two members and six associates across different departments having project proposals involving modern techniques in AMO sciences. These proposals are inter-dependent and involve expertise of more than one member and cover the following areas: (i) Many body theory and its application to atoms and molecules: Multi-electron systems are computationally hard problem to solve. Single or multi-reference coupled cluster theory is a unique technique to address this problem to a large extent. This technique along with appropriate relativistic corrections can address some of the most exciting puzzles of AMO sciences these days like the emergence of electric dipole moment of electrons due to CP violation which may manifest a small EDM in non-polar molecules. The requirement of enforcing gauge invariance and the increase in computational demand, which increases manifold if the systems require multi-reference description, create problems. There is also a delicate interplay of correlation and relativistic effects that needed to be adequately taken care of. These problems pose real challenge to a theoretician (for developing methodologies or formalisms) and computationalchemists (for implementation of the theoretical methods) alike, and need to be targeted in a coordinated manner; (ii) Single and isolated cold ion spectroscopy: A consolidated effort in understanding the many electron correlations in a heavy atomic system like barium can lead us to understand the electroweak interaction at low energies. We envisage performing quadrupole moment measurement of singly charged barium ion with a percent precision which can then be compared to the values obtained with rigorous many-body couple cluster theory. This will ensure good choice of basis wave functions required for the calculation on parity non-conservation (PNC) in such

heavy systems. In future we plan to carry out such measurements as well; (iii) Many body approach to Bose Einstein Condensates: Strongly interacting or strongly correlated system is another challenge for today's atomic theory. WithinRCAMOS, we are developing a mechanism to tackle this problem using coupled cluster technique. This will eventually lead to a microscopic theory for BEC-BCS crossover; (iv) Controlled dynamics using ultrafast light pulse: Electromagnetic fields can be used successfully for the controlled implementation of quantum material systems over a wide range of time and length scales. The light-matter interaction and its application for quantum control have emerged as an integral part of research in diverse areas including chemical dynamics. Lasers have provided experimentalists with a tool to enforce coherent control on the nuclear dynamics and optical properties of atoms and molecules. Close cooperation between theoreticians and experimentalists to design and evaluate novel schemes of coherent controlcould lead to breaking new ground in this area; (v) Precision spectroscopy of cold clusters: Clusters contain rich information about how quantum systems like atoms and molecules finally become solids. Our approach to investigate such systems is bi-folded: on one hand we perform high precision spectroscopy with a gas jet expansion setup while on the other hand we have experts to handle the mean field theory for such large systems; (vi) Beyond adiabatic approximation: The chemical reactions involve bond breaking and bond making. The asymptotic regions of potential energy surfaces are important in such events. In these regions, the adiabatic approximation breaks down and crossingand anti-crossing begin to dominate. In such a scenario, chemical reactions in the ground adiabatic electronic state may be strangely and strongly influenced by the presence of conical intersection with upper adiabats. The understanding of such phenomena is incomplete as yet. As reactive scattering cross sections at appropriate energies and resolution become available, their analysis and interpretation would pose a formidable challenge to the theoretician to develop computationally most effective and analytically elegant techniques of following the dynamics semiclassically or quantum mechanically.The area, in general, is rich in phenomena and possibilities and deservers close attention. We have recently added fresh expertise in these areas to begin with, which may be supplemented later as the centre grows; (vii) Quantum dissipative systems: Close relation between bath and a quantum system leads to de-coherences. But in practice they exist and hence we don't observe quantum phenomena in macroscopic objects. A deep insight into this relationship will lead to improvements on possible quantum devices namely quantum gates, repeaters etc. We are working on such systems in order to understand in a more general way the process of quantum dissipative

systems. During the year wehave submitted a proposal to the Department of Science and Technology under the IRHPA scheme.At the same time we have started functioning in a more collaborative platform having close ties with other theory as well as experimental groups' world wide. Among other important academic activities of the center, this year we had organized one international symposium on AMO sciences and one national workshop on quantum information science. RCAMOS organizes weekly seminars on different aspects of AMO sciences where experts from all over the world participate (A comprehensive list maybe found at the RCAMOS website).

In the Centre for Renewable Energy Sources, the Double junction (10 cm x 10 cm) thin film silicon solar modules have been fabricated using Multichamber deposition system. Attempts are being made to develop large area (1'x 1') microcrystalline silicon layers in order to apply this more stable material in thin film solar modules. The technology developed for amorphous silicon solar modules has been transferred to M/S Hind High Vac. Co. Pvt. Ltd. Bangalore. Carbon nanotubes have been synthesized by catalytic decomposition of turpentine oil using Ni nanocatalyst. The objective is to use it for low cost fuel cell electrodes. Transparent Polymer-like a-C and diamond like carbon films have been developed by CVD for application as antireflection coating in solar cells.

In the Centre for Advanced Materials (CAM), the major research activities of our group are in the field of strongly correlated electron systems and semiconductor nanoparticles in the quantum confinement regime. We are actively involved in studying the electronic, magnetic and dielectric properties of different materials such as manganites, double perovskites, dilute magnetic semiconductors and also multiferroics, both experimentally as well as theoretically. There are serious attempts to discover new useful multiferroic and dielectric materials and also to understand the nature of unusual magnetic responses in comparatively uncorrelated 4d materials. Our group is also particularly active in understanding various aspects of doping, optical properties, and growth mechanisms of various nanoparticles in the nanometric size regime using the so-called bottom-up approach. Our recent results on doped nanomaterials provide important insight in understanding the universal nature of doping and ion solubility in a material matrix.

3.4 Scholarships, Prize and Medals, and Endowed/ Professorship/ Memorial Lectures :

A number of Scholarships, prizes and medals were instituted by the Association and by members to encourage the students to take a lively interest in, and profit by, the lecture of

the Association. The Committee of Management on February 2, 1878 instituted five scholarships of Rs.12/- or Rs.10/- each for such students as passed satisfactorily the annual examination. Jay Kissen Mookerjee had previously offered a number of prizes to successful candidates at such examination. Likewise, Dr. Jagabandhu Bose offered gold medals for general proficiency and DDr. Kanailal Dey a silver medals for proficiency of Physics. The first annual examination was held on January 25 18979 in Chemistry and Physics.The examination of Chemistry was conducted by Kanai Lal Dey and Tara Prasanna Roy and that in Physics by Mr.C.Declippelier and Dr.Mahendra Lal Sircar. The first recipients of the scholarships were Charu Chandra Sirokara, Amulya Charan Mitra,Kissory Mohun Sen Gupta, Bhavodeb Chatterjee and Amrit Lal Sircar.Jai Kissen Prizes were offered to Charu Chandra Sirokara (Rs.100/-), Amulya Charan Mitra (Rs.60/-) and Kissory Mohun Sen Gupta (Rs.40/-). Charu Chandra Sirokara got the medal for Physics and Kissory Mohun Sen Gupta that for Chemistry.

In 1892, the Hon'ble Justice Guroo Das Banerjee donated a sum of Rs.500/- for the Jatindra Chandra Prize in memory of his beloved son who passed away untimely. The first recipient of this prize was Hriday Ranjan Sen Gupta. About this time, Sarat Kumar Ghosal, a lawyer and the Chaitanya Library of Calcutta awarded two medals, the first recipients of these medals being Sarat Chandra Mukhopadhyaya and Sardar Bichitra Singh of Ludhiana. Babu Jadu Nath Mukherjee offered to present a good Ross's microscope to a student for proficiency in Biology. A similar microscope prize was instituted by Dr.Nilratan Srakar for presentation to the student obtaining the highest marks at the Biology examination. In 1899, the Woodburn medals was created for award every second or third year to an Indian research worker for original research in any branch of Physical Science. Not much is known about the later career of these promising young men expect Amritalal Sircar, the Founder's son who, like his father, chose a medical profession and became the honorary Secretary and lecture at the Association after Dr.Sircar's death.

Endowment funds for the creation of whole –time professorships as already mentioned in the chapter one, were opened with the donation received in the lifetime of the Founder himself. But the total donations contributed were inadequate even in Dr. Mahendralal Sircar's time. Later on annual interests from these funds were utilized in inviting eminent foreign and Indian scientists to deliver course of lectures at the Association as Ripon Professor and Coochbehar Professor. In addition to the Endowment Professorship a few gold medals are awarded annually to eminent scientists of India and abroad. The arrangements of

these lectures through the awards of professorships and medals establish contact with scientists of international reputation which serve as an avenue of mutual exchange of scientific ideas. The Association are conducted so many endowment lectures year to year by eminent personalities of India and abroad that are given below:

SL No	NANE Of ENDOWMENT /MEMORIAL /PROFESSORSHIP LECTURES
1.	Dr. Mahendra Lal Sircar Memorial Endowment Lecture
2.	Bimla Churn Law Memorial Lecture
3.	Shri Rajendra Lal Mitra Professorship Lecture
4.	Sir C V Raman Memorial Lecture
5.	Dr.J C Bose Memorial Lecture
6.	Dr.Aneesur Rahman Memorial Lecture
7.	Professor K S Krishnan Memorial Lecture
8.	Dr.T K Rai Dastidar Memorial Lecture
9.	Dr.M N Saha Memorial Lecture
10.	Sir.Akshoy Dutta Memorial Lecture
11.	Sir.A P Mitra Memorial Lecture
12.	DR.Samarendra Nath Sen Memorial Lecture

3.5 Post-b.sc. Integrated ph.d Programme:

In an effort to foster academic cooperation between Research Institutes and Universities, IACS has started conducting a Post-BSc Integrated PhD Programme in chemical sciences (PBIR) since the academic session 2005-2006 and this is run as a joint venture with S N Bose National Centre for Basic Sciences (SNBNCBS). Based on a MOU between IACS and West Bengal University of Technology, the programme enjoys its affiliation for the course with the aforementioned university. The primary objective of this five-year PBIR programme is to offer research-oriented multidisciplinary courses in chemical sciences for the first two year as a part of requirement for M. Sc degree, followed by admission of the students to Ph.D. programme in different departments of IACS and SNBNCBS. For other details we refer to the website of the Institute.

After successful clearance of a National level written test and interview eight students got admitted to this programme in the year 2007-2008 out of nearly 450 applicants. The

students are provided with stipend, accommodation and transport facilities and are also covered by medical scheme and other welfare measures of the Institute.

3.6 Indian Journal of Physics (IJP) :

Indian Journal of Physics is a pioneering journal founded by Sir C V Raman in 1926, devoted to the publication of significant, original and current scientific research results. It is published monthly, containing 12 regular issues in a year,from January to December .ISSN 0973-1458. Starting from January 2009, Indian Journal of Physics is being co-published with Springer (www.springer.com/12648). Springer also distributes print version of the Journal worldwide.

Scope of Journal are Astrophysics, Atmospheric & Space Physics, Atomic & Molecular Physics, Biophysics, Condensed Matter & Materials Physics, General & Interdisciplinary Physics, Nonlinear Dynamics & Complex Systems, Nuclear Physics, Optics & Spectroscopy, Particle Physics, Plasma Physics, Relativity & Cosmology, Statistical Physics.

3.7 Human Resources Developments Programme

Recently, the faculties of IACS have undertaken a number of activities pertaining to societal interests. These activities can be divided into two broad categories, i.e., popularization of science and human resource development (HRD).

Popular lectures on various topics ranging over different disciplines of basic and applied sciences were delivered all throughout the year within IACS and at various places within Kolkata and in other states. University Grant Commission and National Academy of Sciences were two of the primary sponsors of such events. The human resource development program has been undertaken with great interest and vigor this year. Apart from the summer projects carried out at various laboratories by the bachelor/master's level students from all over the country, events like National Science Day were celebrated with a focus on school children. An EDUSAT (education using satellite technology) program was held for the Children Science Congress. Summer schools were held during the summer months both within IACS and at places like CMERI, Durgapur for the school children. Faculties have also taken part in the question paper setting and final selection process for the KVPY (Kishore Vaigyanik Protsahan Yojana)

Fellowship program organized by DST, Govt. of India. Lectures were delivered in the Refresher Courses for the college teachers at various colleges within Kolkata in order to expose them to the most recentdevelopments in science and technology. The Administration

has undertaken the Staff training program as part of HRD activities for improvement of staff performance and internal development of IACS.

3.8 STRATEGIC MANAGEMENT UNIT (SMU)

The Association has been growing at a steady pace for some time and has plans for furtherlarge scale expansion in the days to come. This has resulted in a growing national stake by way of increased government grant and called for the formation of a Strategic Management Unit (SMU) to formulatesuitable plans in various strategic areas. A unit comprising two Advisors (Planning and Development) was accordingly set up in late 2006.

The unit extended active support towards coordinating different activities relating to implementation of the recommendations of the Structural Reforms Committee. It has introduced the system of microbudgeting for both Plan and Non-Plan Expenditure and put in place a system for monitoring timely utilization of government grants. It has also formulated appropriate ways for planning expenditure and investments in an optimal manner. The unit has set up a Training Cell, which caters to the vital requirement of skill upgradation among different sections of non-academic staff. Several programmes have been successfully arranged by them for both administrative and technical staff. A list of such programmes is given below. The Training Cell has concluded an agreement for launching short term training programmes in various subjects jointly with the West Bengal University of Technology (WBUT) and such programmes have already gone on stream. It has also gone for arrangements with the Jadavpur University and its Department of Adult, Continuing Education and Education for conducting various technical programmes.

3.9 MISSION PROGRAMME FOR TECHNOPRENEURSHIP

It is felt that the original mandate of IACS to enable ‘varied applications of science to the arts and comforts of life’ would remain incomplete without an interlinking between science and society. The Fourth Review Committee has strongly recommended the initiation of applied research and work towards practical applications of the scientific advancements in the laboratories. In this connection,the interfacing with the industry was strongly supported.

In the backdrop of the above, the Governing Council cleared the Mission Programme for Technopreneurship during April 2006, to be undertaken as a mission-mode initiative under the 11th Five-Year Plan to serve as an outreach organ of the institute in terms of technology development and transfer. It is mandated to inculcate innovation and knowledge-based entrepreneurship amongst the scientists and enable IACS position itself as an effective provider of technology products and technoentrepreneurial outputs.

Objectives:

- Serve as a single-window approach to institutional technology management
- Establish a technology business incubator to support and develop effective technopreneurship
- Facilitate networking with professional resources
- Identify technologies/innovations that have potential for commercial ventures.
- Undertake capacity building in knowledge based enterpreneurship.

Achievements:

- The Programme coordinated successful licensing of two technologies to the industries and also negotiated the fruition of two industry-institute R&D projects for IACS.
- One provisional patent application has been filed in India. (One patent has also been granted)
- The Programme has been identified as the implementing platform for the Nodal Centre of the Intellectual Property Facilitation Consortium of DST Institutes in Kolkata established at IACS by the TIFAC, Department of Science & Technology, and New Delhi. An extramural support of Rs 15 lakhs has been received under this project.
- A comprehensive Intellectual Property Rights Policy for IACS has been compiled.
- Initiation of work on IPR and Technology Information System

3.10 Central Scientific Services:

During the year 1960 -1961, Department of Central Scientific Services was started or organized with the appointed of Dr. Ranjit Kumar Sen as a reader under control Director of the Association. During the year 1962-63, The scope and function of Department of Central Scientific Services were clarified by the council of the Association. The council resolved that Department of Central Scientific Services do function as service departments and Facilities of Director's research be separated from those of the Department of Central Scientific Services. During the year 1962-63 Total Five Post (One Reader, One Research Assistant, one Draftsman, One Clerk (Senior Grade), One laboratory Assistant, and One Bearer) for Department of Central Scientific Services was sanctioned by the Council. From since inception this department is run successfully as a service department. So many research instruments that are carry out the research work successfully of all departments of the Association purchased by these departments. Now, This department rendered service to research workers of this institute as well as to other institutes utilizing the capacities of its centralized instruments of their respective facilities

3.11 Library:

The IACS Library is one of the oldest libraries in Indian subcontinent. It has vast collection of volumes for references and research especially in the field of natural / pure science. . The library has multifarious repository of valuable reference materials and bound volumes of journals, some dating back to 1600s. In addition to these, the library also has rare books, modern resources such as online /offline databases and non book materials etc. The library strives to serve its internal as well as external members to the best of its ability. Now, the library has near about 76,847 no of titles of books and 646 no of title of Indian & foreign journals along with 148 print journal by subscription /exchange/ complementary.

3.12 CONCLUSION :

IACS ,Kolkata is one of the oldest and world class basic science research institute in India. It is smoothly run under control the council and financially assistance by Department of Science and Technology, Govt. of India. The scientific contributions of the faculty and the students have been noticed by the scientific community all over the world, bringing accolades and recognitions. A unique feature of IACS is a strong synergy existing between theoretical and experimental sciences. Its theoretical research is considered first rate by any standard, and its experimental groups have charted new frontiers – be it with synthesis of novel molecules, designing polymers or fabricating new materials with tantalizing possibilities. The Chemistry and Physics wings have faculty members who are the acknowledged leaders in their fields. Over the past two decades, IACS has initiated research activities with a strong technological bias. Several patents have been filed, and pilot plants to study the efficacy of alternative sources of energy have been initiated. IACS has world-class activity in synthetic chemistry, biomimetic chemistry and chemistry and physics of materials – including nanomaterials, in designed polymers, in unraveling the mechanism of ultrafast chemical dynamics, drug design and in theoretical chemistry / physics.The future of IACS depends upon the new generation who will venture into newer domains and will open new vistas.

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Chapter 4

Data Analyses & Interpretation

CHAPTER-4

DATA ANALYSES & INTERPRETATION

4.0 Introduction

Datum means information in raw unorganized form such as alphabets, numbers, or symbols that refer to or represent, conditions, ideas, objects. Data are limitless and present everywhere in the universe. Data analysis means the process of evaluating data using analytical and logical reasoning to examine each component of the data provided.

This form of analysis is just one of the many steps that must be completed when conducting a research experiment relevant research data on IACS,Kolkata from various sources have been gathered, reviewed and then analyzed to form some sort of findings or conclusions. This study includes total 13654 research output of Indian Association of Cultivation of Science (IACS),Kolkata in various bibliographic forms such as journal articles , conference papers ,theses, lectures, books, books chapters and patents during 1947-2006.

4.1 Distribution of publications year-wise

The total productivity of the scientists & research scholars of IACS, Kolkata for the sixty year period (1947-2006) is given chronologically in table 1.

Table 4.1: Distribution of publications year-wise

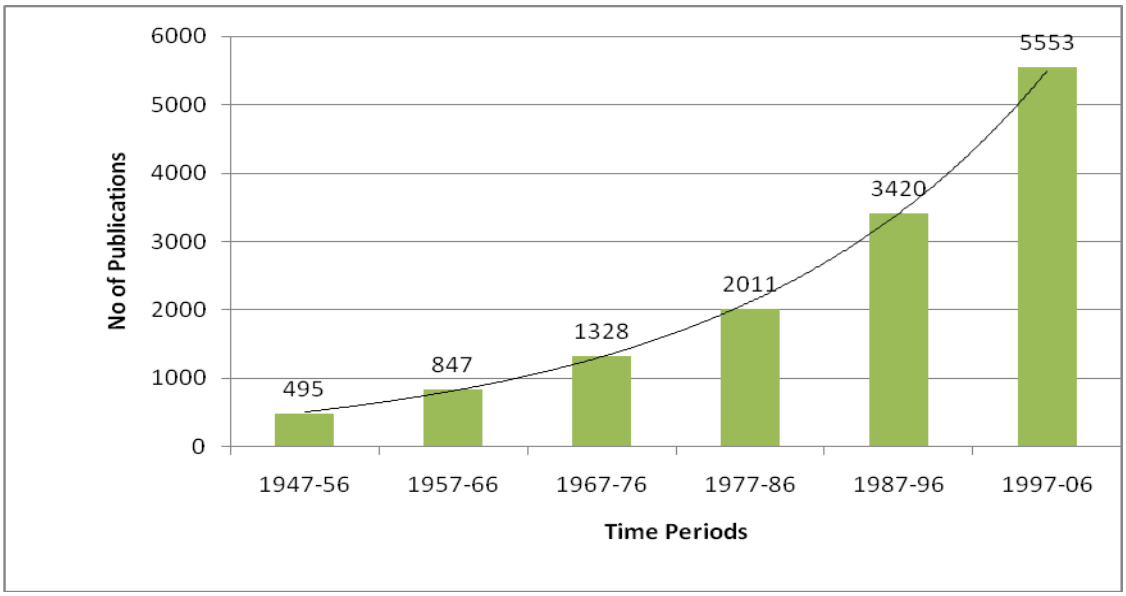
Year	No of publications	Percentage (%)	Decade specifying years	Total no of publications	Percentage (%)
1947	7	0.05	1947-56	495	3.63
1948	19	0.14			
1949	31	0.23			
1950	41	0.30			
1951	43	0.31			
1952	41	0.30			
1953	63	0.46			
1954	86	0.63			
1955	93	0.68			
1956	71	0.52			

Year	No of publications	Percentage (%)	Decade specifying years	Total no of publications	Percentage (%)
1957	69	0.51	1957-66	847	6.20
1958	57	0.42			
1959	85	0.62			
1960	69	0.51			
1961	73	0.53			
1962	85	0.62			
1963	89	0.65			
1964	108	0.79			
1965	108	0.79			
1966	104	0.76			
1967	156	1.14	1967-76	1328	9.73
1968	138	1.01			
1969	125	0.92			
1970	124	0.91			
1971	120	0.88			
1972	121	0.89			
1973	116	0.85			
1974	120	0.88			
1975	156	1.14			
1976	152	1.11			
1977	172	1.26	1977-86	2011	14.73
1978	154	1.13			
1979	166	1.22			
1980	155	1.14			
1981	208	1.52			
1982	199	1.46			
1983	196	1.44			
1984	256	1.87			
1985	239	1.75			
1986	266	1.95			

Year	No of publications	Percentage (%)	Decade specifying years	Total no of publications	Percentage (%)
1987	256	1.87	1987-96	3420	25.05
1988	285	2.09			
1989	259	1.90			
1990	300	2.20			
1991	281	2.06			
1992	329	2.41			
1993	369	2.70			
1994	404	2.96			
1995	428	3.13			
1996	509	3.73			
1997	525	3.85	1997-2006	5553	40.67
1998	489	3.58			
1999	597	4.37			
2000	410	3.00			
2001	557	4.08			
2002	455	3.33			
2003	538	3.94			
2004	570	4.17			
2005	603	4.42			
2006	809	5.93			
Total	13654	100	1947-2006	13654	100

It can be observed that the total published research output of the IACS's scientists for the 60 years period amount to 13654. It includes journal articles, conference papers, lectures, books, and chapter in books, patent, and other publications. The study indicates that 2006 is the most productive years with 809 publications (5.93%) followed by 2005 with 603 publications (4.42%) and 1999 with 597 publications (4.37 %). 1947 is the most low productive year with only 7 publications (0.05%) followed by 1948 with 19 publications (0.14%) and 1949 with 31 publications (0.23 %). It also observed that during 60 years (1947-2006), research outputs of the association is gradually increased.

Fig.4.1: Distribution of Research publications over different time periods



1997 -2006 are most productive periods with 5553 publication (40.67 %) followed by 1987-1996 with 3420 publications (25.05 %) and 1947-1956 are the lowest productive periods with 495 publication (3.63 %) and followed by 1957-1966 with 847 publications (6.20 %).The bar diagram shows that the year 1997-2006 is the most productive time periods and the years 1947-1956 is the most low productive time periods at IACS, Kolkata during the last 60 years.

4.2 Bibliographic Forms / Channels of Communication

The Productivity of social scientists of IACS are spread over variety of publication media like journal articles, Conference papers ,Books ,chapters in books, and other publications etc in depicted table -2.

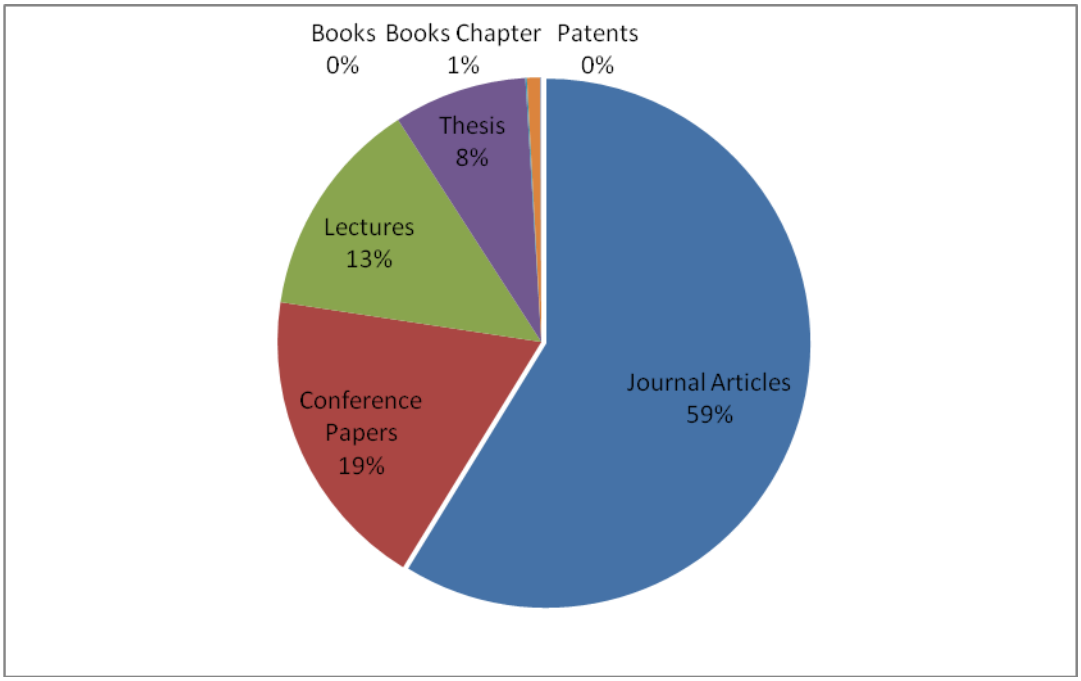
Table 4.2: Distribution of Publications form-wise (bibliographic)

Sl. No.	Bibliographic Forms	No. of Publications	Percentage (%)	Cumulative Percentage (%)
1	Journal Articles	8026	58.78	58.78
2	Conference Papers	2543	18.62	77.40
3	Lectures	1837	13.45	90.86
4	Theses	1116	8.17	99.03
5	Books	12	0.09	99.12
6	Books Chapter	111	0.81	99.93
8	Patents	9	0.07	100.00
	Total	13654	100	

It is clear from the analysis that the share of journal articles is the most prominent bibliographic form of publication and it occupies 58.78 % (8026) of total publications. Conference/ Seminar papers with 2543 (18.62%) contributions and Lectures 1837 (13.45 %) occupy the next two positions.

So It is clearly shows that most preferred channels of communication among the Scientist & Research Scholars of IACS,Kolkata is journal (58.78%) with 8026 publication followed by conference paper (18.62%) with 2543 publication, Lectures (13.45%) with 1837 publications and Thesis (8.17 %) with 1116 publications whereas the publication output in the form of book and book chapters and also patent are relatively low compared with others. They are together account for 132 publications with (0.97%) only out of 13654 publications.

Fig4.2: Distribution of publications in different type of communication channels



1.3 Distribution of publications/publications productivity (Departments/Research Units /Research Centres)

Now, IACS, Kolkata has eight departments for basic science research. In Physics Division has four departments namely materials Science, Solid State Physics, spectroscopy and theoretical physics. There are four department's namely physical chemistry, Inorganic chemistry, Organic chemistry, and Biological chemistry in chemistry division. The Department -wise productivity of scientists of IACS during the period under study is given in

the table 3.During 1947 -2006, the Department of Material Science had maximum contributed 2062 papers (15.10%) of total productivity followed by Physical Chemistry with 1903 papers (13.94 %) and Theoretical Physics with 1609 (11.78%) whereas The publication Productivity of department of Biological Chemistry with 845 publications are relatively law compared with others. This table also indicates that the growth of publications of each departments is gradually increased over different time periods.

The Units of research in IACS ,Kolkata have been established to address specific concern in basic science.IACS,Kolkata has only three research unit namely Energy Research Unit ,MLS Reaserch Unit , Polymer Science Unit established in 1986.The Energy Research unit had contributed 468 papers (3.43%) followed by Polymer Science with 448 papers (3.28%) and MLS Research unit with 260 (1.90%).The research centre in IACS, Kokata has been also established to specific purpose in fundamental research. Now The Association has three research centers namely Raman Center for Atomic Molecular& Optical Sciences (RCAM & OP. Sc), Centre for Renewable Energy Sources, (REN. ENR) and Centre for Advanced Materials (CAM). These are established in 2004-2005. The Centre for Renewable Energy Sources, (REN. ENR) had contributed with only 05 papers and followed by centre of advanced materials (CAM) with 02 that are included in others in table – 3.Only 135 (0.99%) articles published in inter-departmental research during the study.

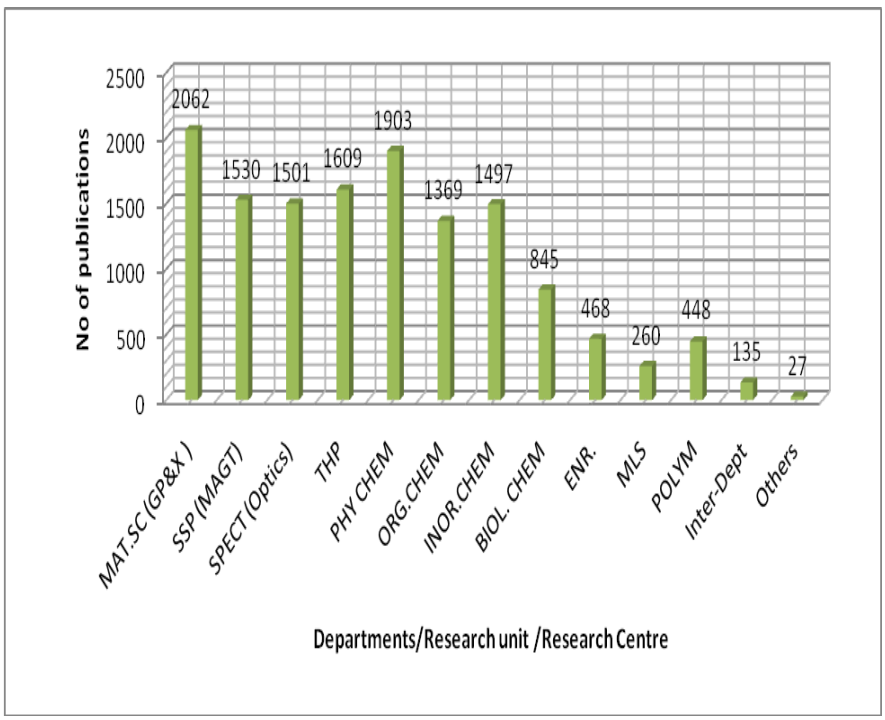
Table 4.3: Distribution of publications department/research Unit /research Centre –wise

SL NO	Dept.	Eastb	Decade specifying years						Total no of publications	Percentage (%)
			1947-56	1957-66	1967-76	1977-86	1987-96	1997-2006		
1	MAT.SC (GP&X)	1900	80	141	239	335	432	835	2062	15.10
2	SSP (MAGT)	1953	32	95	139	239	377	648	1530	11.21
3	SPECT (Optics)	1947	121	117	102	184	425	552	1501	10.99
4	THP	1950	15	42	137	413	391	611	1609	11.78
5	PHY CHEM	1947	113	184	298	257	390	661	1903	13.94
6	ORG.CHEM	1949	65	71	134	214	330	555	1369	10.03

SL NO	Dept.	Eastb	Decade specifying years						Total no of publications	Percentage (%)
7	INOR.CHEM	1951	68	143	178	225	360	523	1497	10.96
8	BIOL. CHEM	1956	0	52	101	137	231	324	845	6.19
9	ENR.	1986	0	0	0	2	159	307	468	3.43
10	MLS	1986	0	0	0	0	113	147	260	1.90
11	POLYM	1986	0	0	0	5	146	297	448	3.28
12	Inter-Dept		0	0	0	0	66	69	135	0.99
13	Others		1	2	0	0	0	24	27	0.20
	Total		495	847	1328	2011	3420	5553	13654	100

GP&X = Department of General Physics &X-Ray ,MAGT=Department of Magnetism, Optics = Dept. of Optics , THP=Dept. of Theoretical Physics, PHY CHEM –Dept. of Physical Chemistry, ORG.CHEM= Dept. of Organic Chemistry , INOR.CHEM=Dept. of Inorganic Chemistry, BIOL. CHEM= Dept. of Biological Chemistry , MAT.SC=Dept of Material Science , SSP=Dept. of Solid State Physics , SPECT=Dept. of Spectroscopy , ENR RES U= Energy Research Unit , MLS'S=MLS Research Unit , POLY RES U= Polymer Research Unit ,RCMA&O =Raman Center for Atomic Molecular& Optical Sciences, REN. ENR =Centre for Renewable Energy Sources, AD. MAT- Centre for Advanced Materials (CAM)

Fig.4.3: Distribution of publications across the Departments /Research Units/ Centres



4.4 Analyses of Journal Articles

Journal is the most important primary sources where the result of the researches conducted are getting published. In this case of analyzing the productivity of the Scientist/Research Scholar of IACS Kolkata, the journal articles contributes the most important form of publications.

4.4.1 Distribution of publications of journal articles year-wise

The total productivity Journal article of the scientists & research scholars of IACS, Kolkata for the sixty years period (1947-2006) under study is given chronologically in table 4.

Table 4.4: Distribution of Publications of Journal article year-wise

Year	No of publications	Percentage (%)	Decade specifying years	Total no of publications	Percentage (%)
1947	6	0.07	1947-1956	398	4.96
1948	18	0.22			
1949	19	0.24			
1950	25	0.31			
1951	36	0.45			
1952	39	0.49			
1953	57	0.71			
1954	61	0.76			
1955	76	0.95			
1956	61	0.76			
1957	60	0.75	1957-1966	653	8.14
1958	47	0.59			
1959	63	0.78			
1960	61	0.76			
1961	52	0.65			
1962	64	0.80			
1963	65	0.81			
1964	74	0.92			
1965	87	1.08			
1966	80	1.00			

Year	No of publications	Percentage (%)	Decade specifying years	Total no of publications	Percentage (%)
1967	111	1.38	1967-1976	906	11.29
1968	85	1.06			
1969	77	0.96			
1970	87	1.08			
1971	83	1.03			
1972	70	0.87			
1973	88	1.10			
1974	86	1.07			
1975	113	1.41			
1976	106	1.32			
1977	99	1.23	1977-1986	1301	16.21
1978	120	1.50			
1979	110	1.37			
1980	109	1.36			
1981	158	1.97			
1982	127	1.58			
1983	140	1.74			
1984	143	1.78			
1985	132	1.64			
1986	163	2.03			
1987	158	1.97	1987-1996	1951	24.31
1988	149	1.86			
1989	146	1.82			
1990	183	2.28			
1991	172	2.14			
1992	204	2.54			
1993	211	2.63			
1994	230	2.87			
1995	217	2.70			
1996	281	3.50			

Year	No of publications	Percentage (%)	Decade specifying years	Total no of publications	Percentage (%)
1997	268	3.34	1997-2006	2817	35.10
1998	268	3.34			
1999	299	3.73			
2000	229	2.85			
2001	270	3.36			
2002	280	3.49			
2003	304	3.79			
2004	274	3.41			
2005	299	3.73			
2006	326	4.06			
Total	8026	100	0	8026	100

It can be observed that the total published Journal articles made by scientists/research scholars of the IACS Kolkata for the 60 years period (1947 -2006) is amount to 8026. The study indicates that 2006 is the most productive years with 326 publications (4.06 %) followed by 2003 with 304 publication (3.79%) and 1999 &2005 with each 299 publications (3.73 %). 1947 is the lowest productive year with only 6 publications (0.07%) followed by 1948 with 18 publications (0.22 %) and so on. This analysis shows that there is a growth of publications during the period of under study.

It also observed that during 60 years (1947-2006), research outputs of the association are gradually increased. 1997 -2006 are most productive periods with 2817 publication (35.10 %) followed by 1987-1996 with 1951 publications (24.31 %) and 1947-1956 are the lowest productive periods with 398 publications (4.96 %) and followed by 1957-1966 with 653 publications (8.14 %) and 1967-76 with 906 publications (11.29 %).The bar diagram shows that the year 1997-2006 is the most productive time periods at IACS, Kolkata during the last 60 years under study.

Fig4.4: Represents the growth of publication trend of Scientist of IACS, Kolkata

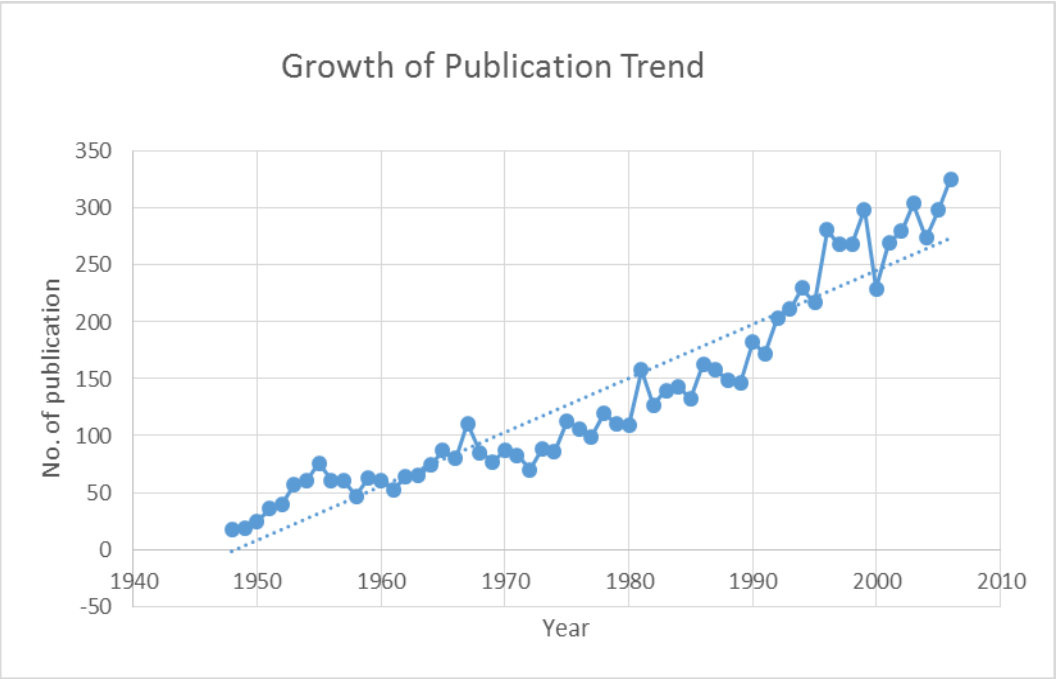
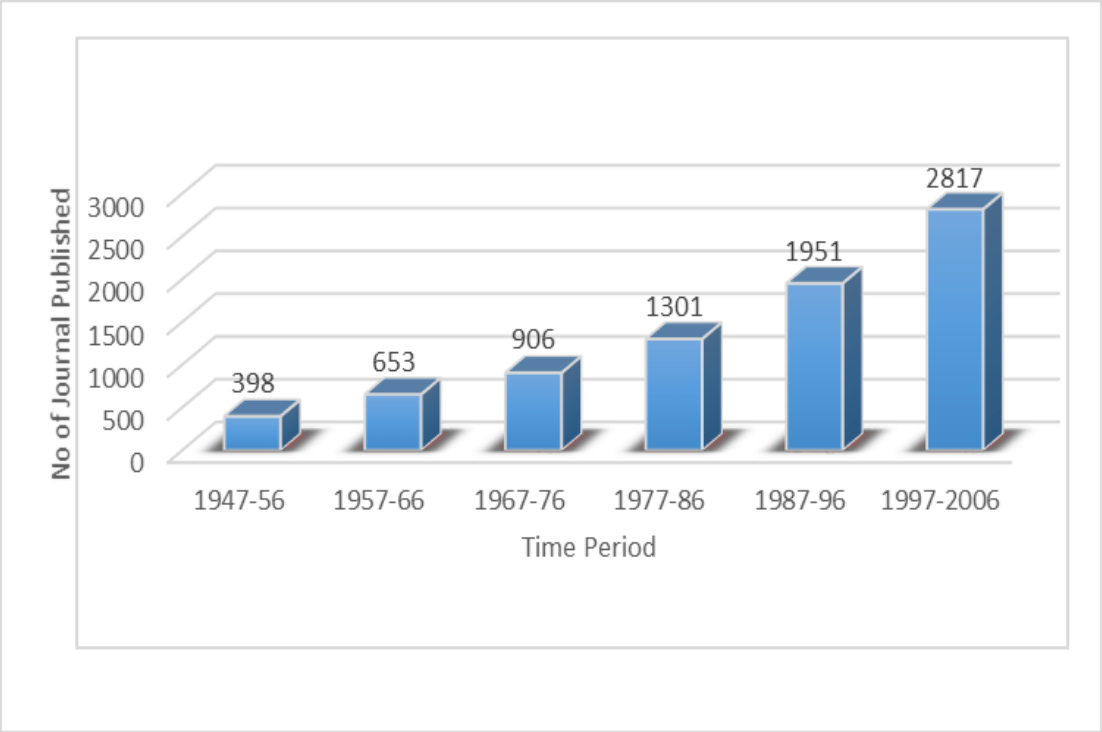


Fig4.5: Distribution of Publications of journal articles over different time periods



4.4.2 Distribution of publication Productivity of journal Articles (Department and Research Unit / Research Centre)

Now ,IACS, Kolkata has eight departments for basic science research , The Department -wise productivity of Scientists of IACS during the period under study is given in the table 5.During 1947 -2006 , the Department of Inorganic Chemistry had contributed 1186 papers (14.78 %) of total productivity followed by Materials Science (formally name General Physics & X-Ray) with 1161 papers (14.47%) and Physical Chemistry with 1125 (14 %) whereas the publication Productivity 424 (5.28%) of Biological Chemistry are relatively law compared with others followed by Organic Chemistry with 735 papers (9.16%).Inorganic Chemistry had highest average publication per year with 19.77 followed by Materials Science (formally name General Physics & X-Ray) with 19.35 % whereas Biological Chemistry had lowest average publication per year with 7.07 % followed by Organic Chemistry with 12.25 . This table also indicates that the growth of publications of each department gradually increased over different time periods.

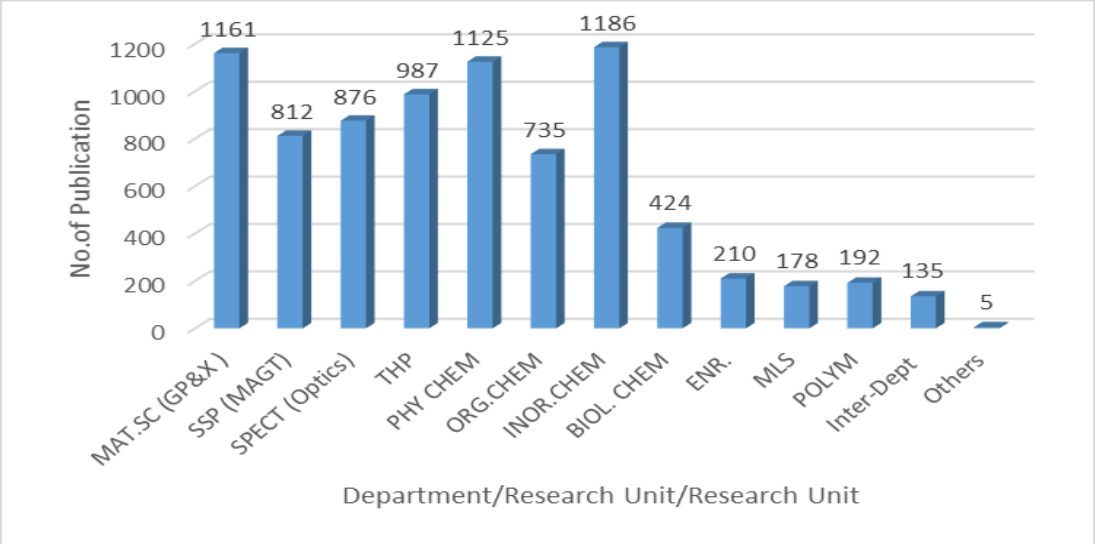
The Units of research in IACS, Kolkata have been established to address specific concern in basic science. IACS,Kolkata has only three research unit namely- Energy Research Unit ,MLS Reaserch Unit , Polymer Research Unit established in 1986 and the publication productivity of Research units is indicated table 5. During 1947-2006, The Energy Research Unit had contributed 210 papers (2.62 %) followed by polymer Science Research unit with 192 papers (2.39 %) and MLS Research unit with 178 (2.22 %)

The research centre in IACS, Kokata has been also established to specific purpose in fundamental research. Now The Association has three research centers namely Raman Center for Atomic Molecular& Optical Sciences (RCAM & OP. Sc), Centre for Renewable Energy Sources, (REN. ENR) and Centre for Advanced Materials (CAM). These are established recently in 2005.The centre of Advanced materials had contributed only 02 Papers and followed by Centre for Renewable Energy Sources,(REN. ENR) with only 01 papers that are included in others in table-5. From analysis, it is found that total average publication per year of journal articles is 133.8 i.e healthy side of the association.

Table 4.5: Distribution of Publications Productivity of Journal articles - Department and Research Unit / Centre wise

SL NO	Depts.	Eastd. Year	Decade Specifying Years						Total no of publication	Average /year	Percentage (%)
			1947-56	1957-66	1967-76	1977-86	1987-96	1997-2006			
1	MAT.SC (GP&X)	1900	66	127	191	206	197	374	1161	19.35	14.47
2	SSP (MAGT)	1953	22	71	84	107	189	339	812	13.53	10.12
3	SPECT (Optics)	1947	108	106	87	126	203	246	876	14.6	10.91
4	THP	1950	13	27	117	271	244	315	987	16.45	12.30
5	PHY CHEM	1947	88	123	168	186	232	328	1125	18.75	14
6	ORG.CHEM	1949	54	43	68	117	198	255	735	12.25	9.16
7	INOR.CHEM	1951	47	121	141	199	283	395	1186	19.77	14.78
8	BIOL. CHEM	1956	0	35	50	84	107	148	424	7.07	5.28
9	ENR.	1986	0	0	0	0	80	130	210	3.5	2.62
10	MLS	1986	0	0	0	0	86	92	178	2.97	2.22
11	POLYM	1986	0	0	0	5	66	121	192	3.2	2.39
12	Inter-Dept		0	0	0	0	66	69	135	2.25	1.68
13	Others(REN-1,CAM-2)		0	0	0	0	0	5	5	0.08	.06
	Total		398	653	906	1301	1951	2817	8026	133.8	0

Fig.4.6: Department /Research Unit/Research Centre-wise Distribution of Publication Productivity of Journal articles:



4.4.3 Authorship Pattern of publications of Journal Articles with Collaboration Coefficient

Table 6 shows the details of the authorship pattern of whole research publications of scientist and research workers at IACS,Kolkata during the period under the study

Table 4.6 : Authorship Pattern of Publications with collaboration Coefficient year wise

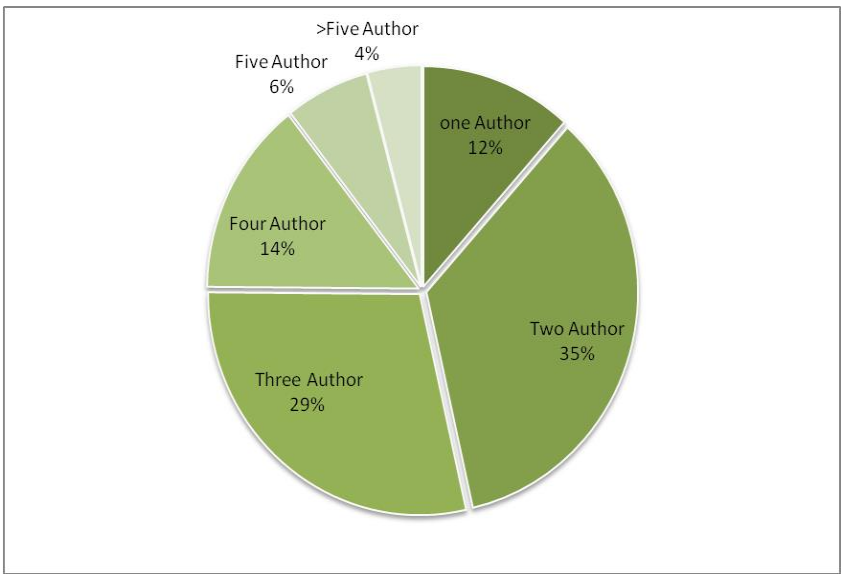
Year	Single Author papers	Multi Author papers						Total (single+ multi authors)	Percentage (%)	Collaboration coefficient
	One	Two	Three	Four	Five	>five	Total			
1947	5	1					1	6	0.07	0.17
1948	13	5					5	18	0.22	0.28
1949	11	8					8	19	0.24	0.42
1950	15	10					10	25	0.31	0.40
1951	21	14	1				15	36	0.45	0.42
1952	24	12	3				15	39	0.49	0.38
1953	37	16	2	2			20	57	0.71	0.35
1954	40	17	4				21	61	0.76	0.34
1955	40	31	5				36	76	0.95	0.47
1956	32	25	3	1			29	61	0.76	0.48
1957	43	13	4				17	60	0.75	0.28
1958	29	15	3				18	47	0.59	0.38
1959	34	23	5	1			29	63	0.78	0.46
1960	28	27	6				33	61	0.76	0.54
1961	26	19	7				26	52	0.65	0.50
1962	30	25	8	1			34	64	0.80	0.53
1963	25	22	17	1			40	65	0.81	0.62
1964	16	36	17	5			58	74	0.92	0.78
1965	18	41	27	1			69	87	1.08	0.79
1966	16	38	18	8			64	80	1.00	0.80
1967	33	50	22	6			78	111	1.38	0.70
1968	13	52	19	1			72	85	1.06	0.85
1969	13	38	21	4	1		64	77	0.96	0.83

Year	Single Author papers	Multi Author papers						Total (single+ multi authors)	Percentage (%)	Collaboration coefficient
	One	Two	Three	Four	Five	>five	Total			
1970	12	53	15	4	3		75	87	1.08	0.86
1971	15	38	27	3			68	83	1.03	0.82
1972	11	27	26	3	2	1	59	70	0.87	0.84
1973	18	33	30	6	1		70	88	1.10	0.80
1974	21	34	24	5	2		65	86	1.07	0.76
1975	17	60	30	6			96	113	1.41	0.85
1976	7	57	36	6			99	106	1.32	0.93
1977	9	53	24	10	2	1	90	99	1.23	0.91
1978	19	50	42	7	2		101	120	1.50	0.84
1979	5	49	42	12	2		105	110	1.37	0.95
1980	10	47	38	11	2	1	99	109	1.36	0.91
1981	8	78	58	12	2		150	158	1.97	0.95
1982	6	62	34	20	5		121	127	1.58	0.95
1983	10	58	52	10	6	4	130	140	1.74	0.93
1984	10	64	40	23	5	1	133	143	1.78	0.93
1985	10	50	43	16	9	4	122	132	1.64	0.92
1986	10	59	63	20	5	6	153	163	2.03	0.94
1987	8	50	70	20	8	2	150	158	1.97	0.95
1988	1	57	57	27	4	3	148	149	1.86	0.99
1989	10	50	55	22	3	6	136	146	1.82	0.93
1990	8	71	63	25	13	3	175	183	2.28	0.96
1991	9	59	49	35	16	4	163	172	2.14	0.95
1992	11	72	53	39	16	13	193	204	2.54	0.95
1993	13	55	75	39	23	6	198	211	2.63	0.94
1994	6	65	88	45	19	7	224	230	2.87	0.97
1995	10	59	78	38	20	12	207	217	2.70	0.95
1996	20	87	87	48	25	14	261	281	3.50	0.93
1997	15	77	82	61	23	10	253	268	3.34	0.94

Year	Single Author papers	Multi Author papers						Total (single+ multi authors)	Percentage (%)	Collaboration coefficient
	One	Two	Three	Four	Five	>five	Total			
1998	10	81	81	50	32	14	258	268	3.34	0.96
1999	13	97	82	60	30	17	286	299	3.73	0.96
2000	5	69	73	48	24	10	224	229	2.85	0.98
2001	3	72	71	62	34	28	267	270	3.36	0.99
2002	3	54	88	67	35	33	277	280	3.49	0.99
2003	8	74	84	69	37	32	296	304	3.79	0.97
2004	5	73	76	61	28	31	269	274	3.41	0.98
2005	8	78	85	49	40	39	291	299	3.73	0.97
2006	6	88	87	77	38	30	320	326	4.06	0.98
Total	932	2798	2300	1147	517	332	7094	8026	100	0.88

It is seen from the table that most of the Journal articles are published by two authors with 2798 publication (34.86%) and followed by three authors with 2300 publication (28.66%). It is clear that only 932 (11.61%) of publications are single authored and four, five and more than five authored publications together contribute remaining 1996 (24.87%) publications. It indicates that single authored works are less than that of the multi authored contributions.

Figure 4.7: Authorship pattern of Publication of journal articles



4.4.4 Degree of Collaborations of Journal articles

Collaboration is said to have taken place when two or more investigator works together on a project and contribute resources and effort both intellectual and physical. The degree of collaboration varies from one discipline to another. The extend of collaboration can be measured with the help of multi-authored papers. To measure the collaborative research pattern a simple indicator called collaboration coefficient is used. Collaboration co-efficient is the ratio of the number of collaborative research papers during a certain period of time. As per formula given by Subramanyan (1983), for determining the degree of collaboration in a discipline, the value of collaboration will be between 0 and 1.

From Table it is clear that the highest Collaboration coefficient was .99 in 1988, 2001&2002 and followed by .98 in 2004 & 2004 and the lowest Collaboration coefficient was .12 in1948 and followed by .17 in 1947. So the degree of collaboration over the years 1947-2006 is calculated in table -6 as per the equation proposed by Subramanyam and it is vary from 0.12 to 0.99.

To determine the degree of collaboration of total publications of IACS, the number of single authored and multi-authored publications is calculated and is applied to the formula that is given below: : C=Nm/Nm + Ns (Where: C = Degree of Collaboration, Nm = Number of Multi-

Authored works. Ns = Number of Single Authored works.)

Here C = 7094/8026 = 0.88. Hence the degree of collaboration of publication of the IACS scientists is 0.88.The mean value is founded to be 0.88.

4.4.5 Most Productive Authors in the Publications of Journal articles

The Table 7 shows the list of 10 most productive authors for Journal article in IACS,Kolkata. The study reveals that, Dr. S.R Palit ,Dept of Physical Chemistry is the most productive author contributing 277 publications with (3.45%), followed by Dr. A K Pal ,Dept. of Material Science (259) with (3.23%) and Dr. A Chakrabarty , Dept. of Inorganic Chemistry (234) with (2.92 %) and so on. It is observed that three authors out of top ten authors are in only Dept of Material Science. Two are in Inorganic Chemistry & Physical Chemistry. It is also observed that Top Ten Authors contributing 2233 publication with (27.9%) out of total publications (8026).

Table 4.7: Rank-list of most Productive Authors of journal articles

Sl.No.	Author	Departments.	No. of Publications	Percentage	Rank
1	Palit S R	Physical.Chemistry	277	3.45	1st
2	Pal A K	Material Science	259	3.23	2nd
5	Chakravorty A	Inorganic Chemistry	234	2.92	3rd
3	Ghosh S	Inorganic Chemistry	233	2.90	4th
4	Chaudhuri S	Material Science	230	2.87	5th
6	Barua A K	Material Science	224	2.79	6th
7	Mukherjee D	Physical Chemistry	200	2.49	7th
8	Chakravorty D	MLS Research Unit	193	2.40	8th
9	Chaudhuri B K	Solid State Physics	193	2.40	9th
10	Bhattacharyya D P	Theoretical Physics	190	2.37	10th

4.4.6 Year-wise distribution of Foreign and Indian Journal

From table-8,analysis of distribution of articles in journal revealed that 1978 (24.64%) are published in Indian Journals. Most of the articles published by the scientists of IACS are in the foreign Journals, and that is accounts for 6048 articles (75.36%). 2006 is the most productive year. Out of the 326 total articles published in 2006, only 25 are in Indian journals and 301 are published in the foreign journals. In 1947-1966, Published articles in Indian journal are more than Published articles in foreign Journals. Then in next time periods 1968-2006, Published articles in foreign Journals are more than Published articles in Indian journal.

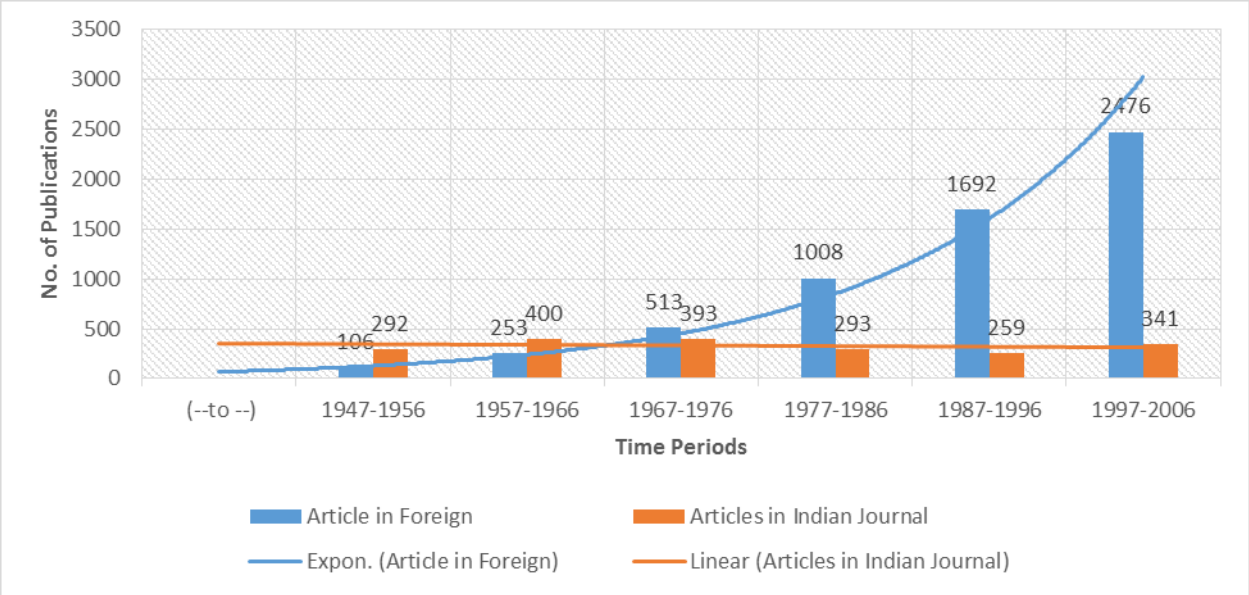
Table 4.8: Year-wise distribution of journal articles in Foreign and Indian Journal

Year	Articles in Foreign Journal	Article in Indian Journal	Total no. of Publication	Decade specifying years	Article in Foreign Journal	Articles in Indian Journal	Total No. of Publication
1947	1	6	7	**1947-1956**	106	292	398
1948	1	16	17				
1949	3	15	18				
1950	4	21	25				
1951	11	25	36				
1952	9	31	40				
1953	12	45	57				
1954	19	42	61				
1955	29	47	76				
1956	17	44	61				
1957	27	33	60	**1957-1966**	253	400	653
1958	18	29	47				
1959	20	43	63				
1960	19	42	61				
1961	11	41	52				
1962	25	39	64				
1963	16	49	65				
1964	30	44	74				
1965	40	47	87				
1966	47	33	80				
1967	53	58	111	**1967-1976**	513	393	906
1968	48	37	85				
1969	44	33	77				
1970	55	32	87				
1971	56	27	83				
1972	40	30	70				
1973	42	46	88				
1974	42	44	86				
1975	70	43	113				
1976	63	43	106				

Year	Articles in Foreign Journal	Article in Indian Journal	Total no. of Publication	Decade specifying years	Article in Foreign Journal	Articles in Indian Journal	Total No. of Publication
1977	66	33	99	1977-1986	1008	293	1301
1978	79	41	120				
1979	78	32	110				
1980	87	22	109				
1981	123	35	158				
1982	106	21	127				
1983	116	24	140				
1984	115	28	143				
1985	106	26	132				
1986	132	31	163				
1987	134	24	158	1987-1996	1692	259	1951
1988	125	24	149				
1989	124	22	146				
1990	141	42	183				
1991	158	14	172				
1992	179	25	204				
1993	189	22	211				
1994	201	29	230				
1995	191	26	217				
1996	250	31	281				
1997	242	26	268	1997-2006	2476	341	2817
1998	244	24	268				
1999	246	53	299				
2000	185	44	229				
2001	220	50	270				
2002	248	32	280				
2003	266	38	304				
2004	250	24	274				
2005	274	25	299				
2006	301	25	326				
Total	6048	1978	8026	1947-2006	6048	1978	8026

The trend shows that more than 75% of journal articles published by scientists of IACS,Kolkata are in foreign journals. In 1947-1966, Published articles in Indian journal are more than Published articles in foreign Journals. Then in next time periods 1968-2006, Published articles in foreign Journals are more than Published articles in Indian journal. In 1947-1966, 65.84 % articles were published in Indian Journals whereas in 1967-2006, only 18.44 % articles were published in Indian Journals. So it is clear that Publication in foreign Journals is gradually increased whereas Publication in Indian Journals is proportionately decreased.

Fig4.8: Distribution of Foreign and Indian Journal over different time periods



4.4.7 Ranking of Journals

Journals are the formal primary medium of communication for researchers. A list of 10 top ranked journals is given in the table 9 according to their frequencies.

Table 4.9: Rank List of Journals

Sl. No.	Journals	Country	No. of Articles	Rank	Percentage (%)
1	Ind.J.Phys	India	819	1st	10.20
2	Phys.Rev.	UK	303	2nd	3.78
3	Indian J.Chem.	India	280	3rd	3.49
4	Chem.Phys.Lett	Nederland	214	4th	2.67
5	Inorg.Chem.	USA	164	5th	2.04
6	J.Chem.Phys.	USA	159	6th	1.98
7	J.Appl.Phys.	USA	139	7th	1.73
8	Acta. Cryst	Denmark	137	8th	1.71
9	Tetrahedron lett	UK	136	9th	1.69
10	J.Chem.Soc.Dalton.Trans.	USA	127	10th	1.58

From the table 9, it is seen that Indian Journal of Physics with a share of 819 (10.20%). Physics Review & Indian Journal of Chemistry occupy the 2nd & 3rd position with 303 & 280 respectively. It is interesting to see that only two top ranked journals out of top 10 journals are Indian journals but four top ten journals published from USA & two top ten journals published from UK and there is only one journal from Nederland & Denmark. It is observed that 2478 (30.87 %) articles published in only top ten Journals and rest of articles 5548 (69.13%) are published in 510 no of journals.

4.4.8 Rank List of Foreign Journals

The rank list of top 10 foreign journals is listed in the table -10. From the table, it is seen that Journals of Physics Review published from, USA is the highest productive journals with 303(3.78%) articles among the foreign journals followed by Chem.Phys. Letter published from Nederland with 214 (2.67 %) and Inorganic Chemistry published from USA with 164 (2.04 %) and so on.

Table 4.10: Rank List of Foreign Journals

Sl. No.	Name of Journal	Country	No. of Articles	Percentage	Rank
1	Phys.Rev.	UK	303	3.78	1st
2	Chem.Phys.Lett	Nederland	214	2.67	2nd
3	Inorg.Chem.	USA	164	2.04	3rd
4	J.Chem.Phys.	USA	159	1.98	4th
5	J.Appl.Phys.	USA	139	1.73	5th
6	Acta. Cryst	Denmark	137	1.71	6th
7	Tetrahedron lett	UK	136	1.69	7th
8	J.Chem.Soc.Dalton.Trans.	USA	127	1.58	8th
9	J.Phys.B	UK	105	1.31	9th
10	J.Phys.Chem.	USA	99	1.23	10th

It can be seen that most of the top ranked foreign journals are published from USA. There are two journals from UK & only one from Nederland & Denmark respectively.

4.4.9 Rank List of Indian Journals

An analysis has been made to identify the list of Indian Journals preferred by the researchers of IACS and the results are shown in the table 11.

Table 4.11: Rank List of Indian Journals

Sl.No.	Name of Journal	No. of Articles	Percentage	Rank
1	Ind.J.Phys	819	10.20	1st
2	Indian J.Chem	280	3.49	2nd
3	Sci & Cult.	99	1.23	3rd
4	Proc.Indian Acad.Sci.	99	1.23	4th
5	J.Indian Chem.Soc.	78	0.97	5th
6	J.I.N.C.	73	0.91	6th
7	Ind.J.Pure and Appl.Phys.	58	0.72	7th
8	J.Sci.Ind.Res.	47	0.59	8th
9	Ind.J.Cryogenics	35	0.44	9th
10	Current Science	21	0.26	10th

It is observed from the table that, Indian Journal of Physics is the most preferred Indian Journal of IACS scientists with 819(10.20 %) articles. Indian Journal of Chemistry with 280(3.49%) articles and Science & Culture with 99 (1.23%) articles each are the second and third positions respectively and so on.

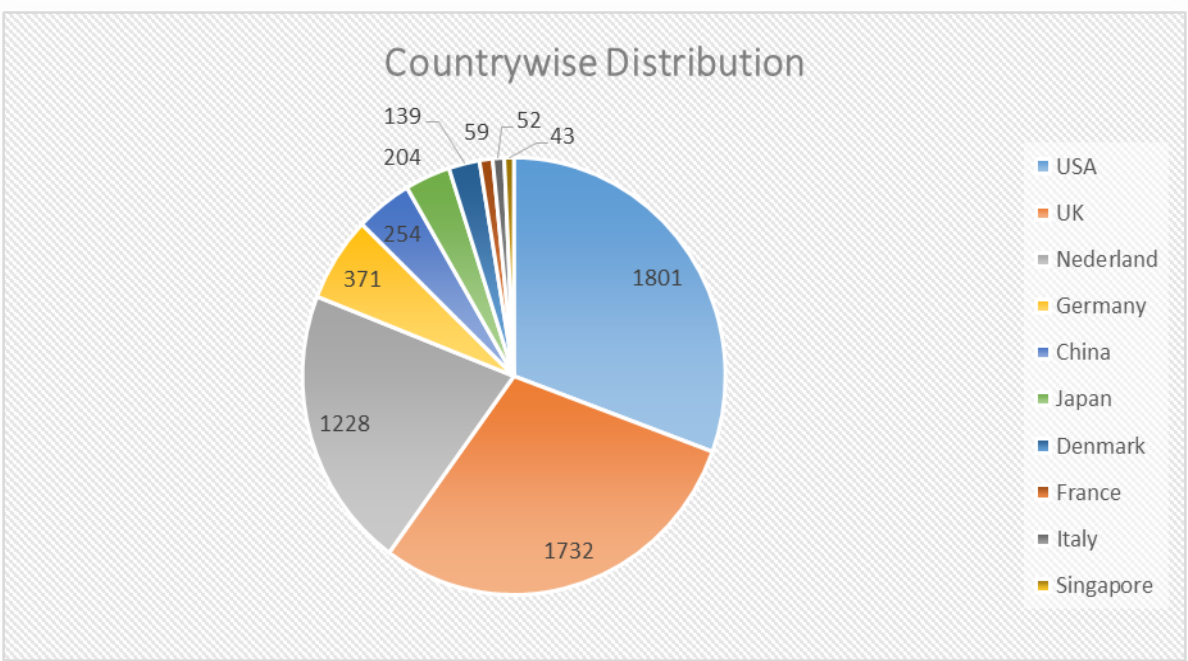
4.4.10. Geographical distribution / Country wise distribution of Journal articles

The journals are analyzed according to their country of origin and the results are shown in the table 12. This table gives the country wise distribution of journal publishing from IACS Kolkata's publications. Among the top ranking journals publishing the papers are from INDIA with 1978 (24.64%) followed by USA with 1801 (22.44%) publications & UK with 1732 (21.58%) publications. The Netherland with 1228 (15.30%) publications and Germany with 371 (4.62%) publications occupy each are 3rd & 4th positions and so on. Nevertheless, it shows that there are more collaboration with Indian authors from United State of America (USA), UK and Netherland

Table 4. 12: Geographical Distribution of Journal articles

Sl.No.	Country	No.of Journal	Rank	Percentage
1	USA	1801	1st	22.44
2	UK	1732	2nd	21.58
3	Nederland	1228	3rd	15.30
4	Germany	371	4th	4.62
5	China	254	5th	3.16
6	Japan	204	6th	2.54
7	Denmark	139	7th	1.73
8	France	59	8th	0.74
9	Italy	52	9th	0.65
10	Singapore	43	10th	0.54

Fig. 4.9 : Country wise distribution of journals articles



4.4.11 Applicability of Bradford's Law of Scattering

Bradford's Law of scattering describes a quantitative relation between journals and the other papers published during a particular time. Bradford, for the first time, tested the journals containing references to these fields in their descending order of productivity and then divided the articles into three approximately equal zones or group. He termed the first

one as the nuclear zone, which is highly productive; the second zone as the moderately productive zone and the third zone as the peripheral zone or law productive zone. Bradford discovered regularity in calculating the number of titles in each of the three zones. Samuel Clement Bradford in 1934 points out that, if scientific journals are arranged in order of decreasing productivity of articles on a given subject, they may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups and zones containing the same number of articles as the nucleus when the number of periodicals in the nucleus and succeeding zones will be 1: n:n^2.

For testing the algebraic interpretation of the law, 520 journal titles are divided into three zones. The Bradford's multiplier factor was arrived at the dividing periodical titles of a zone by the preceding zone. The distribution of journals and corresponding number of articles in the three zones along with the value of Bradford multipliers are shown in table 13.

Table 4.13: Scattering of journals articles over Bradford Zone

Zones	No.of Journals	Percentage of Journals	No.of Articles	Percentage of Articles	Multiplier
1	12	2.31	2682	33.42	1.2 x10
2	38	7.31	2680	33.39	3.8 x10
3	470	90.38	2664	33.19	47 x10
Total	520	100	8026	100	52 x 10

In the present data set, 12 journal covers 2682 articles, next 38 journals covers 2680 articles and remaining 470 journal covers 2664 articles. In other words 1/3rd of the total articles have been covered by each group of the journals. According to Bradford, the zones, thus identified will form an approximately geometric series in the form 1: n:n2. But it is found that the relationship of each zone in the present study **12: 38: 470:: 1.2: 3.8: 47** This does not fit into the Bradford's distribution.

4.5 Analyses of Seminar /Conference papers

Conference papers can be an effective way to try out new ideas, introduce your work to colleagues, and hone your research questions. Presenting at a conference is a great opportunity for gaining valuable feedback from a community of scholars and for increasing your professional stature in your field**.** It is often both a written document and an oral presentation and it is also is the most important primary sources.

4.5.1 Year-wise Distribution of Seminar /Conference papers

The total productivity of the scientists & research workers of IACS ,Kolkata for the sixty years period (1947-2006) under study is given chronologically in table 14.

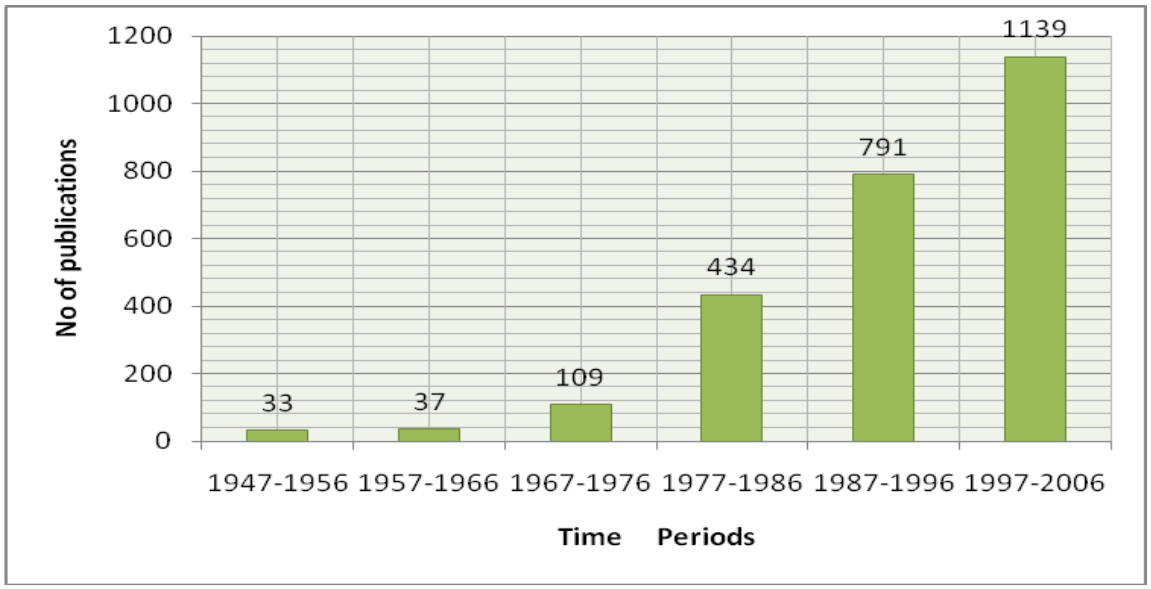
Table 4.14: Distribution of Seminar /Conference papers Year-wise

year	No of publication	Percentage (%)	Decade specifying years	Total no publications	Percentage (%)
1947	1	0.039	1947-1956	33	1.30
1948	1	0.039			
1949		0.000			
1950		0.000			
1951	3	0.118			
1952		0.000			
1953	1	0.039			
1954	10	0.393			
1955	13	0.511			
1956	4	0.157			
1957	1	0.039	1957-1966	37	1.45
1958	3	0.118			
1959	6	0.236			
1960	1	0.039			
1961	3	0.118			
1962	4	0.157			
1963	4	0.157			
1964	5	0.197			
1965	1	0.039			
1966	9	0.354			
1967	5	0.197	1967-76	109	4.29
1968	9	0.354			
1969	13	0.511			
1970	9	0.354			
1971	9	0.354			
1972	31	1.219			
1973	5	0.197			
1974	7	0.275			
1975	11	0.433			

year	No of publication	Percentage (%)	Decade specifying years	Total no publications	Percentage (%)
1976	10	0.393			
1977	34	1.337	1977-1986	434	17.07
1978	6	0.236			
1979	24	0.944			
1980	20	0.786			
1981	32	1.258			
1982	43	1.691			
1983	31	1.219			
1984	74	2.910			
1985	87	3.421			
1986	83	3.264			
1987	70	2.753	1986-1996	791	31.10
1988	87	3.421			
1989	61	2.399			
1990	63	2.477			
1991	54	2.123			
1992	56	2.202			
1993	96	3.775			
1994	78	3.067			
1995	111	4.365			
1996	115	4.522			
1997	125	4.915	1996-2006	1139	44.79
1998	112	4.404			
1999	156	6.134			
2000	100	3.932			
2001	132	5.191			
2002	61	2.399			
2003	108	4.247			
2004	114	4.483			
2005	90	3.539			
2006	141	5.545			
Total	2543	100	1947-2006	2543	100

It can be observed that the total published seminar / conference papers of the IACS Kolkata scientists for the 60 years period amount to 2543. The study indicates that 1999 is the most productive years with 156 publications (6.13 %) followed by 2006 with 141 publication (5.55%), 2001 with 132 publications (5.19 %) and 1997 with 125 publications (4.92%) & so on. The analysis shows that there is a growth of publications during the period of study. It reveals that the association has no publications in conference in 1949 & 1950 respectively.

Fig.4.10 : Distribution of Conference / Seminar papers over different time periods



It also observed that during 60 years (1947-2006), research outputs of the association are gradually increased. 1997 -2006 are most productive periods with 1139 publication (44.79 %) followed by 1987-1996 with 791 publications (31.10 %) and 1947-1956 are the lowest productive periods with 33 publication (1.30 %) and followed by 1957-1966 with only 37 publications (1.45 %) and 1967-76 with 109 publications (4.29%).The bar diagram shows that the year 1997-2006 is the most productive time periods and 1947-1956 is the lowest productive time periods at IACS, Kolkata during the last 60 years. This diagram also shows the growth pattern of publications in seminar/conference papers at IACS,Kolkata.

4.5.2 Distribution of Seminar /Conference papers (Department /research unit)

Now, IACS,Kolkata has Eight departments for basic science research, The Department -wise productivity of scientists of IACS during the period under study is given in the table 15. During 1947 -2006, the Department of material science had contributed 499 papers (19.62 %) of total productivity followed by Solid State Physics with 496 papers (19.50%) and Theoretical Physics with 369 (14.51%) whereas the publication Productivity of

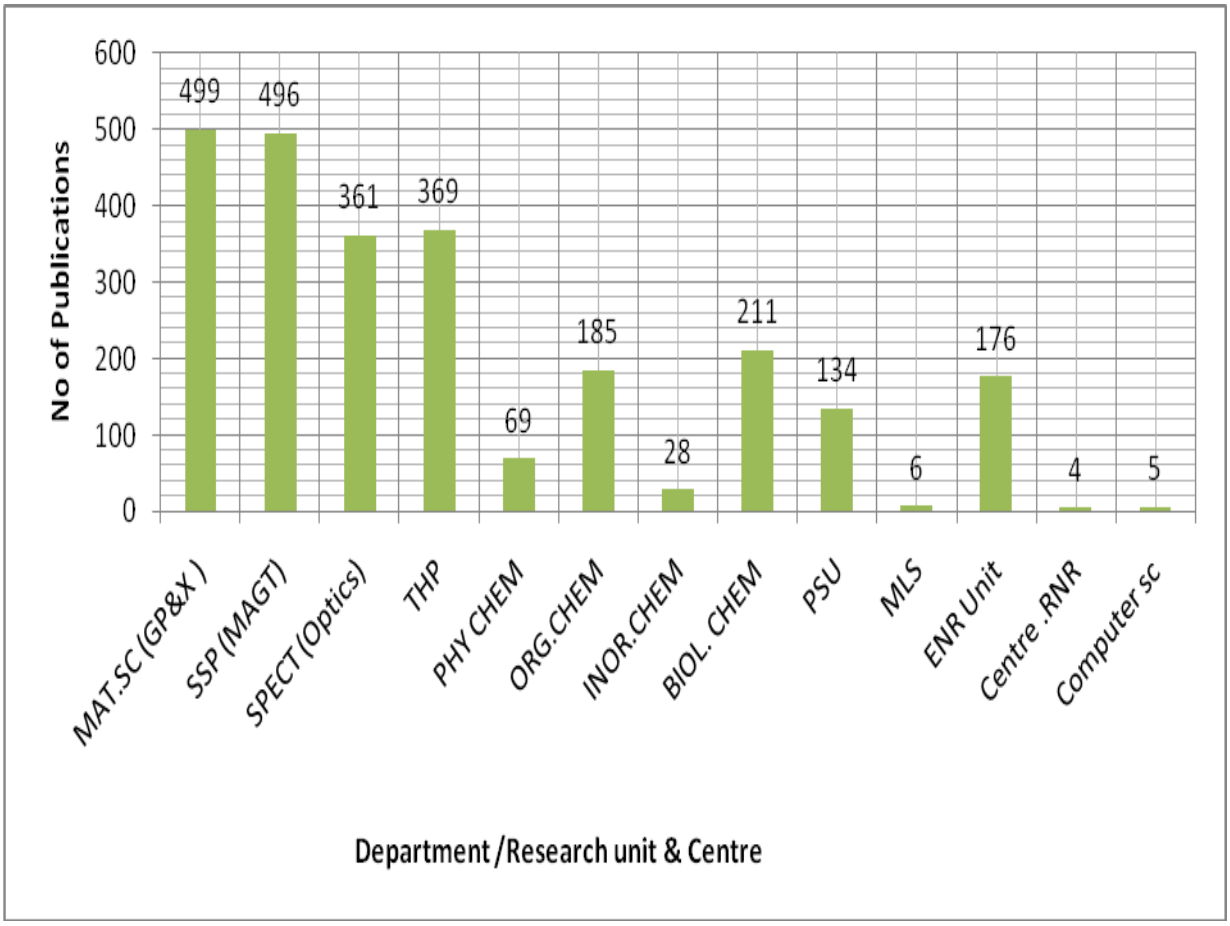
Inorganic Chemistry (28,1.10%), Physical Chemistry (69,2.71%) and are relatively law compared with others. They are together account for only 97 publications. It is also indicates that the growth of publication is gradually increased.

The publication productivity of Research units is also indicated table 15. During 1947-2006, The Energy Research Unit had contributed 176 papers (6.92%) followed by polymer Science Research unit with 134 papers (5.27%) and MLS Research unit with only 06 (0.23%). There are three research centers namely Raman Center for Atomic Molecular& Optical Sciences (RCAM & OP. Sc), Centre for Renewable Energy Sources, (REN. ENR) and Centre for Advanced Materials (CAM). These are established recently in 2005.The centre for Renewable Energy Sources, (REN. ENR) had contributed only 04 (0.16) Papers.

Table 4.15:Distribution of Conference papers by Department/Research Unit and Centre

Sl no	Dept.	1947-56	1957-66	1967-76	1977-86	1987-96	1997-06	Total	Percentage (%)
1	MAT.SC (GP&X)	2	2	14	87	166	228	499	19.62
2	SSP (MAGT)	3	13	32	98	136	214	496	19.50
3	SPECT (Optics)	1	0	0	35	149	176	361	14.20
4	THP	1	7	10	110	96	145	369	14.51
5	PHY CHEM	7	4	15	16	19	8	69	2.71
6	ORG.CHEM	0	5	22	56	48	54	185	7.27
7	INOR.CHEM	19	2	2	0	5	0	28	1.10
8	BIOL. CHEM	0	4	14	31	83	79	211	8.30
9	PSU					27	107	134	5.27
10	MLS					6		6	0.23
11	ENR Unit				1	56	119	176	6.92
12	Centre .RNR						4	4	0.16
13	Computer sc						5	5	0.20
		33	37	109	434	791	1139	2543	100

Fig.4.11: Department /Research Unit/Research Centre-wise Distribution of Publications of conference papers



4.5.3 Authorship Pattern of Seminar /Conference papers with Collaboration Coefficient

Table 16 shows the details of the authorship patterns of whole research publications of scientist and research workers at IACS, Kolkata during the period under the study.

Table 4.16: Authorship Pattern of Publications with collaboration Coefficient year wise

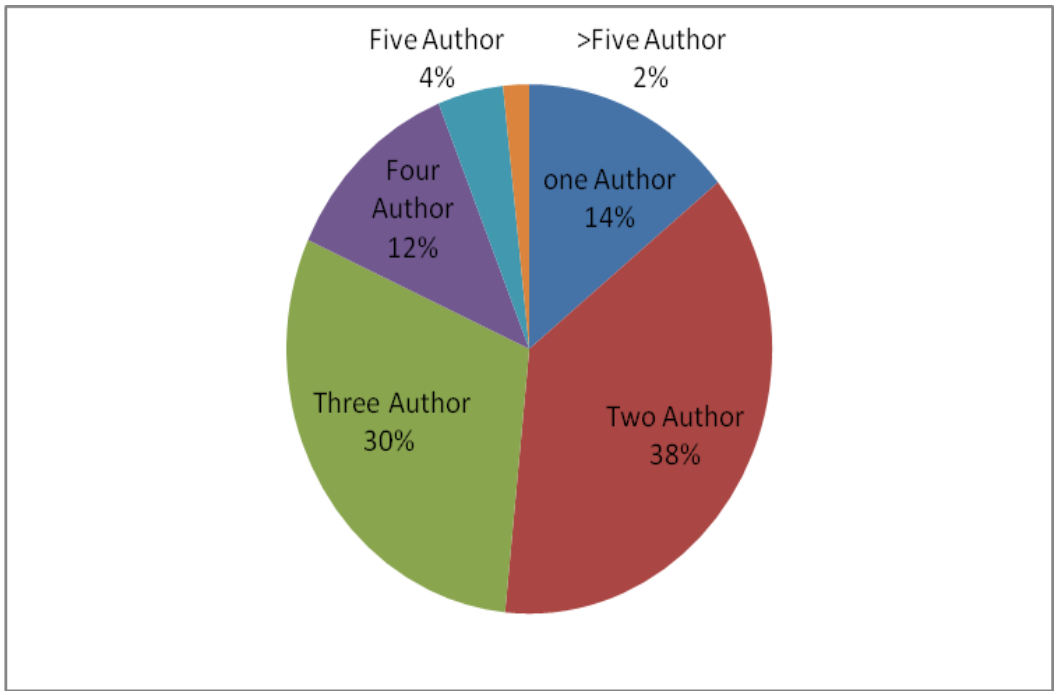
Year	Single authored papers	Multi authored Papers					Total	Total Author	Collaboration Coefficient
	One	Two	Three	Four	Five	<five			
1947	1						0	1	0.00
1948	1						0	1	0.00
1949							0	0	0.00
1950							0	0	0.00
1951	2		1				1	3	0.33

Year	Single authored papers	Multi authored Papers					Total	Total Author	Collaboration Coefficient
	One	Two	Three	Four	Five	<five			
1952			2				2	2	1.00
1953		1					1	1	1.00
1954	7	3					3	10	0.30
1955	6	5					5	11	0.45
1956	3	1					1	4	0.25
1957			1				1	1	1.00
1958	1	1	1				2	3	0.67
1959	4	2					2	6	0.33
1960			1				1	1	1.00
1961		1	2				3	3	1.00
1962	1	1	1	1			3	4	0.75
1963	2	1	1				2	4	0.50
1964		3	2				5	5	1.00
1965			1				1	1	1.00
1966	2	5	2				7	9	0.78
1967	1	2	2				4	5	0.80
1968	1	3	5				8	9	0.89
1969		10	2	1			13	13	1.00
1970	1	2	6				8	9	0.89
1971		8	1				9	9	1.00
1972	3	18	10				28	31	0.90
1973	1	2	2				4	5	0.80
1974	1	5	1				6	7	0.86
1975	1	2	5		3		10	11	0.91
1976		7	3				10	10	1.00
1977	2	20	7	5			32	34	0.94
1978	2	3		1			4	6	0.67
1979	4	16	3	1			20	24	0.83
1980	4	9	7				16	20	0.80
1981	8	12	9	3			24	32	0.75
1982	6	22	14		1		37	43	0.86
1983	5	15	8	3			26	31	0.84

Year	Single authored papers	Multi authored Papers					Total	Total Author	Collaboration Coefficient
	One	Two	Three	Four	Five	<five			
1984	8	37	22	5	1	1	66	74	0.89
1985	9	36	26	14	1	1	78	87	0.90
1986	10	32	34	4	3		73	83	0.88
1987	22	25	19	3		1	48	70	0.69
1988	12	29	27	10	6	3	75	87	0.86
1989	3	24	18	6	6	4	58	61	0.95
1990	11	20	16	10	5	1	52	63	0.83
1991	4	26	16	5	1	2	50	54	0.93
1992	9	15	20	9	2	1	47	56	0.84
1993	10	37	35	13	1		86	96	0.90
1994	5	28	29	10	4	2	73	78	0.94
1995	10	43	23	21	10	4	101	111	0.91
1996	10	50	32	13	8	2	105	115	0.91
1997	14	46	40	22	3		111	125	0.89
1998	14	48	22	21	6	1	98	112	0.88
1999	30	42	44	35	2	3	126	156	0.81
2000	16	27	35	11	9	2	84	100	0.84
2001	23	29	47	24	6	3	109	132	0.83
2002	10	20	22	5	3	1	51	61	0.84
2003	16	35	37	17	2	1	92	108	0.85
2004	23	36	33	12	4	6	91	114	0.80
2005	10	23	31	8	16	2	80	90	0.89
2006	11	64	39	16	8	3	130	141	0.92
Total	360	952	767	309	111	44	2183	2543	0.86
Percentage	14.16	37.44	30.16	12.15	4.36	1.73	85.84	100	

From the table it is clear that only 14.16% (360) of publications are single authored and are only 37.44% (952) are two authors. Three, four and more than four authored publications together contribute remaining 48.41% (1231). It indicates that multi authored works are more than that of the single authored contributions that gradually increased.

Figure 4.12: Authorship pattern of Publication of conference papers



4.5.4 Degree of Collaborations of Seminar /Conference papers

Extend of collaboration can be measured with the help of multi-authored papers. To measure the collaborative research pattern a single indicator called collaboration coefficient is used. Collaboration co-efficient is the ration of the number of collaborative research papers during a certain period of time. As per formula given by Subramanyan (1983), for determining the degree of collaboration in a discipline, the value of collaboration will be between 0 and 1.

From Table it is clear that the highest Collaboration coefficient was one (01) in 1952,1953,1957,1960,1961,1964,1965,1969,1971,1976 and followed by .95 in 1989 and so on and the lowest Collaboration coefficient was 0 in 1947 and followed by .25 in 1956 and so on

To determine the degree of collaboration of total publications of IACS, the number of single authored and multi-authored publications is calculated and is applied to the formula that is given below: : **C=Nm/Nm + Ns** (Where: C = Degree of Collaboration, Nm = Number of Multi Authored works., Ns = Number of Single Authored works.

Here C = 2183/2543 = 0.86. Hence the degree of collaboration of Conference papers publication of the IACS scientists is 0.86.

4.5.5 Most Productive Authors of Seminar /Conference papers

The Table 17 shows the list of 10 most productive authors for conference paper in IACS, Kolkata. The study reveals that, Dr. A K Pal ,Dept of Material Science is the most productive author contributing 166 publications, followed by Dr. B K Choudhuri, Dept. of Solid State Physics (142) and Dr. D.P Bhattacharya , Dept. of Solid State Physics (136).

Table 4.17: Rank-list of most Productive Authors of Seminar /Conference papers

Sl.No.	Author	Department	No. of Publications	Percentage	Rank
1	Pal A K	Material Science	166	6.39	1st
2	Chaudhuri B K	Solid State Physics	142	5.47	2nd
3	Bhattacharyya D P	Solid State Physics	136	5.24	3rd
4	Chaudhuri S	Solid State Physics	124	4.77	4th
7	Sen Gupta S P	Solid State Physics	100	3.85	5th
6	Ray S	Solid State Physics	99	3.81	6th
8	RaiDastidar K	Solid State Physics	92	3.54	7th
5	Misra T N	Biological Chemistry	89	3.43	8th
9	Chatterjee B P	Biological Chemistry	83	3.20	9th
10	Barua A K	Material Science	81	3.12	10th

It is observed that six authors out of top ten authors are in only Dept of Solid State Physics. Two are in Material science & Biological Chemistry.

4.5.6 The year-wise distribution of conference /seminar at Foreign and Indian

The analysis of distribution of conference papers revealed that 1999 papers (78.61%) are published in conference held at India and only 544 numbers of papers (23.39%) are also published in conference held at outside India.

Table 4.18: Year-wise Distribution of Foreign and Indian Seminar /Conference Paper

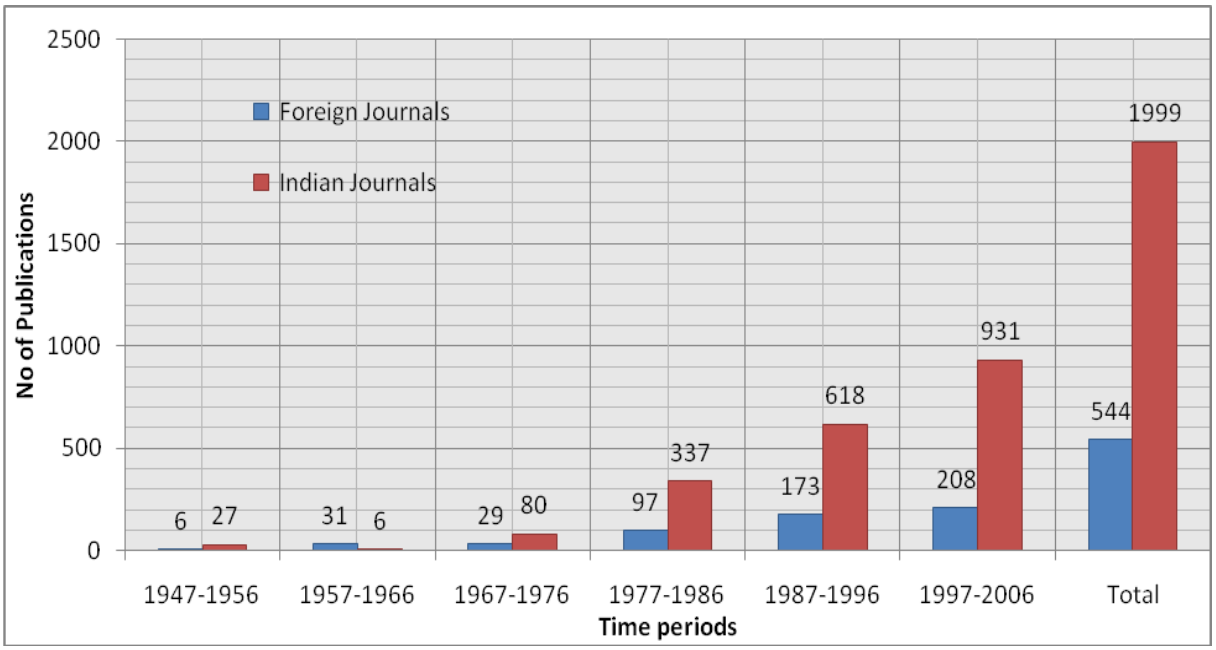
Year	Articles in Foreign Journal	Article in Indian Journal	Total no. of Publication	Decade specifying years	Articles in Foreign Journal	Articles in Indian Journal	Total No. of Publication
1947		1	1	1947-56	6	27	33
1948		1	1				
1949			0				
1950			0				
1951	1	2	3				
1952			0				
1953		1	1				
1954	2	8	10				
1955	3	10	13				
1956		4	4				
1957	1		1	1957-66	31	6	37
1958	2	1	3				
1959	5	1	6				
1960	1		1				
1961	3		3				
1962	3	1	4				
1963	4		4				
1964	4	1	5				
1965		1	1				
1966	8	1	9				
1967	5		5	1967-76	29	80	109
1968	2	7	9				
1969	7	6	13				
1970	3	6	9				
1971	6	3	9				
1972		31	31				
1973	3	2	5				
1974	1	6	7				
1975	1	10	11				
1976	1	9	10				

Year	Articles in Foreign Journal	Article in Indian Journal	Total no. of Publication	Decade specifying years	Articles in Foreign Journal	Articles in Indian Journal	Total No. of Publication
1977	3	31	34	1977-86	97	337	434
1978	1	5	6				
1979	17	7	24				
1980	1	19	20				
1981	19	13	32				
1982	2	41	43				
1983	6	25	31				
1984	12	62	74				
1985	17	70	87				
1986	19	64	83				
1987	27	43	70	1987-96	173	618	791
1988	15	72	87				
1989	19	42	61				
1990	25	38	63				
1991	12	42	54				
1992	10	46	56				
1993	13	83	96				
1994	2	76	78				
1995	24	87	111				
1996	26	89	115				
1997	34	91	125	1997-2006	208	931	1139
1998	17	95	112				
1999	28	128	156				
2000	10	90	100				
2001	25	107	132				
2002	10	51	61				
2003	16	92	108				
2004	28	86	114				
2005	21	69	90				
2006	19	122	141				
Total	544	1999	2543	1947-006	544	1999	2543

Most of the papers published by the scientists of IACS are in the conference at India. 1999 is the most productive year. Total 156 papers published in 1999 followed by 2006 with 141 and

2001 with 132. In 1947-2006, Published papers in conference held at India are more than Published papers in conference held at foreign. So it is clear that Publication in foreign & India conference is gradually increased respectively.

Fig4.13: Distribution of conference papers in India & abroad over Different Time Periods



4.6 Analyses of Thesis / Doctoral Research:

Research work is of little value if results of the research work are not communicated. India invests a huge amount of money on doctoral research. Evolutions of research work of the IACS, Kolkata is necessary for various purposes. Thesis /Doctoral Research publication are the most important primary information sources where the results of the researches conducted are get unpublished.

4.6.1 Year-wise Distribution of Thesis /Doctoral research:

The total productivity Theses of the scientists & research workers of IACS, Kolkata for the sixty years period (1947-2006) under study is given chronologically in table 19.

Table 4.19:Year-wise Distribution of theses/doctoral research work

Year	No of Thesis	Percentage	Specifying Decades	Total no of Thesis	Percentage (%)
1947	0	0	**1947-1956**	35	3.14
1948	0	0			
1949	3	0.27			
1950	3	0.27			
1951	3	0.27			
1952	2	0.18			
1953	2	0.18			
1954	12	1.08			
1955	4	0.36			
1956	6	0.54			
1957	8	0.72	**1957-66**	126	11.29
1958	5	0.45			
1959	16	1.43			
1960	6	0.54			
1961	18	1.61			
1962	16	1.43			
1963	20	1.79			
1964	10	0.90			
1965	12	1.08			
1966	15	1.34			
1967	22	1.97	**1967-1976**	195	17.47
1968	20	1.79			
1969	24	2.15			
1970	24	2.15			
1971	18	1.61			
1972	10	0.90			
1973	18	1.61			
1974	18	1.61			
1975	19	1.70			
1976	22	1.97			
1977	20	1.79	**1977-1986**	174	15.59
1978	17	1.52			

Year	No of Thesis	Percentage	Specifying Decades	Total no of Thesis	Percentage (%)
1979	19	1.70			
1980	15	1.34			
1981	14	1.25			
1982	22	1.97			
1983	21	1.88			
1984	19	1.70			
1985	13	1.16			
1986	14	1.25			
1987	21	1.88			
1988	25	2.24			
1989	26	2.33			
1990	27	2.42			
1991	19	1.70	**1987-1996**	266	23.84
1992	23	2.06			
1993	29	2.60			
1994	35	3.14			
1995	24	2.15			
1996	37	3.32			
1997	36	3.23			
1998	47	4.21			
1999	25	2.24			
2000	25	2.24			
2001	27	2.42	**1997-2006**	320	28.67
2002	33	2.96			
2003	30	2.69			
2004	32	2.87			
2005	30	2.69			
2006	35	3.14			
Total	1116	100	**1947-2006**	1116	100.00

It can be observed that 1116 numbers of theses was submitted during 1947-2006. The study indicates that 1998 is the most productive year with 47 theses (4.21 %) followed by 1996 with 37 theses (3.32%) and 1997 with 36 (3.23%) &2006 with 35 theses (3.14 %) and so on.1952 and 1953 is the least productive years with 02 theses (.018 %).

Fig.4.14: Represents the Growth of theses trend of Research Scholar of IACS,Kolkata

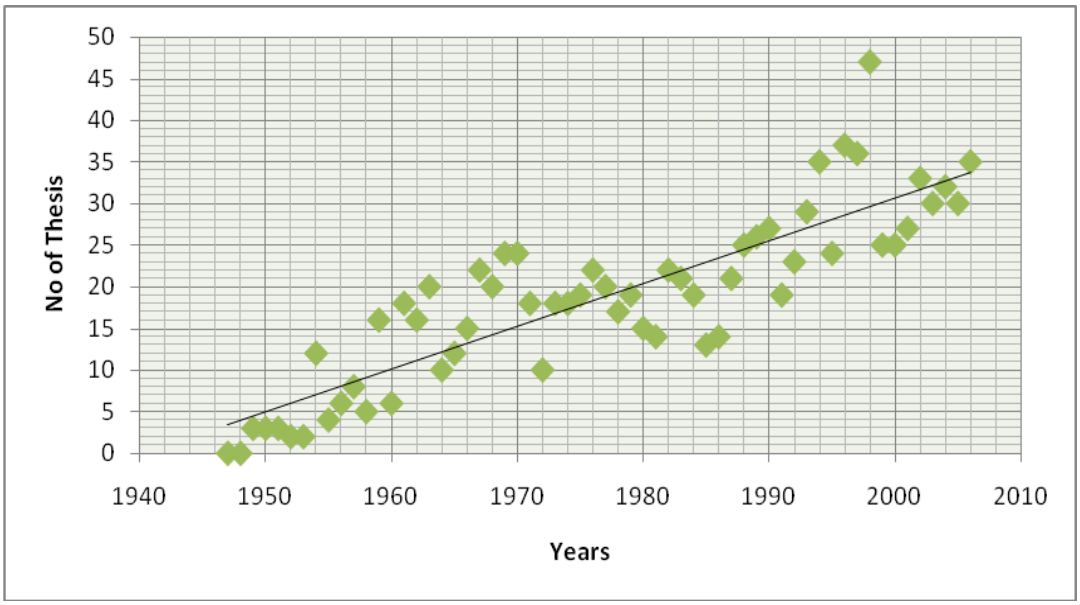
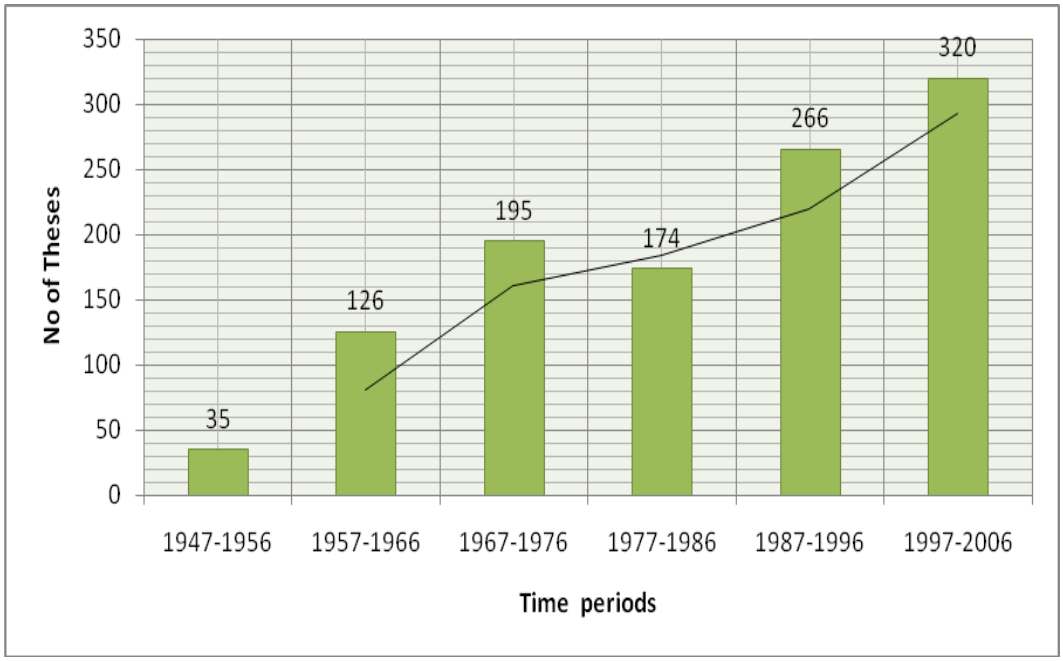


Fig 4.15: Distribution of Theses over different time periods



Ten Yearly grouping of the number of theses submitted from 1947-2006 is shown table 19 and Figure 14. The bar diagram shows that the year 1997-2006 is the most productive time periods with 320 (28.67%) at IACS ,Kolkata during the last 60 years followed by 1987-1996 with 266 theses (23.84 %). It also observed that from 1947-1976, the no of theses has been gradually increased but it is decreased from 1977 – 1986. Again 1987-2006, the no of theses are gradually increased. The years 1947-1956 are the lowest productive periods with 35 theses (3.14 %) and followed by 1957-1966 with 126 theses (11.29 %) and 1977-86 with 174 theses (15.59%) respectively.

4.6.2 Gender –wise Distribution of Theses/doctoral research

Table 20 shows the gender –wise distribution of theses / doctoral research work of IACS, Kolkata.

Table 4.20: Gender -wise distribution of theses over different time periods.

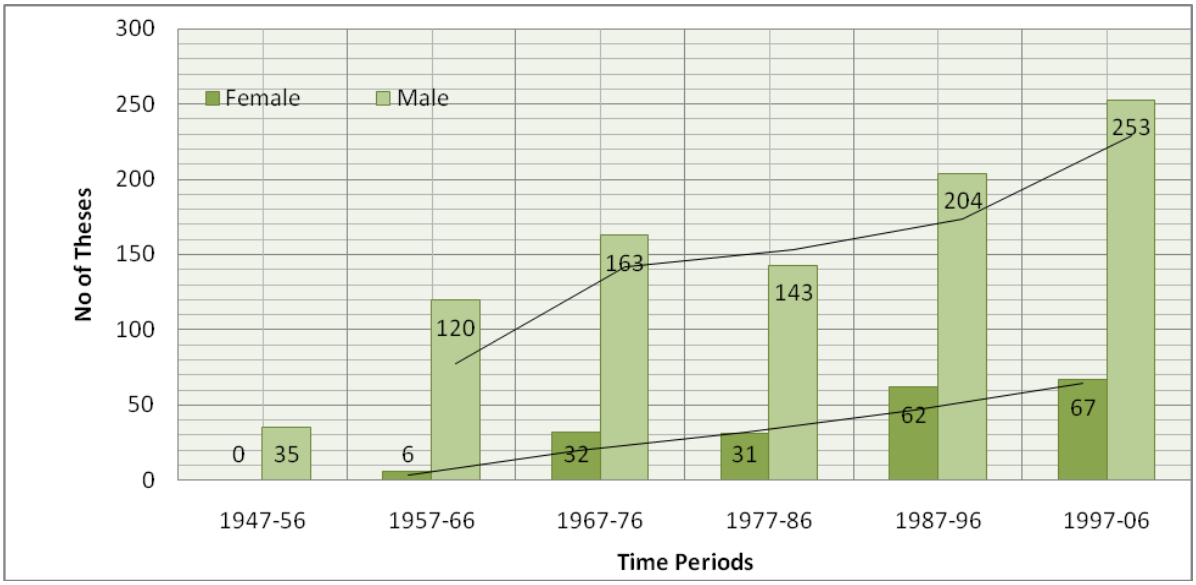
Year	Male	Female	Total	Year	Male	Female	Total
1947	0	0	0	1947-56	35	0	35
1948	0	0	0				
1949	3	0	3				
1950	3	0	3				
1951	3	0	3				
1952	2	0	2				
1953	2	0	2				
1954	12	0	12				
1955	4	0	4				
1956	6	0	6				
1957	8	0	8	1957-66	120	6	130
1958	5	0	5				
1959	16	0	16				
1960	6	0	6				
1961	18	0	18				
1962	16	0	16				
1963	17	3	20				
1964	9	1	10				
1965	12	0	12				
1966	13	2	15				
1967	22	0	22	1967-76	163	32	195
1968	19	1	20				
1969	21	3	24				
1970	21	3	24				
1971	15	3	18				
1972	9	1	10				
1973	16	2	18				
1974	9	9	18				
1975	15	4	19				
1976	16	6	22				

Year	Male	Female	Total	Year	Male	Female	Total
1977	16	4	20	1977-86	143	31	174
1978	16	1	17				
1979	19	0	19				
1980	11	4	15				
1981	10	4	14				
1982	19	3	22				
1983	19	2	21				
1984	14	5	19				
1985	8	5	13				
1986	11	3	14				
1987	17	4	21	1987-96	204	62	266
1988	16	9	25				
1989	16	10	26				
1990	21	6	27				
1991	14	5	19				
1992	18	5	23				
1993	23	6	29				
1994	31	4	35				
1995	15	9	24				
1996	33	4	37				
1997	29	7	36	1997-2006	253	67	320
1998	37	10	47				
1999	22	3	25				
2000	18	7	25				
2001	23	4	27				
2002	27	6	33				
2003	21	9	30				
2004	26	6	32				
2005	19	11	30				
2006	31	4	35				
Total	918	198	1116	1947-2006	918	198	1116

Majority of theses of work of IACS, Kolkata's research scholars are male with 918 (82.26%) theses. The female research scholars have contributed only 198 theses with (17.74%). It is indicate that there are more numbers male research scholars in the IACS, Kolkata.

The associations have no female research scholars during the periods 1947-1962.from 1957-1966 ,only 06 female research scholars (0.54%) had been obtained doctoral degree followed by 1967 – 1976 with 32 (2.87%), 1977-1986 with 31 female research scholars (2.78%), 1987-96 with 62 female scholars (5.56%) and 1996-2006 with 67 (6%) respectively. It is clearly seen that percentage of female scholars involved in research are gradually increased but relatively low compared with male scholars. From 1947 -1976, the no of male research scholars has continuously increased, but it is decreased during the time periods 1977-1986 then the no of male research scholars has also increased during 1987-2006.

Fig.4.16: Gender –wise Distribution of Theses over different Time periods.



4.6.3 Distribution of theses of Department/Research unit wise

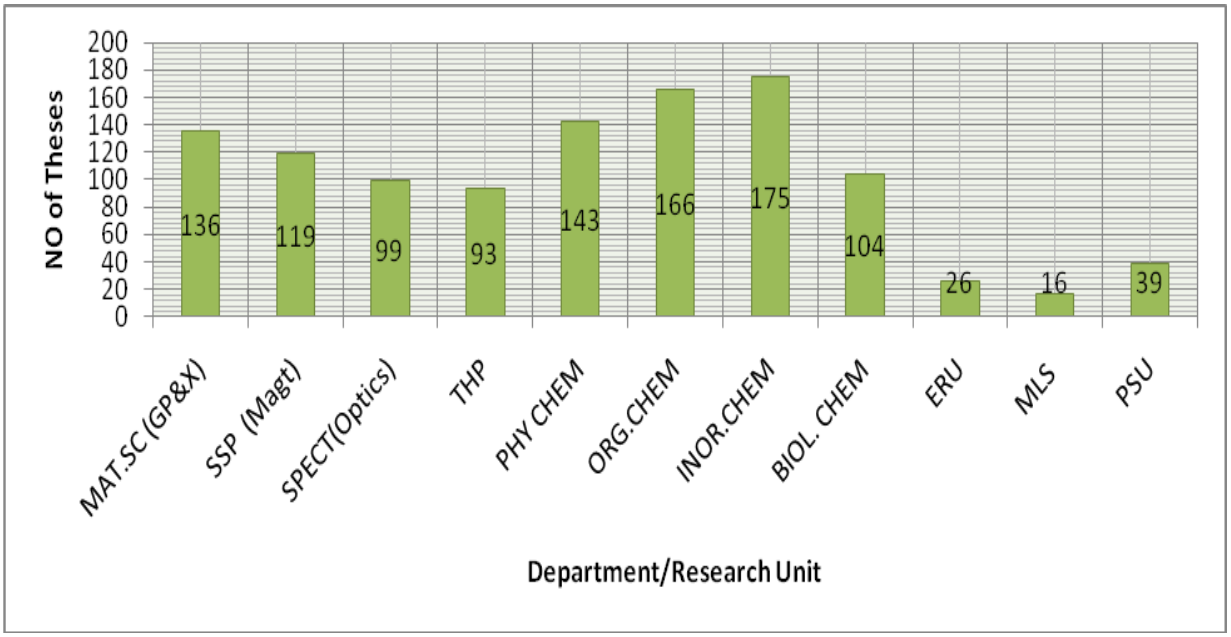
Now ,IACS,Kolkata has Eight departments for basic science research , The Department -wise productivity of scientists of IACS during the period under study is given in the table 21.During 1947 -2006 , the Department of Inorganic Chemistry had contributed 175 theses (15.68%) of total productivity followed by Organic Chemistry with 166 theses (14.87%) and Physical Chemistry with 143 (12.81%) whereas the theoretical physics had contributed only 93 theses (8.33%) followed by Biological Chemistry with 104 theses (9.32%).It is also observed that Inorganic Chemistry had highest average theses per year with 3.13 followed by Organic Chemistry with 2.86 whereas Dept. of Theoretical physics had contributed lowest average theses per year with 1.63 followed by optics with 1.65 and so on.

Table 4.21: Distribution of theses over Different Departments /Research Unit

SL. No.	Dept.	Estd year	Year						No of theses	Averg/year	Percentage (%)
			1947-1956	1957-1966	1967-1976	1977-1986	19871996	1997-2006			
1	MAT.SC (GP & X)	1900	2	12	34	24	27	37	136	2.27	12.19
2	SSP (Magt)	1953	5	10	15	19	31	39	119	2.20	10.66
3	SPECT (Optics)	1947	7	11	15	16	23	27	99	1.65	8.87
4	THP	1950	-	7	10	29	21	26	93	1.63	8.33
5	PHY CHEM	1947	11	30	41	13	21	27	143	2.38	12.81
6	ORG.CHEM	1949	8	23	24	24	44	43	166	2.86	14.87
7	INOR.CHEM	1951	2	20	34	26	41	52	175	3.13	15.68
8	BIOL. CHEM	1956	--	13	22	22	19	28	104	2.04	9.32
9	ERU	1986	--	--	--	01	12	13	26	1.24	2.33
10	MLS	1986	--	--	--	--	8	8	16	0.76	1.43
11	PSU	1986	--	--	--	--	19	20	39	1.86	3.49
	Total		35	126	195	174	266	320	1116	18.60	100

The Units of research in IACS, Kolkata have been established to address specific concern in basic science. IACS, Kolkata has only three research unit namely- Energy Research Unit ,MLS Research Unit , Polymer Research During 1947-2006 , The polymer Science Research unit had contributed 39 theses (3.49%) followed by Energy Research with 26 theses (2.33 %) and MLS Research unit with 16 (1.43 %).

Fig.4.17: Distribution of theses over Different Departments /Research Unit



4.6.4 Most Productive supervisor of Theses:

The Table 22 shows the list of 10 most productive supervisor of doctoral research in IACS,Kolkata. The study reveals that, S R Palit, Department of Physical Chemistry is the most productive supervisor contributing 73 theses with (6.54 %). So It is also seen that the second highest number of theses (48, 4.30 %) were guided by Prof. A. Chakrobarty followed by Dr. A K Barua 46 theses with (4.12 %), Dr. P C Dutta 31 theses with (2.78%) and U R Ghatak 30 theses with (2.69 %) & Dr. N C Sil 27 theses with (2.42%) and so on .

Table 4.22 : Rank-list of most Productive supervisors of theses

Sl.No.	supervisor	Departments	No. of Theses guided	Percentage	Rank
1	Palit S R	Physical Chemistry	73	6.54	I
2	Chakraborty A	Inorganic Chemistry	48	4.30	2
3	Barua A K	MaterialScience(Gen Phys. & X-rays)	46	4.12	3
4	Dutta P C	Organic Chemistry	31	2.78	4
5	Ghatak U R	Organic Chemistry	30	2.69	5
6	Sil N C	Theoretical Physics	27	2.42	6
7	Chaudhuri B K	Solid State Physics	25	2.24	7
8	Pal A K	Material Science (Gen Phys. & X-rays)	25	2.24	8
9	Chaudhury M	Inorganic Chemistry	24	2.15	9
10	Mishra T N	Spectroscopy	23	2.06	10

It is also observed that 352 theses with (31.54%) out of total 1116 were guided by top ten supervisors of the association during under study.

4.7 Analyses of Lectures

Lecture means to give a talk or a series of talks to a group of people to teach them about a particular subject.

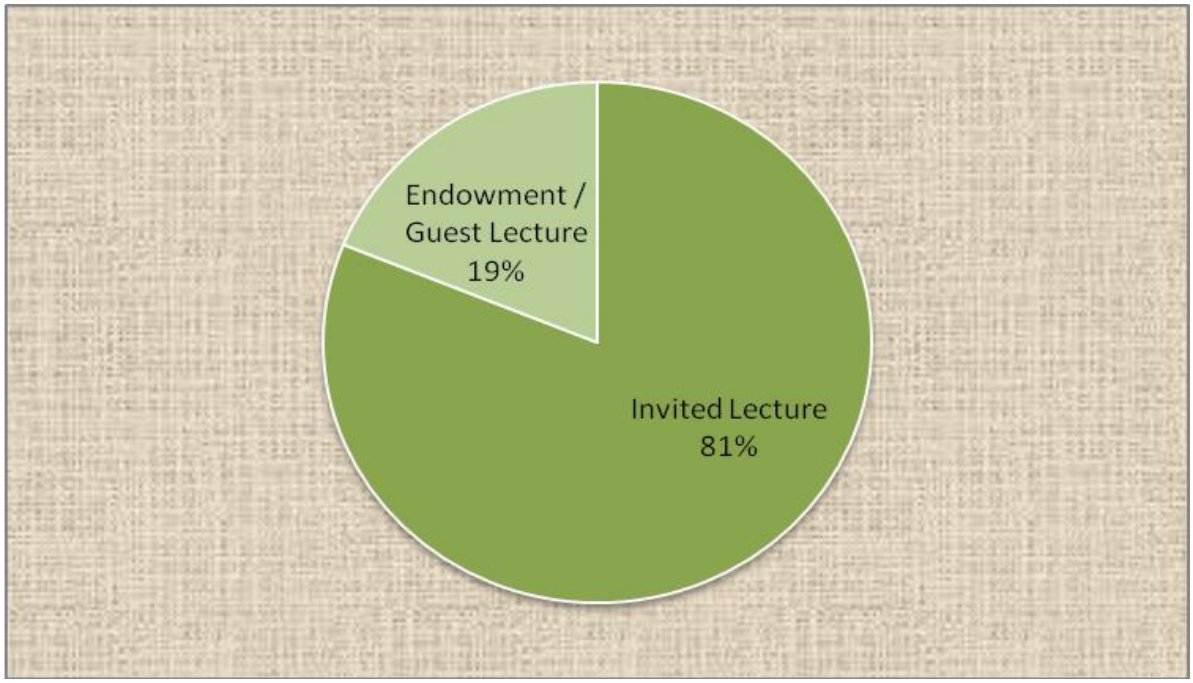
4.7.1 Bibliographic Forms of Lecture

There are three type of lecture namely invited lecture, guest lecture, endowment lecture depicted in table 23.

Table 4.23: Bibliographic forms of lectures at IACS, Kolkata

SL NO	Type	Decade specifying Years						Total	Percentage	Cumulative Percentage (%)
		1947-56	1957-66	1967-76	1977-86	1987-96	1997-06			
1	Invited	22	24	111	88	369	1223	1837	81.21	81.21
2	Endowment/Guest	54	66	33	116	70	86	425	18.79	100
	Total	76	90	144	204	439	1309	2262	100	

Fig.4.18 : Bibliographic forms of lectures at IACS, Kolkata during 1947-2006



It is clear that Invited lecture occupies 81.21 % (1837) of total lecture followed by Guest /Endowment lecture with 425 (18.79%).

4.7.2 Year-wise Distribution of Invited Lectures

The total productivity Lecture of the scientists & research workers of IACS, Kolkata for the sixty years period (1947-2006) under study is given chronologically in table 24.

Table 4.24:Year-wise Distribution of Invited Lectures by Scientist of IACS , Kolkata

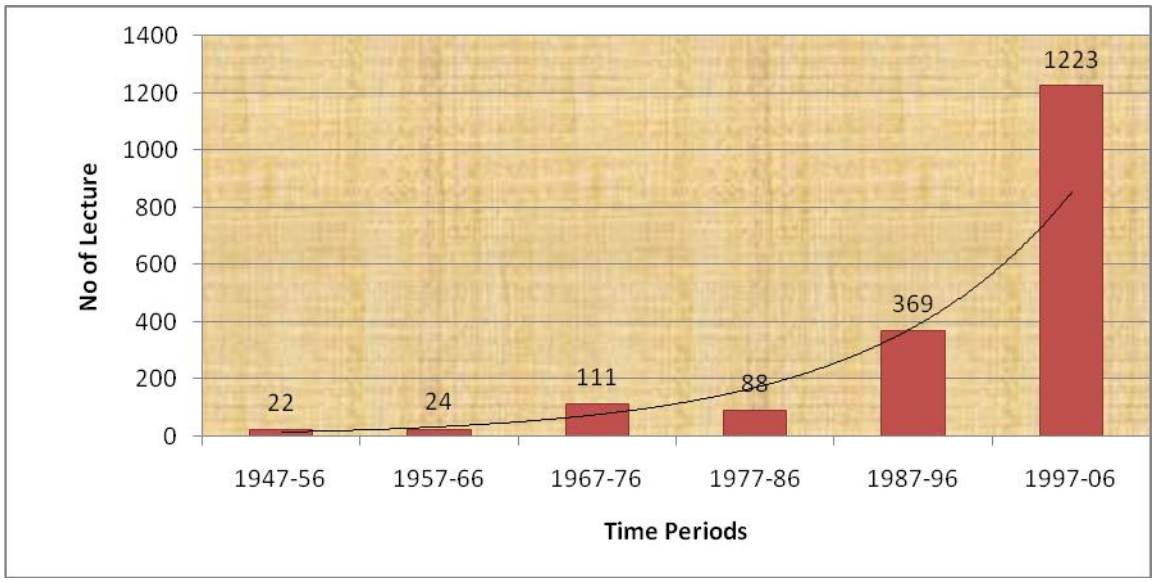
Year	No of lecture	Percentage (%)	Decades specifying years	Total no of lecture	Percentage (%)
1947	0	0.00	**1947-1956**	22	1.20
1948	0	0.00			
1949	9	0.49			
1950	13	0.71			
1951	0	0.00			
1952	0	0.00			
1953	0	0.00			
1954	0	0.00			
1955	0	0.00			
1956	0	0.00			
1957	0	0.00	**1957-1966**	24	1.31
1958	0	0.00			
1959	0	0.00			
1960	0	0.00			
1961	0	0.00			
1962	0	0.00			
1963	0	0.00			
1964	18	0.98			
1965	6	0.33			
1966	0	0.00			
1967	18	0.98	**1967-1976**	111	6.04
1968	24	1.31			
1969	11	0.60			
1970	0	0.00			
1971	9	0.49			
1972	10	0.54			
1973	5	0.27			
1974	7	0.38			
1975	13	0.71			
1976	14	0.76			
1977	19	1.03	**1977-1986**	88	4.79
1978	11	0.60			

Year	No of lecture	Percentage (%)	Decades specifying years	Total no of lecture	Percentage (%)
1979	11	0.60			
1980	11	0.60			
1981	4	0.22			
1982	4	0.22			
1983	1	0.05			
1984	17	0.93			
1985	4	0.22			
1986	6	0.33			
1987	4	0.22	**1986-1996**	369	20.09
1988	23	1.25			
1989	26	1.42			
1990	27	1.47			
1991	32	1.74			
1992	39	2.12			
1993	27	1.47			
1994	53	2.89			
1995	67	3.65			
1996	71	3.86			
1997	91	4.95	**1996-2006**	1223	66.58
1998	60	3.27			
1999	114	6.21			
2000	51	2.78			
2001	124	6.75			
2002	71	3.86			
2003	94	5.12			
2004	142	7.73			
2005	177	9.64			
2006	299	16.28			
Total	1837	100	1947-2006	1837	100

It can be observed that 1837 no of invited lecture delivered by IACS Kolkata scientists for the 60 years from 1947-2006. The study indicates that 2006 is the most productive years with 299 lectures (16.28 %) followed by 2005 with 177 lectures (9.64%)

and 2004 with 142 (7.73 %). The analysis shows that there is a growth of delivered lectures during the period of study. The bar diagram shows that the year 1997-2006 is the most productive time periods with 1223 lectures (66.58 %) at IACS ,Kolkata during the last 60 years followed by 1987-1996 with 369 lectures (20.09 %) . The years 1947-1956 are the lowest productive periods with 22 lectures (1.20 %) and followed by 1957-1966 with 24 lectures (1.31 %) and 1977-86 with 88 lectures (4.79%). It is indicate that recently, scientist of IACS, Kolkata is highly interested to deliver the lectures compared with past years.

Fig.4.19 : Distribution of invited lectures over different time periods



4.7.3 Department -wise Distribution of invited lectures

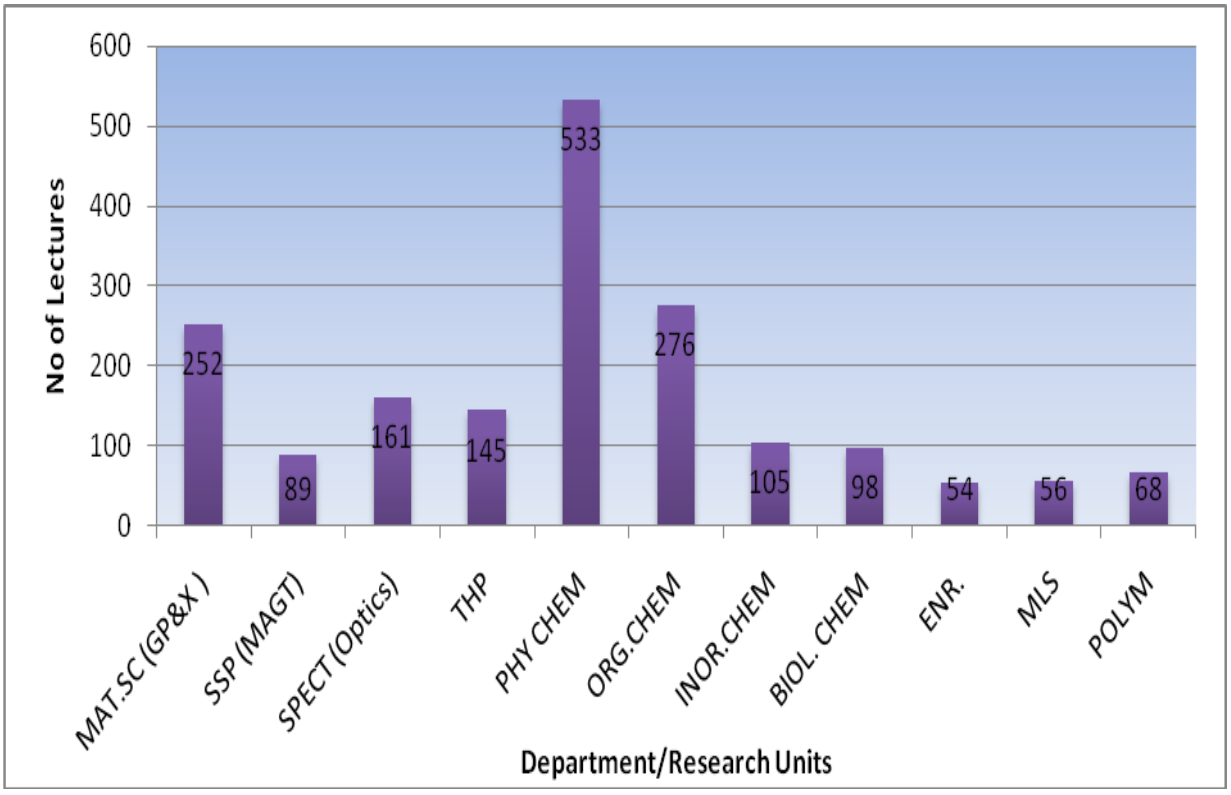
Now, IACS, Kolkata has Eight departments for basic science research, The Department -wise productivity of scientists of IACS during the period under study is given in the table 25.During 1947 -2006 , the Department of Physical Chemistry had contributed 533 lectures (29.01%) of total productivity followed by Organic Chemistry with 276 lectures (15.02%) and Material Science with 252 (13.72%) and so on. It is also observed that Physical Chemistry had highest average lecture per year with 8.88 followed by Organic Chemistry with 4.76 whereas Dept. of solid state Physics had contributed lowest average theses per year with 1.65 followed by Inorganic Chemistry with 1.88 and Biological Chemistry with 1.92.

The Units of research in IACS, Kolkata have been established to address specific concern in basic science. IACS, Kolkata has only three research unit namely- Energy Research Unit ,MLS Research Unit , Polymer Research During 1947-2006 , The polymer Science Research unit had contributed 68 lectures (3.70 %) followed by MLS Research unit with 56 lectures (3.05 %) and Energy Research with 54 (2.54 %)

Table 4.25: Distribution of invited lectures by Department/research unit wise :

Sl No	Depts	Estd. year	Decade Specifying Years						Total	Aver. /year	Percentage (%)
			1947-56	1957-66	1967-76	1977-86	1987-96	1997-06			
1	MAT.SC (GP&X)	1900	7			18	38	189	252	4.20	13.72
2	SSP (MAGT)	1953			8	9	18	54	89	1.65	4.84
3	SPECT (Optics)	1947	5			5	49	102	161	2.68	8.76
4	THP	1950	1			1	30	113	145	2.54	7.89
5	PHY CHEM	1947	6	24	71	38	105	289	533	8.88	29.01
6	ORG.CHEM	1949	3		17	17	39	200	276	4.76	15.02
7	INOR.CHEM	1951					30	75	105	1.88	5.72
8	BIOL. CHEM	1956			15		19	64	98	1.92	5.33
9	ENR.	1986					11	43	54	2.57	2.94
10	MLS	1986					11	45	56	2.66	3.05
11	POLYM	1986					19	49	68	3.23	3.70
	Total		22	24	111	88	369	1223	1837	30.62	100

Fig.4.20: Distribution of invited lectures by Department/research unit wise



4.7.4 List of Top 10 Lecturer

The Table 26 shows the list of 10 most productive scientists of IACS, Kolkata. The study reveals that, Dr. B C Ranu , Professor Dept. of organic Chemistry is the most productive lecturer contributing 132 (7.19%) lectures, followed by A. K. Pal , Dept of Material Science (111 ,6.04 %) and Dr. D Mukherjee , Department of Physical Chemistry (87, 4.74 %) ,Dr. P K Mukherjee ,Department of Spectroscopy (73, 3.97%) , S Ghosh, Department of Inorganic Chemistry (72, 3.92%), Dr. S P Sengupta, Department of Solid State Physics (71,3.86%) , Dr. D S Roy , Department of Physical Chemistry (70,3.81%),Dr. K Bhattacharyya ,Department of Physical Chemistry and Dr. T N Misra ,Department of Biological chemistry (68,3.70%) ,Chakravoty Department of MLS Research Unit (67,3.65%).

Table 4.26: List of Top Ten Lecturer of IACS,Kolkata

Sl.No.	Author	Department	No.of Lecture	Percentage	Rank
1	Dr.Ranu B C	Organic Chemistry	132	7.19	1st
2	Dr.Pal A K	Material Science	111	6.04	2nd
3	Dr.Mukherjee D	Physical Chemistry	87	4.74	3rd
4	Dr.Mukherjee P K	Spectroscopy	73	3.97	4th
7	Dr.Ghosh S	Inorganic Chemistry	72	3.92	5th
6	Dr.Sen Gupta S P	Solid State Physics	71	3.86	6th
8	Dr.Ray D S	Physical Chemistry	70	3.81	7th
5	Dr.Bhattacharyya K	Physical Chemistry	68	3.70	8th
9	Dr.Misra T N	Biological Chemistry	68	3.70	9th
10	Dr.Chakravorty D	MLS Professor's Unit	67	3.65	10th

4.8 Analyses of Books

Books means a set of written, printed, or blank pages fastened along one side and encased between protective covers.

4.8.1 Distribution of Books by Department & time Periods

The total productivity of books of the scientists & research workers of IACS, Kolkata for the sixty years period (1947-2006) under study is given chronologically in table 27. The Scientist /research Scholars of the associations have contributing only twelve (12) books during 1947-2006.The scientist/research scholars/Staff of material Science, Physical Chemistry and others Departments have contributing only three books. The Department of

Material Science & Physical Chemistry had maximum contributed three books each (25%) of total books whereas The publication Productivity of department of Organic Chemistry, Inorganic Chemistry & Spectroscopy had contributing only one book (8.33 %) each. It is also indicates that the publication of books are relatively law compared with other bibliographic forms of the association.

The table also shows that the year 1947-1956 is the most productive time periods with only 5 books (41.67 %) at IACS, Kolkata during the last 60 years followed by 1957-1966 & 1997-2006 with 03 Books (25 %). It is very interesting that the scientist/research scholars/Staff of the association have no contribution of books during 1977-1996.In 1967-1976 The years 1977- 1996 have lowest productive periods with only 01 book (8.33 %). It is indicate that the scientist of IACS, Kolkata is less interested to contributing of books.

Table 4.27: Department -wise Distribution of Books of Scientist of IACS,Kolkata:

Sl No	**Depts.**	**Estd. year**	**Decade specifying Years**						**Total no of book**	**Percentage**
			1947-56	1957-66	1967-76	1977-86	1987-96	1997-2006		
1	MAT.SC (GP&X)	1900	2					1	3	25
2	SPECT (Optics)	1947	1						1	8.33
3	PHY CHEM	1947	1	1				1	3	25
	ORG.CHEM	1949						1	1	8.33
5	INOR.CHEM	1951			1				1	8.33
6	Others		1	2					3	25
	Total		5	3	1	0	0	3	12	100

Fig.4.21: Distribution of books across various departments

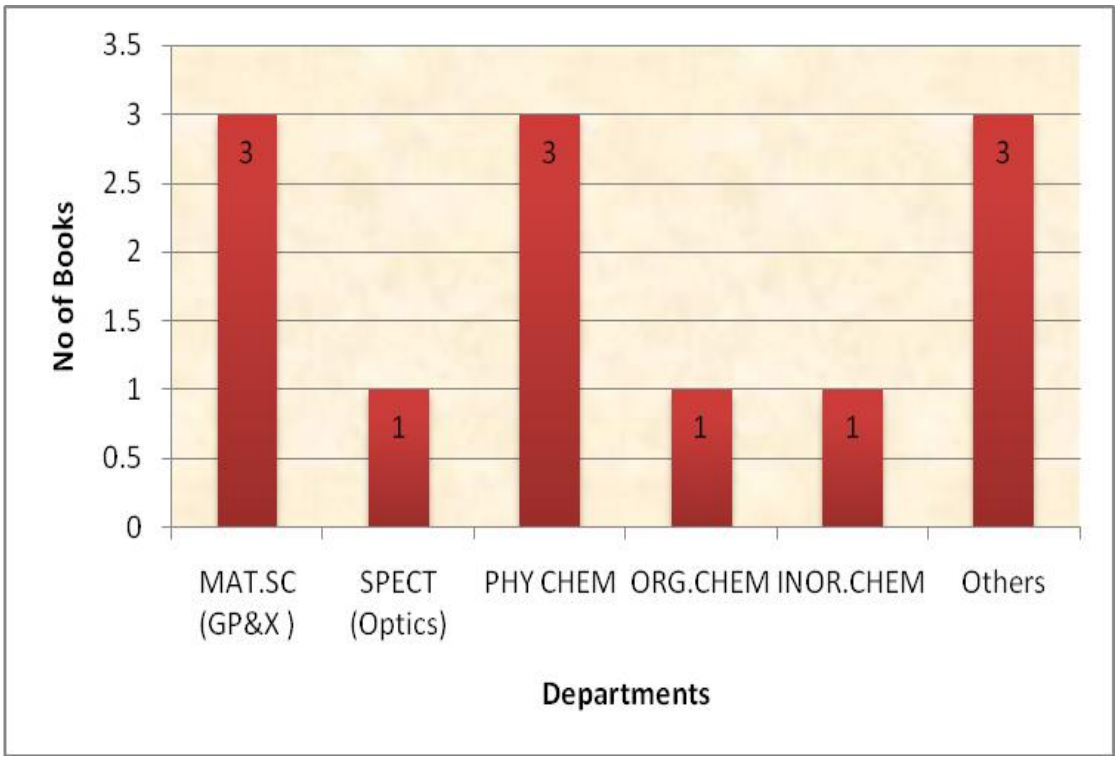
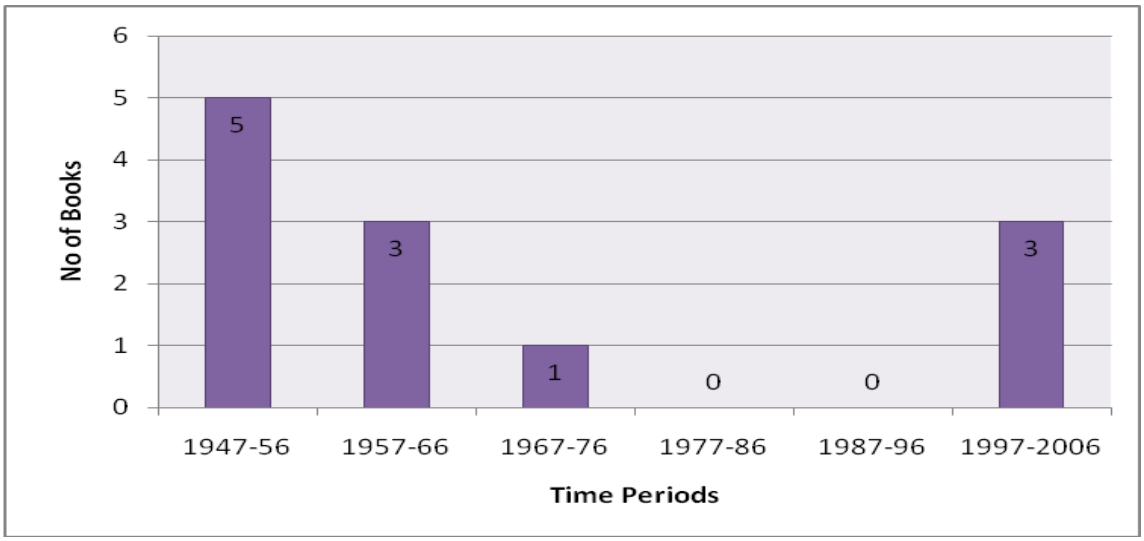


Fig.4.22 : Distribution of books over different time periods



4.9 Analyses of Book Chapters

Variety of research articles are written by the scientists & research workers of IACS, Kolkata in books treatise, encyclopedia and advances etc for the sixty years period (1947-2006)

4.9.1 Department - wise Distribution of Books chapters

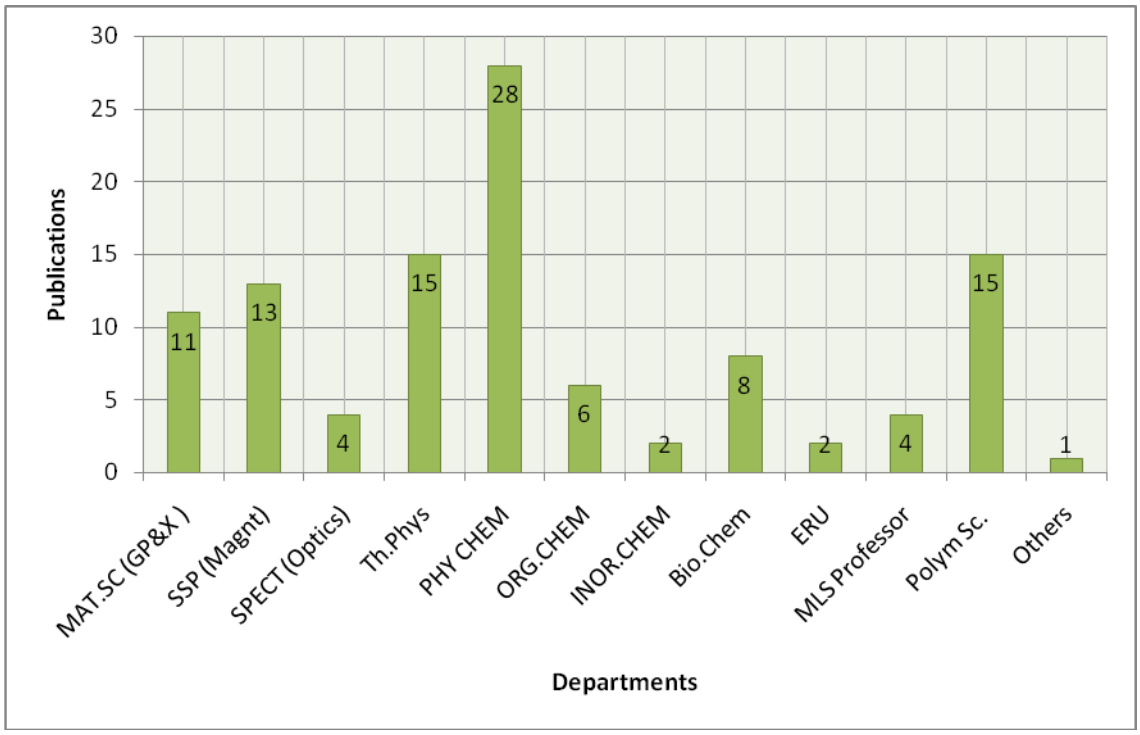
The total productivity of books Chapters of the scientists & research workers of IACS, Kolkata for the sixty years period (1947-2006) under study is given chronologically in table 28.

Tabl.4.28: Department-wise Distribution of Book Chapters by scientist of IACS, Kolkata:

Sl No	Depts	Est.year	Decade specifying Years						Total no of book chapters	Aver. /year	Percentage
			1947-56	1957-66	1967-76	1977-86	1987-96	1997-06			
1	MAT.SC (GP&X)	1900	1				4	06	11	0.20	9.09
2	SSP (Magnt)	1953	1	1		6	3	2	13	0.22	11.71
3	SPECT (Optics)	1947				2	1	1	4	0.07	3.60
4	Th.Phys	1950		1		2		12	15	0.25	13.51
5	PHY CHEM	1947		2	3	4	13	08	30	0.48	27.07
6	ORG.CHEM	1949			3		1	2	6	0.10	5.41
7	INOR.CHEM	1951					1	1	2	0.03	1.80
8	BIO. CHEM	1956					3	5	8	0.13	7.21
9	ERU	1986						2	2	0.03	1.80
10	MLS	1986					2	2	4	0.07	3.60
11	PRU	1986					15		15	0.25	13.51
12	Others							1	1	0.02	0.90
	Total		2	4	6	14	43	42	111		100

The Scientist /research Scholars of the associations have contributing only one hundred eleven (111) books chapters during 1947-2006. The Department of Physical Chemistry had maximum contributed Thirty (30) books chapters (27.07 %) of total books followed by Theoretical Physics & Polymer Research Unit 15 books chapters (13.51%) whereas The publication Productivity of other department are relative very low. It is also indicates that the publication of books are relatively law compared with other bibliographic forms of the association.

Fig.4.23: Distribution of Book chapters over different departments



4.9.2 Year-wise distribution of Book Chapters

The total productivity of book chapters of the scientists & research workers of IACS, Kolkata for the sixty years period (1947-2006) under study is given chronologically in table 29.

Table 4.29:Year-wise Distribution of Books Chapter by Scientist of IACS, Kolkata

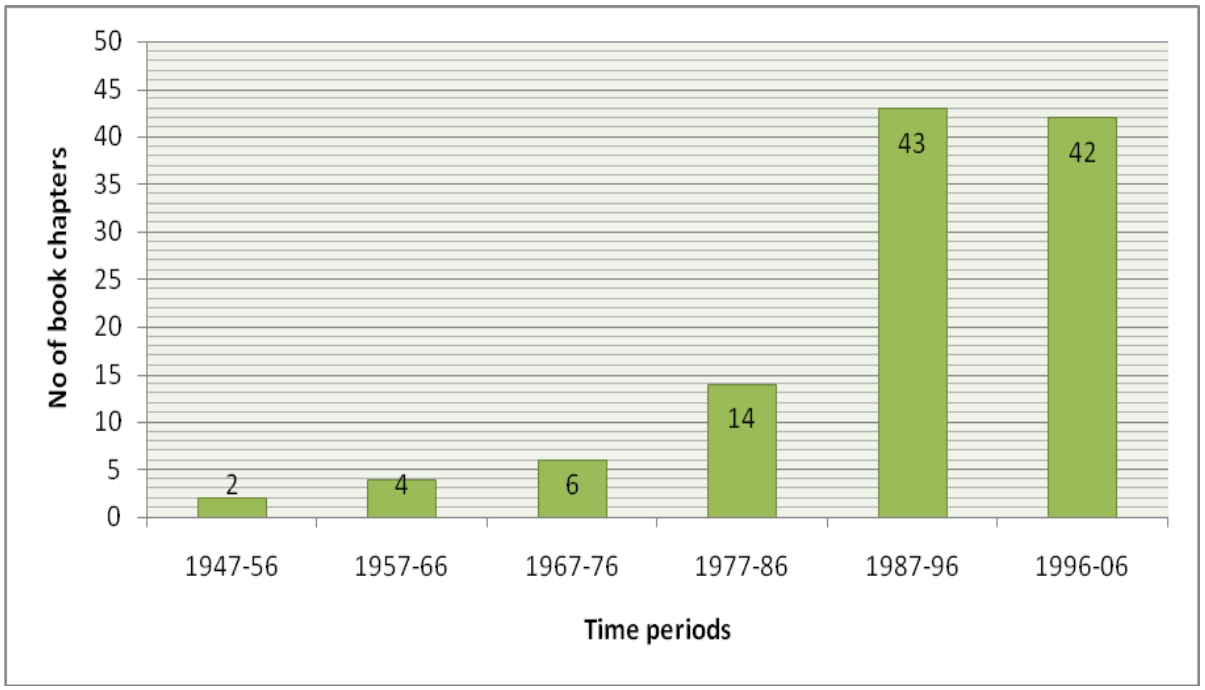
Year	Total Publication	Percentage (%)	Decade Specifying Years	Total no of Publication	Percentage (%)
1947		0.0	1947-56	2	1.80
1948		0.0			
1949		0.0			
1950		0.0			
1951	1	0.9			
1952		0.0			
1953	1	0.9			
1954		0.0			
1955		0.0			
1956		0.0			
1957		0.0			

Year	Total Publication	Percentage (%)	Decade Specifying Years	Total no of Publication	Percentage (%)
1958		0.0	1957-66	4	3.60
1959		0.0			
1960	1	0.9			
1961		0.0			
1962	1	0.9			
1963		0.0			
1964		0.0			
1965	2	1.8			
1966		0.0			
1967		0.0	1967-76	6	5.41
1968		0.0			
1969		0.0			
1970	3	2.7			
1971	1	0.9			
1972		0.0			
1973		0.0			
1974	2	1.8			
1975		0.0			
1976		0.0			
1977		0.0	1977-86	14	12.61
1978		0.0			
1979	2	1.8			
1980		0.0			
1981		0.0			
1982	3	2.7			
1983	3	2.7			
1984	3	2.7			
1985	3	2.7			
1986		0.0			
1987	3	2.7			

Year	Total Publication	Percentage (%)	Decade Specifying Years	Total no of Publication	Percentage (%)
1988	1	0.9			
1989		0.0			
1990		0.0			
1991	4	3.6			
1992	7	6.3	1987-96	43	38.74
1993	6	5.4			
1994	8	7.2			
1995	9	8.1			
1996	5	4.5			
1997	5	4.5			
1998	2	1.8			
1999	3	2.7			
2000		0.0			
2001	4	3.6	1997-2006	42	37.84
2002	9	8.1			
2003	2	1.8			
2004	7	6.3			
2005	4	3.6			
2006	6	5.4			
Total	111	100	1947-2006	111	100

It can be observed that 111 no of invited lecture delivered by IACS Kolkata scientists for the 60 years from 1947-2006. The study indicates that 2002 &1995 is the most productive years with 09 book chapters (8.1 %) followed by 1994 with 08 book chapters (7.20%) and so on. The analysis shows that there is a growth of publications of book chapters during the period of study. The table also shows that the year 1987-1996 is the most productive time periods with only 43 books chapters (38.73 %) at IACS, Kolkata during the last 60 years followed by 1997-2006 with 42 Books chapters (37.84 %)..In 1947-1956 The years 1977-1996 have lowest productive periods with only 02 book chapters (1.80 %). It is indicating that the scientist of IACS, Kolkata has less interested to contributing of books chapters.

Fig.4.24: Distribution of Book chapters over different Time Periods



4.10 Analysis of Patent

A patent is a right granted to the owner of an invention that prevents others from making, using, importing or selling the invention without his permission. A patentable invention can be a product or a process that gives a new technical solution to a problem. It can also be a new method of doing things, the composition of a new product, or a technical improvement on how certain objects work. Once it is granted, its term of a patent is 20 years from the Date of Filing, subject to the payment of annual renewal fees.

4.10.1 Distribution of Patent (Year-wise)

The Patent of the scientists & research workers of IACS, Kolkata for the sixty years period (1947-2006) under study is given chronologically in table 30.

Table 4.30: Distribution of Patent (Year-wise) by Scientist of IACS , Kolkata

Year	Total Publication	Percentage (%)	Decade Specifying Years	Total no of Publication	Percentage (%)
1947			1947-56		0.00
1948		0.0			
1949		0.0			

Year	Total Publication	Percentage (%)	Decade Specifying Years	Total no of Publication	Percentage (%)
1950		0.0			
1951		0.0			
1952		0.0			
1953		0.0			
1954		0.0			
1955		0.0			
1956		0.0			
1957		0.0	1957-66		0.00
1958		0.0			
1959		0.0			
1960		0.0			
1961		0.0			
1962		0.0			
1963		0.0			
1964		0.0			
1965		0.0			
1966		0.0			
1967		0.0	1967-76		0.00
1968		0.0			
1969		0.0			
1970		0.0			
1971		0.0			
1972		0.0			
1973		0.0			
1974		0.0			
1975		0.0			
1976		0.0			
1977		0.0	1977-86		0.00
1978		0.0			
1979		0.0			

Year	Total Publication	Percentage (%)	Decade Specifying Years	Total no of Publication	Percentage (%)
1980		0.0			
1981		0.0			
1982		0.0			
1983		0.0			
1984		0.0			
1985		0.0			
1986		0.0			
1987		0.0	1987-96		0.00
1988		0.0			
1989		0.0			
1990		0.0			
1991		0.0			
1992		0.0			
1993		0.0			
1994		0.0			
1995		0.0			
1996		0.0			
1997		0.0	1997-2006	9	8.11
1998		0.0			
1999		0.0			
2000	5	55.6			
2001		0.0			
2002	1	11.1			
2003		0.0			
2004	1	11.1			
2005	2	22.2			
2006		0.0			
Total	9	100	1947-2006	9	100

It can be observed that the total published patent of the IACS Kolkata scientists for the 60 years period only 09. The study indicates that 2000 is the most productive years with 05 patent (55.55 %) followed by 2005 with 02 patent (22.22%) and 2002 &2004 with each 01 patent (11.11 %). It also observed that during 1947-1999, the scientist of the association have no patent. During 2000 -2006, the scientist of the association obtained only 09 patents.

4.11 Conclusion

Publication productivity has been used as a criterion to assess the research output of individual scholars, academic program and institution. Evaluation of the productivity of institutional research and development activities highlights the contribution of the institution and the individuals engaged in research. The analysis shows that the scientists of IACS are publishing their research outputs in various forms like journal articles, books, book chapters, working papers and other publications. The year wise growth of publications of the scientist, research scholar of the associations has a uniform pattern i.e. gradually increased.

Journal articles are the most preferred form of publication of IACS scientists and it amounts 1/2th of the total publications. The social scientists of IACS prefer mostly foreign journals to publish their articles. The foreign journal contributes the highest no of articles. The Indian journal Physics contributes the highest number of articles. Multi author contributions predominate which shows degree of collaboration is eventually very high. This is healthy sign for research at IACS, Kolkata. The productivity of scientists of IACS shows substantial growth both quantitatively and qualitatively with the development of the institution.

Measuring research productivity of an institution reflects its scientific and technological developments and progress. Evaluating the productivity of institutional research and development activities highlights the contribution of the institution and the individual scientists engaged in research. It also provides some insights into the complex dynamics of research activity and directs the research activities in a proper direction. There are urgent need for the bibliographic control of IACS publications and creation of a comprehensive database of publications. This kind of studies is useful to enable the policy makers and science administrators to take appropriate decisions.

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Chapter 5

Findings & Conclusion

CHAPTER-V

FINDINGS AND CONCLUSIONS

5.0 Introduction

All evaluations depend on the availability of adequate and reliable data relating to the outcomes of the activity under scrutiny. Bibliometric indicators which quantify the productions and use bibliographic materials have been used extensively in the assessments of research performances. The validity of bibliometric indicators is much greater at aggregate levels of research groups and research institutes and should be applied with extreme caution when measuring and comparing the performance of individual scientist. Bibliometric indicators are not intended to replace peer review, but rather to make research visible and debatable ,ensuring that experts are sufficiently informed to make sound judgments. Publication based evalutions, however, considers purely the research aspects of institutional scientific activity and should, therefore, be seen as only partial indicators of overall scientific performance.

During pre-independence, IACS ,Kolkata became the only place in India where sustained non-institutional research work had been carried out. The pioneering researches carried out by C.V. Raman,K.S. Krishnan, S. N.Bose , M. N. Saha and others in the laboratories of the association put India quite prominently in the world map of research in Physics. The present study was initiated with the main objectives of examining the research work done on scientific outputs of IACS,Kolkata and to reveal the assessments of research performance both quantitatively and qualitatively of scientists/research scholars of the associations. This investigations reveals many unique features of research of IACS,Kolkata indentifying the strength and weakness of research process over the periods and how the research pattern is changed by their respective researchers in basic science research which may be considered to represent the research scene at IACS, Kolkata. The major findings, conclusions, recommendations and suggestions for further research are stated in these chapters. An attempt has been made try to take a brief look at the sixty years (1947-2006) of the scientific endeavors and significant achievements of the association.

5.1 Growth of research:

5.1.1 Chronologically

During the periods 1947-2006, 13654 no of total research outputs such as journal articles, Conference papers, theses, lectures, books ,books chapters and also patents etc have been published by scientist /research scholars of the associations. These data suggested that there was significant research productivity among the scientist /researcher in Indian Associations of Cultivation of Science during that period. So it is clear that the association have been playing a significant role in contributing substantial growth in basic science research mainly physics and chemistry in India and abroad. Thus the associations have been taken a significant place in the world map in basic science research since long. Growth of research publications has been gradually increased. But a slight decline was found in the middle of the years from 1997-1998, 1999-2000, 1990-1991, 1988-1989, 1979-1980 and 1977-1978.It may guide existing researcher to contributes more and concentrating on their researches in future.

5.1.2 Department wise:

In physics divisions, no of 7430 (55%) research outputs have been published whereas comparatively low in chemistry divisions 6062(45%). It reveals that with the able guidance of C.V Raman, S.N. Bose, M.N. Sahaand K.S. Roys etc., the research output in physics division become very high both qualitatively and quantitatively and also research output of physics division is being played significant role since long. Material Science is the most productive departments in the association and physical chemistry is also most productive department in chemistry divisions. Biological chemistry is the least productive department .It is to be kept in mind that the research output can vary in the no of scientist/research scholars, research funding, and time span of each department of the associations.

5.2 Channels of communications /Bibliographic forms:

From the analysis from table 2, Most preferred channels of communication among the Scientist & Research Scholars of IACS,Kolkata is journal (58.78 %) with 8026 publication followed by conference paper (18.62%) with 2543 publication, Lectures (13.45%) with 1837 publications and Thesis (8.17 %) with 1116 publications whereas the publication output in the form of book and book chapters and also patent are relatively low compared with others. They are together account for 132 publications with (0.97%) only out of 13654 publications. Large amount of research output were published during the periods under study.

It is concluded that Journal is most common preferred channels of communications to each researcher /scientist to publish their research output from IACS, Kolkata. All scientist /scholars of the associations are less interested in written books and books chapters and also fully engaged in specialized field of research.

5.3 Journal articles:

5.3.1 Chronologically

From the analysis, it is found that the significant no of journal articles (8026,58.78%) have been published during the periods.1997-2006 was most productive and 1947-1956 was the least productive periods. It is also reveals that the scientist /scholars have been published 281.7 no of journal articles per year during last decades (1997-2006) followed by 195.1 in 1987-1996, 130.1, in 1977-1986 and so on. It is the good indications of R & D at IACS,Kolkata. Growth rate of journal articles per year is highly skewed with respect to specified decades. It is possible due to good amount of fund by different funding institutes i.e. being gradually increased as results increases no of scientist/research scholars and no of facilities in all respects.

5.3.2 Department wise:

In physics divisions, 4224 (52.63%) journal articles have been published where as slight low in chemistry divisions 3802 (47.37%). Here, the inorganic chemistry has contributed maximum no of journal articles with 1186 i.e 21.16 % of total publications during the year 1947-2006 followed by Material science with 1161(14.47%) , physical chemistry with 1125 (14%) and so on. Biological Chemistry has contributed minimum numbers of journal articles with 424 i.e. 5.28 % of total publications. The reason may be cited that the no of scientists /research scholars of department of biological chemistry are significantly low compared with others.

5.3.3 Authorship characteristics:

Multiple authorships are the distinctive feature of modern science. Authorship and collaboration trend moves towards towards multi-authored publications. In total 7094 (88.39 %) multi-authored publications , 932 (11.61%) single authored publications and a total 22408 authorships found in 8026 publication. So majority of scientist / research scholars of the IACS, Kolkata preferred to publish the research result in joint authorship or collaborative mode. It is eventually that most of scientist or research scholars of the association have a tendency to publish their collaborative research work confined with two or three authors instead of

sharing the authorship among more than three scientists. The degree of joint authorship has been gradually decreased.

5.3.4 Degree of collaboration/Collaborations Coefficients:

To measure the collaborative research pattern of the association, a simple indicator called degree of collaboration or collaboration coefficient over the years from 1947-2006 has been calculated .It varies from 0.12 to 0.99 and the mean value has been found to be 0.89,which means there is few or negligible contributions by single authors. Though a single author contribution predominates which shows degree of collaboration is less in basic science research during 1947-1958. Reason may be in the beginning, research fund of association was very low and most of the scientists /scholars carried out his research work with their own motivation. But, after 1960s multi author's contributions have been started dominating which shows high degree of collaborations in research. Here the reason may be the collaboration trends among the scientist which moves towards multi authored papers, indicative of the highly specialized areas of scientific work that they were engaged in.

5.3.5 Most prolific Authors

There are 2995 authors who have published their journals articles with 22408 authorships found in 8026 publications. The most prolific authors indentified from the study have been holding important positions in IACS which shows that publications productivity is one of the important indicators to identify the scientist to be fit for career advancements with additional responsibilities. It reveals from the study that Pro. S R Palit from Department of Physical Chemistry has contributed maximum number of articles to be the most productive author in IACS, Kolkata. It is to be kept in mind that the research outputs of individual scientist can vary on the basis of time span for which he /she engaged in research and no of research associates. This appears to be true for both high and low prolific authors.

5.3.6 Journals Preferred:

Scientists /Research scholars of the association have written articles in a total of 520 no of Journals including Indian (55) and foreign (465) journals. It concludes that scientists / scholars have mostly preferred to publish their research work in foreign journals having high impact factors and it has also been found that motivation of publishing papers in foreign journal have been gradually increased whereas publishing in Indian journal have been proportionately decreased. It indicates that research contribution of IACS, Kolkata has been internationally acclaimed. It is observed that only two top ranked journals out of top 10

journals are Indian journals, four are published from USA & two from UK, one each from Netherland & Denmark. It is found that 30.87 % articles that have been published only in top ten Journals and rest of the articles published in more than 510 no of journals. Indian Journal of Physics is the most preferred Journal among the scientists/research scholars of the association with 819 (10.20 %) articles.

5.3.7 Geographical distributions or International collaborations

Collaborations in the scientific research have been usually considered to be essential and useful for widening and validation of the research and which ultimately helps to increase quality of research. In collaborative research numbers of experts contribute to the given research and international collaborations are considered more valuable in the research field. Almost a total 6067 (75.59%) papers have been written with international collaborations. This percentage is quite encouraging. What is further noticeable that the highest number collaborations (1801, 22.52%)) are with USA followed by UK with 1732 (21.66%) publications. The Netherland with 1226 (15.33%) publications and Germany with 371 (4.64%) publications occupy each are 3rd& 4th positions. Nevertheless, it shows that there are more collaboration with Indian authors from United States, UK and Netherland. It is also worth noting that China and Japan have encouraged emerging as preferred Asian collaborators (ranked fifth and sixth) with the scientists /research scholars of IACS,Kolkata. This study reveals that the research outputs of IACS,Kolkata have been highly recognized at international level.

5.3.8 Applicability of Bradford laws of scatterings

From the study, it is found that the relationship of each zone in the present study is **12: 38: 470:: 1.2: 3.8: 47 T**his does not fit into the Bradford's distribution cause of this laws used only for specialized field of research.

5.4 Conference Papers:

5.4.1 Chronologically

From the analysis, it is found that the significant no of conference papers (2543, 18.62%) have been published by the scientist/scholars of the associations during the specified period. It is second preferred channel of communications to the scientists /research scholars of the association.1997-2006 is most productive periods and 1947-1956 is the least productive period. It is also reveals that the scientist /scholars have published 113.9 no of

journal articles per year during the last decades (1997-2006) followed by 79.1 in 1987-1996, 43.4, in 1977-1986 and so on.

At early stage scientists /research scholars of the association were less interested to participate national and international conference and presented the papers. But, the scenario was changed during last two decades. Growth rate of conference papers per year are highly skewed in respects of specifying decades. So it is also noted that the growth of publications at conference proceedings have been gradually increased but not satisfactory.

5.4.2 Department wise

In physics divisions, 1854 (72.90%) conference papers have been published whereas comparatively very low in chemistry divisions, only 627 (24.66%). It is reveals that scientists/scholars at physics divisions are much more interested to publish their research papers in conference than scientist of chemistry divisions of the associations. The material science had contributed maximum no of conferences papers with 499 i.e 19.26 % of total publications during the year 1947-2006 followed by Solid state physics with 496 (19.50 %) , theoretical physics with 369 (14.51 %) and so on. Inorganic Chemistry had contributed minimum numbers of conference papers with only 28 i.e.1.10 % of total publications. Probably, the scientists/scholars of inorganic chemistry feel that the quality of publications are only be the manifested through journal articles than other channel of communication.

5.4.3 Authorship characteristics:

Authorship and collaboration trend moves towards multi-authored publications. From the analysis, it is observed that a total of 6063 authorships found in 2543 conference publications. Only 360 (14.16%) of publications are single authored. 952 (37.44%) and 767 (30.16 %) are two & three authored respectively. more than three authored publications together contributes remaining 18.25 % (464). So majority of scientists / research scholars of the IACS, Kolkata preferred to publish the research result in joint authorship or collaborative mode. It is eventually that most of scientists or research scholars of the association have a tendency to publish their collaborative research work confined with two or three authors instead of sharing the authorship among more than three scientists. The degree of joint authorship gradually decreased. But it is true that multi authored works more than that of single authored contributions that have been gradually increased. This data indicates that researchers mostly prefer to research and write in collaboration.

5.4.4 Degree of collaboration/Collaborations Coefficients:

To measure the collaborative research pattern of the association, a simple indicator called degree of collaboration or collaboration coefficient over the years from 1947-2006 has been calculated. It varies from 0 to 1 and the mean value is found to be 0.86, which means there is few or negligible contributions by single authors. So it is concluded that the collaboration trends among the scientist towards multi authored papers is indicative of the highly specialized areas of scientific work that they were engaged in.

5.4.5 Most prolific Authors

There are 1131 authors who have published their research articles in conference with 6063 authorships found in 2543 publications. The most prolific authors indentified from the study have been holding important positions in IACS which shows that publications productivity is one of the important indicators to identify the scientist to be fit for career advancements with additional responsibilities. It reveals from the study that Dr. A K Pal ,Dept of Material Science is the most productive author contributing 166 publications, followed by Dr. B K Choudhuri (142) and Dr. D.P Bhattacharya (136).It is observed that Six authors out of top ten authors are only from Dept of Solid State Physics. Two are each from Material science & Biological Chemistry. It is to be kept in mind that the research outputs of individual scientist can vary on the basis of time span for which he /she engaged in research and no of research associates. This appears to be true for both high and low prolific authors.

5.4.6 International collaborations

From the analysis, it reveals that only 544 no of papers (21.39 %) have been published in conference held at outside India i.e. called international collaborations. This percentage is quite a matter of concern. Growth of conference papers has been gradually increased during already specifying decades. What is further noticeable that the research productivity of IACS,Kolkata in conference is less noticeable at international level.

5.5 Thesis/Doctoral research:

From the analysis, it is observed that in ten yearly grouping, 1116 numbers of theses were submitted from IACS,Kolkata during 1947-2006. The study indicates that 1998 is the most productive year with 47 theses (4.20 %). From the analysis, it is observed that no of theses has been continuously increased But a slight decline was found during 1977-1986.627 (56.18%) no of research scholars in chemistry divisions where obtained Ph.D degree whereas only 489 (43.82%) in physics divisions during the specified periods. It is also observed that

only 194 (17.38 %) of female research scholars out of 1116 had been engaged in research to obtain Ph.D degree during the period. It is probably a low figure. It is also reveals that the highest no of theses 175 (15.68%) and lowest no of theses 93 (8.33%) were submitted from inorganic chemistry and theoretical Physics respectively. Beside these , the highest no of theses were guided by Dr. S.R. Palit who occupied the important position in IACS,Kolkata and an eminent person within the research community at national and international level.

5.6 Lectures

Total 1837 no of lectures were delivered by the scientists of the association at national and international level during the periods. It is observed that so many research institutes learned societies & associations/organigations/universities at national and international level invited the scientists of the associations to deliver the lectures on different specialized research areas during last decade 1996-2006.It indicates the quality of research activities of scientists as well as status & positions of the associations in global respects. Dr. B.C.Ranu from department of inorganic chemistry has delivered highest no of lectures at different national and international platform.

5.7 Books and books chapters

The scientists of the association have been published only 12 books and contributed only 111 book chapters in composite books during the periods i.e. comparatively low with other bibliographic form. It is indicated that they are less interested to write book and chapters in composites books .All have been found to be engaged specialized field of research not in others mode of written communications.

5.8 Patent

Patents are one of the most important scientific indicators for evaluating quality of research of scientists in an organizations. It is found that the association had no patents during 1947-1999 and after that, only nine (09) patents obtained by the scientist of the association probably be consider. Reason may be that basically fundamental basic science research culminates by the scientists of the association rather than applied research. But it is encouraging that recently some applied research has been started with some new research centre such as Raman Centre for atomic molecular and optical sciences, Centre for renewable energy sources and Centre for advanced materials.

5.9 Award and honours

Award, honours are not bibliometric indicators to assess the research performance but it is an important recognition of quality research activities of individuals as well as institute. So it would be useful to these qualitative indicators based on participation in international meetings/symposiums, academic qualifications, honours, awards received by these scientists . These kinds of study are useful to enable the policy makers and science administrators to take appropriate decisions in proper directions.

5.10 Further Research

It can be mentioned that this study analyzed as a whole all research productivity of scientists /scholars of IACS, Kolkata during 1947-2006 .But this present study could be extended for a wider period and could be compared with other similar institutions within country and abroad and also be compared among different departments of the association. By increasing the periods of study and analysis of research output of each department of the association, one may get a fairly comprehensive trend of research characteristics and assessments of research performance of each department of the association.

Further may be initiated incorporating the applicability of scattering laws in bibliometrics and other bibliometric parameters. As Institutional evaluations through Bibliomertric analysis is a continuous process to evaluates research performances, There is a urgent need for the bibliographic control of IACS, Kolkata publications and developments of a comprehensive database of publications. Many other bibliometric parameters are excluded in this studies that are need to be incorporated. Participation in international meetings/symposiums, academic qualifications, honours, awards received by these scientist are to be treated as bibliometric indicators to assess the quality of research activity of individuals as well as institution for further study

I hope this work will have an immense value to the competent authority of the association for made an excellent policy making and road map for further research activities of the association in all respects. At the same time, this will also help research scholars of concerned subjects for further study.

5.11 Conclusion:

Evaluation of the productivity of institutional research and developments (R&D) activities highlights the contributions of the institutions as well as individual

scientists/research scholars engaged in research. Measuring the research productivity of an institutions reflects its scientific and technical developments and progress.

This study has explored the publishing behaviors and tried to highlight quantitatively evaluates the contributions such as journal articles, conference papers, theses, lecture, book and book chapters, patent etc. made by scientists /scholars of IACS,Kolkata during 1947-2006.This study examines the most preferred channel of communication, growth of research ,department wise distribution, authorship pattern, degree of collaborations, geographical distribution of publications, preferred journals and applicability of Bradford laws of scattering etc. The productivity of scientists of the associations shows substantial growth both qualitatively and qualitatively with developments of the institution and research of the associations is much more recognized at international level. Majority of research publications have been brought out in joint authorship where degree of collaboration is also quite high among the scientists working therein. This analyses provides some insights into the complex dynamics of research activity and it will enable to policy makers and science administrators to make available adequate facilities and direct the research activities in a proper directions. This looks obvious as research is an intellectual activity deeply influenced by state of mind of scientists besides availability of quality information and input of scientific productivity.

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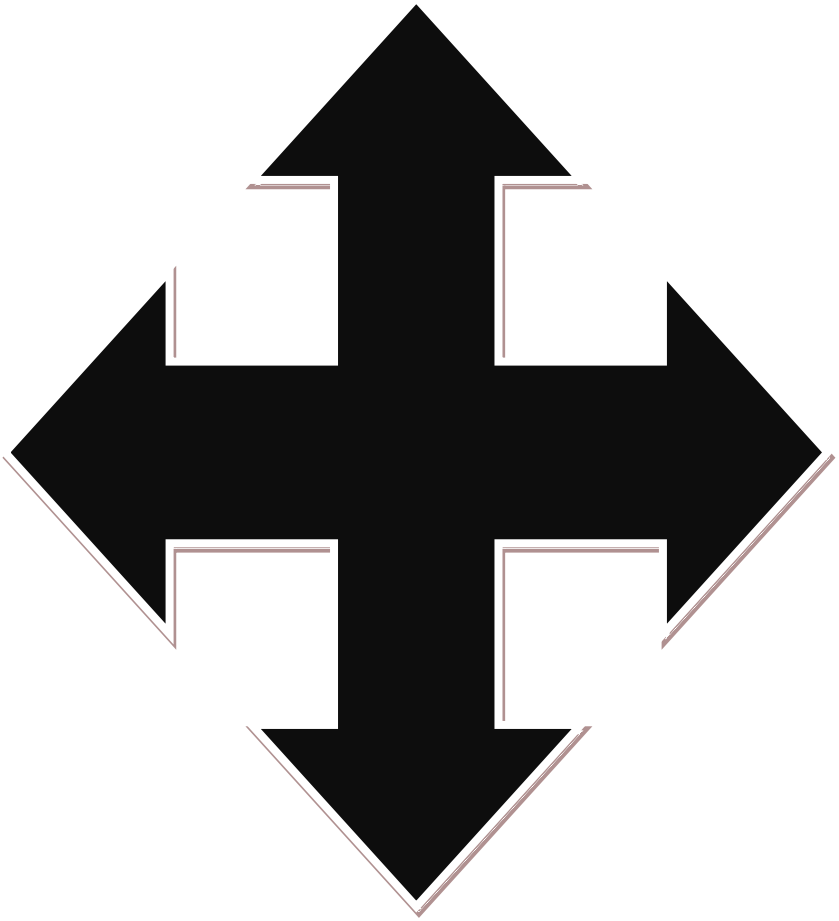
Appendices



Rank List of Productive Authors of Journal Articles of IACS, Kolkata 1947-2006

Sl No	Author	No of Authorship	%
1	Palit S R	277	**3.45**
2	Pal A K	259	**3.23**
3	Chakravorty A	234	**2.92**
4	Ghosh S	233	**2.9**
5	Chaudhuri S	230	**2.87**
6	Barua A K	224	**2.79**
7	Mukherjee D	200	**2.49**
8	Chakravorty D	193	**2.4**
9	Chaudhuri B K	193	**2.4**
10	Bhattacharyya D P	190	**2.37**
11	Ghosh A	188	**2.34**
12	Ray Chaudhuri N	180	**2.24**
13	Misra T N	158	**1.97**
14	Sen Gupta S P	155	**1.93**
15	Sil N C	155	**1.93**
16	Ghosh A S	146	**1.82**
17	Bhattacharyya S P	145	**1.81**
18	Ray S	144	**1.79**
19	Ranu B C	141	**1.76**
20	Bhattacharyya K	136	**1.69**
21	Chatterjee S	131	**1.63**
22	Chowdhury M	129	**1.61**
23	Mukherjee S	128	**1.59**
24	Ghatak U R	120	**1.5**
25	Nag K	120	**1.5**
26	Das D	117	**1.46**
27	Banerjee P	110	**1.37**
28	Ray D S	100	**1.25**
29	Mukherjee P K	95	**1.18**
30	Chatterjee B P	93	**1.16**
31	Gautam V P	92	**1.15**
32	Mukherjee M	92	**1.15**
33	Pal A J	91	**1.13**
34	Datta D	87	**1.08**
35	Poddar S N	87	**1.08**
36	Bhattacharjee J K	86	**1.07**
37	Mandal B M	86	**1.07**
38	Nandi A K	84	**1.05**
39	Ganguly T	83	**1.03**
40	Banerjee S	82	**1.02**
41	Chattopadhyay S	82	**1.02**
42	Kastha G S	82	**1.02**
43	Mukherjee A K	80	**1**
44	Ghosh D	79	**0.98**
45	Banerjee A	77	**0.96**
46	Mukherjee S C	77	**0.96**
47	Roy S	77	**0.96**
48	Basu S	75	**0.93**
49	Mitra S	75	**0.93**
50	Bhattacharyya S	73	**0.91**
51	Das A K	72	**0.9**
52	Kundu N G	71	**0.88**
53	Drew M G B	70	**0.87**
54	De M	69	**0.86**
55	Roy N	69	**0.86**

Sl No	Author	No of Authorship	%
56	Ghosh A K	68	**0.85**
57	Sinha C	67	**0.83**
58	Goswami S	66	**0.82**
59	Sen S	66	**0.82**
60	Banerjee S B	64	**0.8**
61	Mostafa G	64	**0.8**
62	Bhattacharya S	63	**0.78**
63	Pal S	63	**0.78**
64	Sen S K	62	**0.77**
65	De A	59	**0.74**
66	De S K	59	**0.74**
67	Basu C	58	**0.72**
68	Das S	58	**0.72**
69	Das R	57	**0.71**
70	Roy S C	57	**0.71**
71	Basu D K	54	**0.67**
72	Das A	54	**0.67**
73	Mondal S	54	**0.67**
74	Bhattacharyya S S	53	**0.66**
75	Biswas R	53	**0.66**
76	Pal P	53	**0.66**
77	Sarkar A	53	**0.66**
78	Chatterjee P	52	**0.65**
79	Kar S	52	**0.65**
80	Ghosh P	51	**0.64**
81	Mandal S K	51	**0.64**
82	Dutt N K	50	**0.62**
83	Rao C V N	50	**0.62**
84	Roy K	50	**0.62**
85	Venkateswaran R V	49	**0.61**
86	Banerjea D	48	**0.6**
87	Bhattacharyya S N	48	**0.6**
88	Chaudhury M	48	**0.6**
89	Ghosh U S	48	**0.6**
90	Basu B	47	**0.59**
91	Ghosh M	47	**0.59**
92	Saha S K	46	**0.57**
93	Das A R	45	**0.56**
94	Chakrabarti S	43	**0.54**
95	Dutta P	43	**0.54**
96	Mallik B	43	**0.54**
97	Nandi U S	43	**0.54**
98	Rai Dastidar K	43	**0.54**
99	Bagchi B	42	**0.52**
100	Mitra A	42	**0.52**
101	Basu M	41	**0.51**
102	Deb N C	41	**0.51**
103	Maji T K	41	**0.51**
104	Saha S	41	**0.51**
105	Basu D	40	**0.5**
106	Mukhopadhyay S	40	**0.5**
107	Banerjee D	39	**0.49**
108	Datta A	39	**0.49**
109	Guha A K	39	**0.49**
110	Roy S K	39	**0.49**

Rank List of Productive Authors of Journal Articles of IACS, Kolkata 1947-2006

Sl No	Author	No of Authorship	%
111	Talapatra G B	39	**0.49**
112	Zangrando E	39	**0.49**
113	Pal S K	38	**0.47**
114	Chaudhuri P	37	**0.46**
115	Roy S B	37	**0.46**
116	Sarkar S	37	**0.46**
117	Dutt	36	**0.45**
118	Nath D	36	**0.45**
119	Batabyal A K	35	**0.44**
120	Chakravorti S	35	**0.44**
121	Lahiri S	35	**0.44**
122	Ray Swati	35	**0.44**
123	Srivastava B N	35	**0.44**
124	Bhattacharyya D	34	**0.42**
125	Chatterjee A	34	**0.42**
126	Pradhan S K	34	**0.42**
127	Rai Dastidar T K	34	**0.42**
128	Ribas J	34	**0.42**
129	Samanta S	34	**0.42**
130	Bagchi P	33	**0.41**
131	Bose A	33	**0.41**
132	Chaudhuri A K	33	**0.41**
133	Das P K	33	**0.41**
134	Datta S	33	**0.41**
135	Dutta S	33	**0.41**
136	Banerjee R	32	**0.4**
137	Bhaumik A	32	**0.4**
138	Chowdhury S	32	**0.4**
139	Dutta A K	32	**0.4**
140	Dutta S K	32	**0.4**
141	Konar S	32	**0.4**
142	Mukherjee R K	32	**0.4**
143	Ray M	32	**0.4**
144	Bhattacharyya S S	31	**0.39**
145	Dutta P C	31	**0.39**
146	Sahoo S	31	**0.39**
147	Chakrabarti J	30	**0.37**
148	Majumdar D	30	**0.37**
149	Mukherjee D K	30	**0.37**
150	Pal M	30	**0.37**
151	Ray D	30	**0.37**
152	Sengupta S	30	**0.37**
153	Sirkar S C	30	**0.37**
154	Ali M	29	**0.36**
155	Dutta A	29	**0.36**
156	Mandal D	29	**0.36**
157	Mukherjee P S	29	**0.36**
158	Roy A	29	**0.36**
159	Saha B	29	**0.36**
160	Das K	28	**0.35**
161	Das S K	28	**0.35**
162	Guha S	28	**0.35**
163	Nath D N	28	**0.35**
164	Roy D	28	**0.35**
165	Dutta J	27	**0.34**
166	Hazra S	27	**0.34**
167	Mitra T K	27	**0.34**

Sl No	Author	No of Authorship	%
168	Banerjee B	26	**0.32**
169	Ganguli D	26	**0.32**
170	Karmakar S	26	**0.32**
171	Saha M	26	**0.32**
172	Sarkar B K	26	**0.32**
173	Brahma P	25	**0.31**
174	Mukhopadhyay A	25	**0.31**
175	Sarkar N	25	**0.31**
176	Basak D	24	**0.3**
177	Chakravorty S	24	**0.3**
178	Chattopadhyay S K	24	**0.3**
179	Mallick P K	24	**0.3**
180	Mondal A	24	**0.3**
181	Ray Priyadaranjan	24	**0.3**
182	Sahu K	24	**0.3**
183	Sengupta P	24	**0.3**
184	Bandyopadhyay D	23	**0.29**
185	Dutta R I	23	**0.29**
186	Patra G K	23	**0.29**
187	Sen P	23	**0.29**
188	Som K K	23	**0.29**
189	Jana T	22	**0.27**
190	Kar T	22	**0.27**
191	Mahapatra U S	22	**0.27**
192	Mandal T K	22	**0.27**
193	Nanda K K	22	**0.27**
194	Pal Pratibha	22	**0.27**
195	Pal R	22	**0.27**
196	Ray A K	22	**0.27**
197	Sinha P K	22	**0.27**
198	Sircar A K	22	**0.27**
199	Bandopadhyay A	21	**0.26**
200	Basu Sadhan	21	**0.26**
201	Bhattacharyya S M	21	**0.26**
202	De G	21	**0.26**
203	Gangopadhyay S	21	**0.26**
204	Ghatak A	21	**0.26**
205	Paul P	21	**0.26**
206	Pramanik A	21	**0.26**
207	Sarkar S K	21	**0.26**
208	Adhikari S	20	**0.25**
209	Bag N	20	**0.25**
210	Bandyopadhyay S	20	**0.25**
211	Basu P	20	**0.25**
212	Bhattacharya R	20	**0.25**
213	Chakraborty S	20	**0.25**
214	Gangopadhyay G	20	**0.25**
215	Giri S	20	**0.25**
216	Maji S K	20	**0.25**
217	Peng S M	20	**0.25**
218	Roy R	20	**0.25**
219	Sinha S	20	**0.25**
220	Adhikari B	19	**0.24**
221	Chattopadhyay K K	19	**0.24**
222	Das B P	19	**0.24**
223	Das K K	19	**0.24**
224	Dasgupta A	19	**0.24**

Rank List of Productive Authors of Journal Articles of IACS, Kolkata 1947-2006

Sl No	Author	No of Authorship	%
225	Ganguly S	19	**0.24**
226	Ghosh R	19	**0.24**
227	Ghoshal D	19	**0.24**
228	Helliwell M	19	**0.24**
229	Lahiri G K	19	**0.24**
230	Lu H-T	19	**0.24**
231	Mandal A	19	**0.24**
232	Nath A	19	**0.24**
233	Shaikh N	19	**0.24**
234	Banerjee A K	18	**0.22**
235	Banerjee K	18	**0.22**
236	Banik S K	18	**0.22**
237	Basu A	18	**0.22**
238	Biswas P K	18	**0.22**
239	De R	18	**0.22**
240	Ghosh K	18	**0.22**
241	Gupta S	18	**0.22**
242	Kundu T K	18	**0.22**
243	Lahiri A	18	**0.22**
244	Mal N K	18	**0.22**
245	Manna A	18	**0.22**
246	Mazumdar P S	18	**0.22**
247	Middya A R	18	**0.22**
248	Mukherjee T K	18	**0.22**
249	Singh Y	18	**0.22**
250	Sur S	18	**0.22**
251	Chakraborty T	17	**0.21**
252	Debnath S C	17	**0.21**
253	Ghosh T K	17	**0.21**
254	Hajra A	17	**0.21**
255	Mandal P	17	**0.21**
256	Mukhopadhyay R	17	**0.21**
257	Nandi P K	17	**0.21**
258	Nandy S K	17	**0.21**
259	Quader M A	17	**0.21**
260	Sarkar A K	17	**0.21**
261	Stubb H	17	**0.21**
262	Ahmed H	16	**0.2**
263	Barman A	16	**0.2**
264	Bhattacharjee A	16	**0.2**
265	Biswas D C	16	**0.2**
266	Biswas R	16	**0.2**
267	Chakraborty A K	16	**0.2**
268	Chandra S K	16	**0.2**
269	Datta B	16	**0.2**
270	Dey K	16	**0.2**
271	Dutta Ahmed A	16	**0.2**
272	Dutta B	16	**0.2**
273	Guin C	16	**0.2**
274	Misra T	16	**0.2**
275	Mukherjee T	16	**0.2**
276	Pal D	16	**0.2**
277	Pariya C	16	**0.2**
278	Ray K	16	**0.2**
279	Saha A	16	**0.2**
280	Sarma A S	16	**0.2**
281	Sengupta S P	16	**0.2**
282	Tocher D A	16	**0.2**
283	Bandhopadhyay A K	15	**0.19**
284	Bandyopadhyay P	15	**0.19**
285	Chakraborty K K	15	**0.19**
286	Datta R N	15	**0.19**
287	Deb S K	15	**0.19**
288	Guha D	15	**0.19**
289	Kundu T	15	**0.19**
290	Maiti S	15	**0.19**
291	Maity A B	15	**0.19**
292	Mandal P K	15	**0.19**
293	Menon M	15	**0.19**
294	Mollah S	15	**0.19**
295	Moulik S P	15	**0.19**
296	Panja A	15	**0.19**
297	Roy Nirmolendu	15	**0.19**
298	Sukul D	15	**0.19**
299	Yang H D	15	**0.19**
300	Bera S C	14	**0.17**
301	Bhattacharyya P K	14	**0.17**
302	Bhattacharyya R	14	**0.17**
303	Chatterjee S K	14	**0.17**
304	Chaudhuri R K	14	**0.17**
305	Chaudhury P	14	**0.17**
306	Chowdhury A	14	**0.17**
307	Das C	14	**0.17**
308	Dutta R	14	**0.17**
309	Haldar D	14	**0.17**
310	Hati S	14	**0.17**
311	Jana S	14	**0.17**
312	Khan P	14	**0.17**
313	Laskar I R	14	**0.17**
314	Majumdar R	14	**0.17**
315	Malik S	14	**0.17**
316	Marjit D	14	**0.17**
317	Mazumdar S K	14	**0.17**
318	McGuin J H	14	**0.17**
319	Medhi K C	14	**0.17**
320	Mitra M	14	**0.17**
321	Mukherji S M	14	**0.17**
322	Pal P K	14	**0.17**
323	Panja S	14	**0.17**
324	Rakshit R	14	**0.17**
325	Ray P	14	**0.17**
326	Roy R K	14	**0.17**
327	Saran Anil	14	**0.17**
328	Sarkar K	14	**0.17**
329	Sural D P	14	**0.17**
330	Barik D	13	**0.16**
331	Bhar S	13	**0.16**
332	Bhattacharyya P K	13	**0.16**
333	Bhattacharyya T	13	**0.16**
334	Chakraborty A	13	**0.16**
335	Chakraborty P	13	**0.16**
336	Chakraborty R	13	**0.16**
337	Chatterjee K	13	**0.16**
338	Chattopadhyay N	13	**0.16**

Rank List of Productive Authors of Journal Articles of IACS, Kolkata 1947-2006

Sl No	Author	No of Authorship	%
339	Dalai S	13	**0.16**
340	Dasgupta S K	13	**0.16**
341	De S	13	**0.16**
342	Falvello L R	13	**0.16**
343	Floerke U	13	**0.16**
344	Guha P	13	**0.16**
345	Jana M	13	**0.16**
346	Koll A	13	**0.16**
347	Maiti G	13	**0.16**
348	Nag A	13	**0.16**
349	Nakamura H	13	**0.16**
350	Naskar N	13	**0.16**
351	Roy B	13	**0.16**
352	Roy Chaudhury R K	13	**0.16**
353	Saha B C	13	**0.16**
354	Sanyal G S	13	**0.16**
355	Sarkar D C	13	**0.16**
356	Sarkar Deepali	13	**0.16**
357	Sarkar M	13	**0.16**
358	Saxena S C	13	**0.16**
359	Sen Gupta S	13	**0.16**
360	Sural M	13	**0.16**
361	Bag B C	12	**0.15**
362	Bahttacharyya K	12	**0.15**
363	Baitalik S	12	**0.15**
364	Banerjee G	12	**0.15**
365	Banerjee Ratnabali	12	**0.15**
366	Bangal P R	12	**0.15**
367	Bhattacharya M	12	**0.15**
368	Bocelli G	12	**0.15**
369	Das Gupta A	12	**0.15**
370	Dirghangi B K	12	**0.15**
371	Ganguly G	12	**0.15**
372	Guchhait N	12	**0.15**
373	Jana U	12	**0.15**
374	Kar Tanusree	12	**0.15**
375	Kumar S B	12	**0.15**
376	Kundu B	12	**0.15**
377	Kutzelnigg W	12	**0.15**
378	Maiti A	12	**0.15**
379	Mallah T	12	**0.15**
380	Mallick B	12	**0.15**
381	Mandal C R	12	**0.15**
382	Mitra B C	12	**0.15**
383	Mondal C K	12	**0.15**
384	Mukherjee A	12	**0.15**
385	Mukherjee A R	12	**0.15**
386	Mukherjee Ajit Kr.	12	**0.15**
387	Naskar J P	12	**0.15**
388	Paul A	12	**0.15**
389	Rana K K	12	**0.15**
390	Rath S P	12	**0.15**
391	Ray Chaudhuri J	12	**0.15**
392	Saha M K	12	**0.15**
393	Sain S	12	**0.15**
394	Sen S N	12	**0.15**
395	Sengupta A	12	**0.15**

Sl No	Author	No of Authorship	%
396	Sharma S N	12	**0.15**
397	Batabyal S K	11	**0.14**
398	Bhadra K	11	**0.14**
399	Bose I	11	**0.14**
400	Chakrabarti K	11	**0.14**
401	Chakraborti A K	11	**0.14**
402	Chakraborti R	11	**0.14**
403	Chakraborty I	11	**0.14**
404	Chakraborty M	11	**0.14**
405	Chatterjee M	11	**0.14**
406	Chaudhuri R	11	**0.14**
407	Choudhury S B	11	**0.14**
408	Chowdhury P	11	**0.14**
409	Das Gupta A	11	**0.14**
410	Das M N	11	**0.14**
411	Das P	11	**0.14**
412	Deb B	11	**0.14**
413	Dey A	11	**0.14**
414	Filarowski A	11	**0.14**
415	Haase W	11	**0.14**
416	Kar S C	11	**0.14**
417	Khan M W	11	**0.14**
418	Kundu S	11	**0.14**
419	Laha S	11	**0.14**
420	Maity A K	11	**0.14**
421	Majumdar P	11	**0.14**
422	Meikap A K	11	**0.14**
423	Mukherjee R N	11	**0.14**
424	Mukhopadhyay B	11	**0.14**
425	Pal A	11	**0.14**
426	Pal C K	11	**0.14**
427	Pal Majumder T	11	**0.14**
428	Pramanik K	11	**0.14**
429	Roychoudhury R K	11	**0.14**
430	Saha S C	11	**0.14**
431	Sakata H	11	**0.14**
432	Salomon R G	11	**0.14**
433	Sanyal S	11	**0.14**
434	Sinha Roy S	11	**0.14**
435	Sur S K	11	**0.14**
436	Tripathi S	11	**0.14**
437	Venkatsubramanian K	11	**0.14**
438	Wanklyn B M	11	**0.14**
439	Adhya J N	10	**0.12**
440	Bahadur D	10	**0.12**
441	Banerjee B K	10	**0.12**
442	Banerjee S N	10	**0.12**
443	Bhattacharjee D	10	**0.12**
444	Bhattacharyya S K	10	**0.12**
445	Bishui P K	10	**0.12**
446	Das U K	10	**0.12**
447	Dasgupta R	10	**0.12**
448	Datta K K	10	**0.12**
449	De D	10	**0.12**
450	Deb K K	10	**0.12**
451	Dey S S	10	**0.12**
452	Ghosh M C	10	**0.12**

Rank List of Productive Authors of Journal Articles of IACS, Kolkata 1947-2006

Sl No	Author	No of Authorship	%
453	Ghosh P K	10	**0.12**
454	Giri A K	10	**0.12**
455	Gorai S	10	**0.12**
456	Goswami K	10	**0.12**
457	Goswami K N	10	**0.12**
458	Halder A	10	**0.12**
459	Kundu S K	10	**0.12**
460	Lee G H	10	**0.12**
461	Mandal T	10	**0.12**
462	Manna S C	10	**0.12**
463	Mitra K N	10	**0.12**
464	Modak D K	10	**0.12**
465	Mohanta S	10	**0.12**
466	Mukherjee G	10	**0.12**
467	Mukhopadhyay P	10	**0.12**
468	Nandi B	10	**0.12**
469	Nandy A	10	**0.12**
470	Nath B	10	**0.12**
471	Pal T	10	**0.12**
472	Pan A	10	**0.12**
473	Patra A	10	**0.12**
474	Saha G	10	**0.12**
475	Sahoo B K	10	**0.12**
476	Sarkar P B	10	**0.12**
477	Som J	10	**0.12**
478	Somayajulu G R	10	**0.12**
479	Talukder P B	10	**0.12**
480	Banerjee C	9	**0.11**
481	Banik B K	9	**0.11**
482	Bhattacharya T	9	**0.11**
483	Bhattacharyya J	9	**0.11**
484	Bhattacharyya N K	9	**0.11**
485	Biswas S K	9	**0.11**
486	Bose K	9	**0.11**
487	Brahma S K	9	**0.11**
488	Brunskill J S A	9	**0.11**
489	Chakravarty J	9	**0.11**
490	Chaudhuri G	9	**0.11**
491	Choudhury M	9	**0.11**
492	Chowdhury J	9	**0.11**
493	Das B	9	**0.11**
494	Dasgupta S	9	**0.11**
495	De A K	9	**0.11**
496	Debnath S	9	**0.11**
497	Dey B N	9	**0.11**
498	Dutta Gupta N	9	**0.11**
499	Ghosh S K	9	**0.11**
500	Guchhait S K	9	**0.11**
501	Gupta P	9	**0.11**
502	Halder D	9	**0.11**
503	Jana P	9	**0.11**
504	Kamar K K	9	**0.11**
505	Karan S	9	**0.11**
506	Longeand C	9	**0.11**
507	Mahanty J S	9	**0.11**
508	Maiti P	9	**0.11**
509	Majee A	9	**0.11**
510	Maji K	9	**0.11**
511	Maji M	9	**0.11**
512	Mallik Biswanath	9	**0.11**
513	Mandal S	9	**0.11**
514	Midda S	9	**0.11**
515	Misra A K	9	**0.11**
516	Mukherjee B	9	**0.11**
517	Mukherjee K M	9	**0.11**
518	Mukhopadhyay Sukla	9	**0.11**
519	Pal H	9	**0.11**
520	Pal T	9	**0.11**
521	Panda B K	9	**0.11**
522	Parui P P	9	**0.11**
523	Pathak G K	9	**0.11**
524	Patra D	9	**0.11**
525	Paul G K	9	**0.11**
526	Pujari M P	9	**0.11**
527	Rai R	9	**0.11**
528	Rajak K K	9	**0.11**
529	Ray P K	9	**0.11**
530	Sadhukhan M	9	**0.11**
531	Saha R K	9	**0.11**
532	Samaddar S	9	**0.11**
533	Sarkar P	9	**0.11**
534	Sen A C	9	**0.11**
535	Sen Gupta R	9	**0.11**
536	Sen R K	9	**0.11**
537	Sengupta K	9	**0.11**
538	Shivakumar M	9	**0.11**
539	Sinha P	9	**0.11**
540	Srivastava I B	9	**0.11**
541	Sthanapati J	9	**0.11**
542	Tiekink E R T	9	**0.11**
543	Acharyya S	8	**0.1**
544	Bagchi R N	8	**0.1**
545	Banerjee M	8	**0.1**
546	Banthia A K	8	**0.1**
547	Bhattacharjee B	8	**0.1**
548	Bhattacharya D M	8	**0.1**
549	Bishui B M	8	**0.1**
550	Bishui P K	8	**0.1**
551	Biswas T	8	**0.1**
552	Bolognesi A	8	**0.1**
553	Butcher R J	8	**0.1**
554	Cabarrocas P Roca i	8	**0.1**
555	Chatterjee L	8	**0.1**
556	Chattopadhyay A	8	**0.1**
557	Chattopadhyay T	8	**0.1**
558	Chowdhury C	8	**0.1**
559	Dasgupta D	8	**0.1**
560	Dastidar K Rai	8	**0.1**
561	Datta Shyamal	8	**0.1**
562	Deb A R	8	**0.1**
563	Dutta P K	8	**0.1**
564	Dutta Roy S K	8	**0.1**
565	Fissekis J D	8	**0.1**
566	Ganguly A K	8	**0.1**

Rank List of Productive Authors of Journal Articles of IACS, Kolkata 1947-2006

Sl No	Author	No of Authorship	%
567	Ghosal M	8	**0.1**
568	Haldar M	8	**0.1**
569	Halder S K	8	**0.1**
570	Jain K M	8	**0.1**
571	Jana A R	8	**0.1**
572	Kanrar A	8	**0.1**
573	Krishna Murti G S R	8	**0.1**
574	Kundu S N	8	**0.1**
575	Maiti N	8	**0.1**
576	Maity S	8	**0.1**
577	Majumdar C K	8	**0.1**
578	Mallik G K	8	**0.1**
579	Manna S	8	**0.1**
580	Mascharak P K	8	**0.1**
581	Merlitz H	8	**0.1**
582	Mukhopadhyay D	8	**0.1**
583	Pal B N	8	**0.1**
584	Pal Prabir	8	**0.1**
585	Paloheimo J	8	**0.1**
586	Panda S K	8	**0.1**
587	Parichha T K	8	**0.1**
588	Pattanayak S	8	**0.1**
589	Prasad P N	8	**0.1**
590	Rakshit A B	8	**0.1**
591	Ray M M	8	**0.1**
592	Ray P P	8	**0.1**
593	Ray Siddhartha	8	**0.1**
594	Roy Kanika	8	**0.1**
595	Saha N	8	**0.1**
596	Samanta R	8	**0.1**
597	Sarkar N K	8	**0.1**
598	Satyanarayana G O S V	8	**0.1**
599	Sengupta D	8	**0.1**
600	Sengupta N R	8	**0.1**
601	Seth P	8	**0.1**
602	Sheldrick W S	8	**0.1**
603	Sil A N	8	**0.1**
604	Singh R	8	**0.1**
605	Srivastava K P	8	**0.1**
606	Talukdar D	8	**0.1**
607	Taran S	8	**0.1**
608	Xavier J	8	**0.1**
609	Bag P	7	**0.09**
610	Bandyopadhyay S K	7	**0.09**
611	Banerjee Arindam	7	**0.09**
612	Baruah B	7	**0.09**
613	Bera A K	7	**0.09**
614	Bhattacharyya B	7	**0.09**
615	Bhowal J	7	**0.09**
616	Castineiras A	7	**0.09**
617	Chakrabarti M K	7	**0.09**
618	Chakraborti P K	7	**0.09**
619	Chakravarty	7	**0.09**
620	Chakravarty A K	7	**0.09**
621	Chattapadhyay S	7	**0.09**
622	Chatterjee R	7	**0.09**
623	Chatterjee U	7	**0.09**

Sl No	Author	No of Authorship	%
624	Chattopadhyay D	7	**0.09**
625	Chaudhuri J	7	**0.09**
626	Chaudhuri K	7	**0.09**
627	Dan A	7	**0.09**
628	Das Debajyoti	7	**0.09**
629	Das G P	7	**0.09**
630	Das M	7	**0.09**
631	De S C	7	**0.09**
632	Dinda R	7	**0.09**
633	Dutta K K	7	**0.09**
634	Ghosal S K	7	**0.09**
635	Ghosh B K	7	**0.09**
636	Ghosh B P	7	**0.09**
637	Gomanthy V	7	**0.09**
638	Gupta R	7	**0.09**
639	Hossain M	7	**0.09**
640	Houk K N	7	**0.09**
641	Jewrajka S K	7	**0.09**
642	Joardar D S	7	**0.09**
643	Karmakar B	7	**0.09**
644	Kohara T	7	**0.09**
645	Kolay A P	7	**0.09**
646	Mahapatra A K	7	**0.09**
647	Majumdar H S	7	**0.09**
648	Majumder M	7	**0.09**
649	Mal S	7	**0.09**
650	Mandal S S	7	**0.09**
651	Mazumder Monomohan	7	**0.09**
652	Misra A	7	**0.09**
653	Mitra R N	7	**0.09**
654	Mitra S S	7	**0.09**
655	Mukherjee P	7	**0.09**
656	Mukhopadhyay S K	7	**0.09**
657	Nair V S K	7	**0.09**
658	Nakatsuji H	7	**0.09**
659	Nambissan P M G	7	**0.09**
660	Nandi M	7	**0.09**
661	Okamota K	7	**0.09**
662	Pal T K	7	**0.09**
663	Paul T	7	**0.09**
664	Pradhan B	7	**0.09**
665	Pramanick D	7	**0.09**
666	Rahaman M H	7	**0.09**
667	Ray R	7	**0.09**
668	Routh H	7	**0.09**
669	Roy A C	7	**0.09**
670	Roy J K	7	**0.09**
671	Roychoudhury P	7	**0.09**
672	Saha A K	7	**0.09**
673	Saha Samir	7	**0.09**
674	Saini R D	7	**0.09**
675	Samanta A	7	**0.09**
676	Samanta S S	7	**0.09**
677	Sanyal B	7	**0.09**
678	Sarkar J	7	**0.09**
679	Sen D	7	**0.09**

Rank List of Productive Authors of Journal Articles of IACS, Kolkata 1947-2006

Sl No	Author	No of Authorship	%
680	Shee S K	7	**0.09**
681	Singh S D	7	**0.09**
682	Sinha D	7	**0.09**
683	Spears C P	7	**0.09**
684	Swamy H N	7	**0.09**
685	Thander A	7	**0.09**
686	Welch A J	7	**0.09**
687	Adhya L	6	**0.07**
688	Alam S K	6	**0.07**
689	Allkofer O C	6	**0.07**
690	Bag S C	6	**0.07**
691	Bandyopadhyay T K	6	**0.07**
692	Basak B S	6	**0.07**
693	Bataval Lakshmi	6	**0.07**
694	Bera S K	6	**0.07**
695	Bhattacharjee R R	6	**0.07**
696	Bhattacharyya A	6	**0.07**
697	Bhattacharyya T J	6	**0.07**
698	Bhattacharyya T K	6	**0.07**
699	Bose N R	6	**0.07**
700	Bose P	6	**0.07**
701	Chakrabarti R	6	**0.07**
702	Chakraborti P C	6	**0.07**
703	Chakrabortty D M	6	**0.07**
704	Chakraborty B R	6	**0.07**
705	Chakravarty A S	6	**0.07**
706	Chakravarty B	6	**0.07**
707	Chatterjee Ela	6	**0.07**
708	Chattopadhyay U	6	**0.07**
709	Chaudhuri N Ray	6	**0.07**
710	Chen L	6	**0.07**
711	Chihara H	6	**0.07**
712	Chong D P	6	**0.07**
713	Choudhury A	6	**0.07**
714	Choudhury A K	6	**0.07**
715	Chowdhury K	6	**0.07**
716	Das R K	6	**0.07**
717	Daskhan M	6	**0.07**
718	De B	6	**0.07**
719	De D K	6	**0.07**
720	De Molly	6	**0.07**
721	De U	6	**0.07**
722	Deb A K	6	**0.07**
723	Dev A	6	**0.07**
724	Dikshit A K	6	**0.07**
725	Dutta Gupta P	6	**0.07**
726	Fujii M	6	**0.07**
727	Ghosal A K	6	**0.07**
728	Ghosh Alpana	6	**0.07**
729	Ghosh D B	6	**0.07**
730	Ghosh Minakshi	6	**0.07**
731	Ghosh S	6	**0.07**
732	Gopakumar G	6	**0.07**
733	Guha E	6	**0.07**
734	Halder M	6	**0.07**
735	Haque A	6	**0.07**
736	Hung C H	6	**0.07**
737	Jana R	6	**0.07**
738	Jana Y M	6	**0.07**
739	kamila S	6	**0.07**
740	Kanjilal P R	6	**0.07**
741	Karpha T K	6	**0.07**
742	Konar R S	6	**0.07**
743	Kotal A	6	**0.07**
744	Maddali U B	6	**0.07**
745	Maiti A B	6	**0.07**
746	Maiti A K	6	**0.07**
747	Maity D K	6	**0.07**
748	Maity S K	6	**0.07**
749	Majumdar A	6	**0.07**
750	Majumdar M	6	**0.07**
751	Mak T C W	6	**0.07**
752	Malakar B	6	**0.07**
753	Manivannan V	6	**0.07**
754	Msezane A Z	6	**0.07**
755	Mukherjee C	6	**0.07**
756	Mukherjee I	6	**0.07**
757	Mukherjee Pasupati	6	**0.07**
758	Mukherjee S K	6	**0.07**
759	Nagar B R	6	**0.07**
760	Nandy M	6	**0.07**
761	Nath Triloki	6	**0.07**
762	Nayak N P	6	**0.07**
763	Osterbacka R	6	**0.07**
764	Ostergard T	6	**0.07**
765	Pal Chawdhury M	6	**0.07**
766	Paul D	6	**0.07**
767	Pradhan T K	6	**0.07**
768	Rahut S	6	**0.07**
769	Rana D	6	**0.07**
770	Rao A S	6	**0.07**
771	Ray Asit Kumar	6	**0.07**
772	Ray B	6	**0.07**
773	Riaz S S	6	**0.07**
774	Roy Chaudhuri N	6	**0.07**
775	Roy S S	6	**0.07**
776	Rozenberg E	6	**0.07**
777	Saha R	6	**0.07**
778	Sanyal G	6	**0.07**
779	Sarker A	6	**0.07**
780	Satpati B	6	**0.07**
781	Satyam P V	6	**0.07**
782	Sen Gupta Nihar Ranjan	6	**0.07**
783	Sen R	6	**0.07**
784	Sen Suchitra	6	**0.07**
785	Sengupta T K	6	**0.07**
786	Seshadri T	6	**0.07**
787	Sinha B	6	**0.07**
788	Srivastava S C	6	**0.07**
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790	Thompson L K	6	**0.07**
791	Weakley T J R	6	**0.07**
792	Adhikari S K	5	**0.06**

Rank List of Productive Authors of Journal Articles of IACS, Kolkata 1947-2006

Sl No	Author	No of Authorship	%
793	Banerjee B C	5	**0.06**
794	Banerji D	5	**0.06**
795	Basu M K	5	**0.06**
796	Basu N	5	**0.06**
797	Bera N R	5	**0.06**
798	Bera P K	5	**0.06**
799	Bhattacharya P	5	**0.06**
800	Bhattacharyya P	5	**0.06**
801	Bhaumik S	5	**0.06**
802	Chadha S C	5	**0.06**
803	Chakladar S	5	**0.06**
804	Chakraborti S	5	**0.06**
805	Chanda A	5	**0.06**
806	Chatterjee C	5	**0.06**
807	Chaudhuri L N	5	**0.06**
808	Chaudhuri P P	5	**0.06**
809	Choudhury D	5	**0.06**
810	Choudhury S	5	**0.06**
811	Das Burman A	5	**0.06**
812	Das K S	5	**0.06**
813	Das T K	5	**0.06**
814	Datta A K	5	**0.06**
815	Datta J	5	**0.06**
816	De K	5	**0.06**
817	De P K	5	**0.06**
818	Dey P K	5	**0.06**
819	Dey S	5	**0.06**
820	Durgaprasad N	5	**0.06**
821	Durocher G	5	**0.06**
822	Dutt M B	5	**0.06**
823	Dutta D	5	**0.06**
824	Dutta N K	5	**0.06**
825	Dutta U	5	**0.06**
826	Fenell R A	5	**0.06**
827	Gabe E J	5	**0.06**
828	Ghosh B	5	**0.06**
829	Ghosh D K	5	**0.06**
830	Ghosh Dilip Kumar	5	**0.06**
831	Ghosh Urmi	5	**0.06**
832	Ghosh Z	5	**0.06**
833	Guenet J M	5	**0.06**
834	Guha T	5	**0.06**
835	Guhaniyogi S C	5	**0.06**
836	Gupta R P	5	**0.06**
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840	Jana D	5	**0.06**
841	Jana J	5	**0.06**
842	Jha R	5	**0.06**
843	Kar I	5	**0.06**
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845	Karwowski J	5	**0.06**
846	Komatsa T	5	**0.06**
847	Kshirsagar S T	5	**0.06**
848	Kundu A	5	**0.06**
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852	Majumder S	5	**0.06**
853	Medda T	5	**0.06**
854	Medhi C	5	**0.06**
855	Mitra G B	5	**0.06**
856	Mondal B M	5	**0.06**
857	Mukherjee A K	5	**0.06**
858	Mukherjee K	5	**0.06**
859	Mukherjee Monika	5	**0.06**
860	Mukherji S	5	**0.06**
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862	Pahari D	5	**0.06**
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864	Paul R	5	**0.06**
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871	Ram S	5	**0.06**
872	Rath J K	5	**0.06**
873	Ray A	5	**0.06**
874	Ray H	5	**0.06**
875	Ray J K	5	**0.06**
876	Rogez G	5	**0.06**
877	Roy A K	5	**0.06**
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879	Roychaudhury R K	5	**0.06**
880	Sabui S K	5	**0.06**
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889	Sinha A	5	**0.06**
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892	Some K K	5	**0.06**
893	Srivastava P	5	**0.06**
894	Sur C	5	**0.06**
895	Suzuki K	5	**0.06**
896	Tripathi K K	5	**0.06**
897	Waghorne E	5	**0.06**
898	Williamson D L	5	**0.06**
899	Acharya S	4	**0.05**
900	Agarwal D C	4	**0.05**
901	Ahmad Z	4	**0.05**
902	Anantaraman A V	4	**0.05**
903	Banerjee C C	4	**0.05**
904	Banerjee Dipali	4	**0.05**
905	Banerjee U K	4	**0.05**
906	Becker R S	4	**0.05**

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907	Bhaduri A	4	**0.05**
908	Bhanja S	4	**0.05**
909	Bhattacharjee G	4	**0.05**
910	Bhattacharya K	4	**0.05**
911	Bhattacharya Ramendra Narayan	4	**0.05**
912	Bhattacharya S N	4	**0.05**
913	Bhattacharyya D M	4	**0.05**
914	Bhattacharyya I	4	**0.05**
915	Bhattacharyya Kinkini	4	**0.05**
916	Bhattacharyya M	4	**0.05**
917	Bhowmik D	4	**0.05**
918	Biswas A M	4	**0.05**
919	Biswas B	4	**0.05**
920	Biswas D K	4	**0.05**
921	Biswas M	4	**0.05**
922	Biswas P	4	**0.05**
923	Biswas S G	4	**0.05**
924	Biswas S N	4	**0.05**
925	Bose S	4	**0.05**
926	Canuto S	4	**0.05**
927	Chakraborty P K	4	**0.05**
928	Chakravarty A R	4	**0.05**
929	Chakravaty A R	4	**0.05**
930	Chanda M	4	**0.05**
931	Charland J P	4	**0.05**
932	Chatterjee J	4	**0.05**
933	Chatterjee N R	4	**0.05**
934	Chatterjee S R	4	**0.05**
935	Chattopadhyay P	4	**0.05**
936	Chaudhury S	4	**0.05**
937	Chen Y	4	**0.05**
938	Choudhury K	4	**0.05**
939	Chowdhuri J	4	**0.05**
940	Chowdhury Joydeep	4	**0.05**
941	Cotton F A	4	**0.05**
942	Crothers D S F	4	**0.05**
943	Das G C	4	**0.05**
944	Das Gupta D R	4	**0.05**
945	Das N S	4	**0.05**
946	Dasgupta M K	4	**0.05**
947	Datta P	4	**0.05**
948	Dawn A	4	**0.05**
949	Deb S	4	**0.05**
950	Dev B	4	**0.05**
951	Dey K K	4	**0.05**
952	Dhar A	4	**0.05**
953	Dutta Chaudhuri S	4	**0.05**
954	Dutta D K	4	**0.05**
955	Dutta H	4	**0.05**
956	Eisenthal K B	4	**0.05**
957	Endo A	4	**0.05**
958	Ewing D F	4	**0.05**
959	Felfli Z	4	**0.05**
960	Fujiihad M	4	**0.05**
961	Ganguli A	4	**0.05**
962	Ganguli S	4	**0.05**

Sl No	Author	No of Authorship	%
963	Geller S	4	**0.05**
964	Ghorai A	4	**0.05**
965	Ghosal Probir K	4	**0.05**
966	Ghosh C K	4	**0.05**
967	Ghosh N	4	**0.05**
968	Ghosh S C	4	**0.05**
969	Ghoshal A K	4	**0.05**
970	Gravel D	4	**0.05**
971	Guha Sunanda	4	**0.05**
972	Guhathakurata S R	4	**0.05**
973	Guhathakurta B	4	**0.05**
974	Gupta G N	4	**0.05**
975	Gupta M	4	**0.05**
976	Hasan A	4	**0.05**
977	Hay R W	4	**0.05**
978	Hazra Sukti	4	**0.05**
979	Hill H A O	4	**0.05**
980	Holt D J	4	**0.05**
981	Hudlicky T	4	**0.05**
982	Jain H	4	**0.05**
983	Jenkins P R	4	**0.05**
984	Karmakar P Roy	4	**0.05**
985	Karmakar R	4	**0.05**
986	Kemeny G	4	**0.05**
987	Khan Priti Kana	4	**0.05**
988	Koch S	4	**0.05**
989	Lloret F	4	**0.05**
990	Maiti A K	4	**0.05**
991	Maiti B C	4	**0.05**
992	Majee S K	4	**0.05**
993	Majumdar S	4	**0.05**
994	Mal J	4	**0.05**
995	Mallik T	4	**0.05**
996	Mandal S H	4	**0.05**
997	Manoharan P T	4	**0.05**
998	Mazumdar G	4	**0.05**
999	Misra N	4	**0.05**
1000	Mitra Bani	4	**0.05**
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1004	Mukherji A	4	**0.05**
1005	Mukherji Sudeshna	4	**0.05**
1006	Mukhopadhyay M	4	**0.05**
1007	Mullick K	4	**0.05**
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1009	Narang	4	**0.05**
1010	Nayek A	4	**0.05**
1011	Nigam A K	4	**0.05**
1012	Palmar R A	4	**0.05**
1013	Parthasarathy S	4	**0.05**
1014	Pati L C	4	**0.05**
1015	Patterson D	4	**0.05**
1016	Paul Atreyi	4	**0.05**
1017	Paul N	4	**0.05**
1018	Philip J	4	**0.05**
1019	Poddar D	4	**0.05**

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1021	Rana A K	4	**0.05**
1022	Ranjan O A	4	**0.05**
1023	Ray G	4	**0.05**
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1025	Ray T	4	**0.05**
1026	Roy Abhijit	4	**0.05**
1027	Roy Arup	4	**0.05**
1028	Roy Choudhury H	4	**0.05**
1029	Roy H B	4	**0.05**
1030	Roy Rita	4	**0.05**
1031	Roy S R	4	**0.05**
1032	Saha D C	4	**0.05**
1033	Saha H P	4	**0.05**
1034	Saha U	4	**0.05**
1035	Sahu P	4	**0.05**
1036	Santra A	4	**0.05**
1037	Sanyal S B	4	**0.05**
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1041	Sen A K	4	**0.05**
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1043	Sen M	4	**0.05**
1044	Sen Susmita	4	**0.05**
1045	Sengupta Ranajit	4	**0.05**
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1047	Sinharoy P K	4	**0.05**
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1050	Vignoli S	4	**0.05**
1051	Vojtioeek P	4	**0.05**
1052	Werner R	4	**0.05**
1053	Woolfson M M	4	**0.05**
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1056	Bahumik D	3	**0.04**
1057	Balzarini J	3	**0.04**
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1071	Bhanot G S	3	**0.04**
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1073	Bhattacharya D	3	**0.04**
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1142	Ghosh Manash	3	**0.04**
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1222	Roy Chaudhury S	3	**0.04**
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1225	Roy Tanusree	3	**0.04**
1226	Saha N N	3	**0.04**
1227	Saha Roy S	3	**0.04**
1228	Samanata S	3	**0.04**
1229	Samanta H S	3	**0.04**
1230	Samanta Rekha	3	**0.04**
1231	Sanyal A	3	**0.04**
1232	Sanyal I	3	**0.04**
1233	Sarangi A K	3	**0.04**
1234	Sarbajana S	3	**0.04**
1235	Sarbajna S	3	**0.04**
1236	Sarkar D	3	**0.04**
1237	Sarkar Kalpana	3	**0.04**
1238	Sarkar R L	3	**0.04**
1239	Sarkar S C Nath	3	**0.04**
1240	Sasmal D	3	**0.04**
1241	Sastry K N S	3	**0.04**
1242	Schwalbe C H	3	**0.04**
1243	Seal Alpana	3	**0.04**
1244	Sen A	3	**0.04**
1245	Sen Gupta U K	3	**0.04**
1246	Sen P K	3	**0.04**

Rank List of Productive Authors of Journal Articles of IACS, Kolkata 1947-2006

Sl No	Author	No of Authorship	%
1247	Sen Seema	3	**0.04**
1248	Sengupta K K	3	**0.04**
1249	Sengupta Malabika	3	**0.04**
1250	Sengupta Susanta K	3	**0.04**
1251	Seth S	3	**0.04**
1252	Sharma B Ram	3	**0.04**
1253	Sharma S K	3	**0.04**
1254	Si S	3	**0.04**
1255	Sikdar R	3	**0.04**
1256	Simson J	3	**0.04**
1257	Singh E D	3	**0.04**
1258	Singh I P	3	**0.04**
1259	Sun C P	3	**0.04**
1260	Sur B	3	**0.04**
1261	Sur Sukanya	3	**0.04**
1262	Talapatra S K	3	**0.04**
1263	Taliami C	3	**0.04**
1264	Talukdar B	3	**0.04**
1265	Thakkar Ajit J	3	**0.04**
1266	Thakur M	3	**0.04**
1267	Thirumalai D	3	**0.04**
1268	Tominaga K	3	**0.04**
1269	Vala M	3	**0.04**
1270	Venkateswarlu V	3	**0.04**
1271	Vidyarthi D K	3	**0.04**
1272	Wijekoon W M K P	3	**0.04**
1273	Will G	3	**0.04**
1274	Winnik M A	3	**0.04**
1275	Yoshizawa A	3	**0.04**
1276	Achari B	2	**0.02**
1277	Adhikary K	2	**0.02**
1278	Al-Jassim M M	2	**0.02**
1279	Amin G	2	**0.02**
1280	Antony P C	2	**0.02**
1281	Atake T	2	**0.02**
1282	Bagui S	2	**0.02**
1283	Bandopadhyay B	2	**0.02**
1284	Bandyopadhyay R	2	**0.02**
1285	Banerjee A B	2	**0.02**
1286	Banerjee N S	2	**0.02**
1287	Banerjee P C	2	**0.02**
1288	Banerjee S K	2	**0.02**
1289	Banerjee Souri	2	**0.02**
1290	Baral S	2	**0.02**
1291	Barlett R J	2	**0.02**
1292	Bartolome E Di	2	**0.02**
1293	Basak R K	2	**0.02**
1294	Bashui B M	2	**0.02**
1295	Bera N	2	**0.02**
1296	Bergeron J Y	2	**0.02**
1297	Bhadbhade M	2	**0.02**
1298	Bhaskara M L	2	**0.02**
1299	Bhatacharyya A	2	**0.02**
1300	Bhattacharjee B K	2	**0.02**
1301	Bhattacharjee S	2	**0.02**
1302	Bhattacharya A	2	**0.02**
1303	Bhattacharya B	2	**0.02**

Sl No	Author	No of Authorship	%
1304	Bhattacharya B D	2	**0.02**
1305	Bhattacharya C	2	**0.02**
1306	Bhattacharya D L	2	**0.02**
1307	Bhattacharya D P	2	**0.02**
1308	Bhattacharya G	2	**0.02**
1309	Bhattacharya T K	2	**0.02**
1310	Bhattacharyya B R	2	**0.02**
1311	Bhattacharyya Bharati	2	**0.02**
1312	Bhattacharyya S B	2	**0.02**
1313	Bhattacharyya Sankar Prasad	2	**0.02**
1314	Bhattacharyya Sulapani	2	**0.02**
1315	Bhattachryya R	2	**0.02**
1316	Bhoumik A	2	**0.02**
1317	Bhowmik B B	2	**0.02**
1318	Bhowmik D R	2	**0.02**
1319	Bhowmik G	2	**0.02**
1320	Bhusari D M	2	**0.02**
1321	Bid S	2	**0.02**
1322	Bielinska-Was D	2	**0.02**
1323	Biswas G S	2	**0.02**
1324	Biswas H K	2	**0.02**
1325	Biswas Shipra	2	**0.02**
1326	Bose E	2	**0.02**
1327	Bose Madhuri	2	**0.02**
1328	Bose P P	2	**0.02**
1329	Botta C	2	**0.02**
1330	Broder C K	2	**0.02**
1331	Burckel P	2	**0.02**
1332	Burgess J	2	**0.02**
1333	Carius R	2	**0.02**
1334	Castro A	2	**0.02**
1335	Castro Marcos	2	**0.02**
1336	Chakdar N C	2	**0.02**
1337	Chakder N	2	**0.02**
1338	Chakrabarti P	2	**0.02**
1339	Chakraborti A	2	**0.02**
1340	Chakraborti M B	2	**0.02**
1341	Chakraborti P	2	**0.02**
1342	Chakraborty A N	2	**0.02**
1343	Chakraborty B	2	**0.02**
1344	Chakraborty K	2	**0.02**
1345	Chakraborty Lily	2	**0.02**
1346	Chakraborty N K	2	**0.02**
1347	Chakraborty P C	2	**0.02**
1348	Chakraborty P N	2	**0.02**
1349	Chakraborty S S	2	**0.02**
1350	Chakraboti B	2	**0.02**
1351	Chakravarti	2	**0.02**
1352	Chakravarty S C	2	**0.02**
1353	Chakravorty A K	2	**0.02**
1354	Chakravorty A R	2	**0.02**
1355	Chakravorty B R	2	**0.02**
1356	Chakravorty I	2	**0.02**
1357	Chakravorty M	2	**0.02**
1358	Chatterjee B	2	**0.02**
1359	Chatterjee G	2	**0.02**

Rank List of Productive Authors of Journal Articles of IACS, Kolkata 1947-2006

Sl No	Author	No of Authorship	%
1360	Chattopadhyay R	2	**0.02**
1361	Chaudhuri A	2	**0.02**
1362	Chaudhuri C	2	**0.02**
1363	Chaudhury C	2	**0.02**
1364	Chaudhury K	2	**0.02**
1365	Chaudhury P K	2	**0.02**
1366	Chen C F	2	**0.02**
1367	Chen J W	2	**0.02**
1368	Cheng J	2	**0.02**
1369	Chihare H	2	**0.02**
1370	Chintalapudi S N	2	**0.02**
1371	Chou H	2	**0.02**
1372	Choudhuri R K	2	**0.02**
1373	Choudhury Anjali	2	**0.02**
1374	Chowdhury Biva	2	**0.02**
1375	Chowdhury S B	2	**0.02**
1376	Chowdhury S K	2	**0.02**
1377	Coutinho K	2	**0.02**
1378	Cover R E	2	**0.02**
1379	Csige I	2	**0.02**
1380	Das B K	2	**0.02**
1381	Das Gupta	2	**0.02**
1382	Das Gupta P	2	**0.02**
1383	Das Gupta T P	2	**0.02**
1384	Das N K	2	**0.02**
1385	Dasgupta T P	2	**0.02**
1386	Dastidar G S	2	**0.02**
1387	De Abhijit	2	**0.02**
1388	De Clercq E	2	**0.02**
1389	Deb C	2	**0.02**
1390	Deb P C	2	**0.02**
1391	Dey A D	2	**0.02**
1392	Dey J	2	**0.02**
1393	Dey T	2	**0.02**
1394	Digar M	2	**0.02**
1395	Duggan E	2	**0.02**
1396	Dutta B B	2	**0.02**
1397	Dutta Gupta N B	2	**0.02**
1398	Dutta M N	2	**0.02**
1399	Dutta Roy R	2	**0.02**
1400	Dutta Roy S K	2	**0.02**
1401	Escuer A	2	**0.02**
1402	Fallah M S El	2	**0.02**
1403	Fanwick P E	2	**0.02**
1404	Farmer L	2	**0.02**
1405	Farrel R A	2	**0.02**
1406	Fawcett J	2	**0.02**
1407	Finger F	2	**0.02**
1408	Fun H K	2	**0.02**
1409	Gangopadhyay A	2	**0.02**
1410	Gangopadhyay I	2	**0.02**
1411	Gangopadhyay J	2	**0.02**
1412	Ganguli T	2	**0.02**
1413	Ganguly Chhaya	2	**0.02**
1414	Gao S	2	**0.02**
1415	Gartia R K	2	**0.02**
1416	Ghosahl D	2	**0.02**
1417	Ghosal P K	2	**0.02**
1418	Ghosh D	2	**0.02**
1419	Ghosh Anusree	2	**0.02**
1420	Ghosh Arundhati	2	**0.02**
1421	Ghosh C	2	**0.02**
1422	Ghosh Dastidar S	2	**0.02**
1423	Ghosh G	2	**0.02**
1424	Ghosh S N	2	**0.02**
1425	Ghosh Shakti Prasad	2	**0.02**
1426	Ghosh T	2	**0.02**
1427	Ghosh U R	2	**0.02**
1428	Ghoshal M	2	**0.02**
1429	Ghoshal S K	2	**0.02**
1430	Ghoshal T	2	**0.02**
1431	Giri S N	2	**0.02**
1432	Gmelin E	2	**0.02**
1433	Gopal Krishna E M	2	**0.02**
1434	Gordotsky G	2	**0.02**
1435	Guha M	2	**0.02**
1436	Guhu S	2	**0.02**
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1438	Gupta N	2	**0.02**
1439	Gupta N N	2	**0.02**
1440	Gupta N T	2	**0.02**
1441	Gupta S K	2	**0.02**
1442	Halder K C	2	**0.02**
1443	Hara K	2	**0.02**
1444	Hariharan T A	2	**0.02**
1445	Hazra M K	2	**0.02**
1446	Hoppe U	2	**0.02**
1447	Hung D-H	2	**0.02**
1448	Hus C H	2	**0.02**
1449	Isaa J	2	**0.02**
1450	Iwasaki N	2	**0.02**
1451	Jackson L C	2	**0.02**
1452	Jain A	2	**0.02**
1453	Jamaddar Y A	2	**0.02**
1454	Jana P B	2	**0.02**
1455	Jana P K	2	**0.02**
1456	Jana Samar	2	**0.02**
1457	Jash S S	2	**0.02**
1458	Jeffrcy H	2	**0.02**
1459	Jha J	2	**0.02**
1460	Johnson L F	2	**0.02**
1461	Kajimoto O	2	**0.02**
1462	Kang S I	2	**0.02**
1463	Kanjilal C	2	**0.02**
1464	kanner W	2	**0.02**
1465	Karpha A	2	**0.02**
1466	Karvaly B	2	**0.02**
1467	Karvaly Bela	2	**0.02**
1468	Khanna S N	2	**0.02**
1469	Kharmawphalang W	2	**0.02**
1470	Khatun Jainab	2	**0.02**
1471	Kola S	2	**0.02**
1472	Kranold R	2	**0.02**
1473	Kuila B K	2	**0.02**

Sl No	Author	No of Authorship	%
1474	Kumar R	2	**0.02**
1475	Kumar S	2	**0.02**
1476	Kundu L	2	**0.02**
1477	Kuroda R	2	**0.02**
1478	Lahiry Subrata	2	**0.02**
1479	Lambropolulos P	2	**0.02**
1480	Latha K V P	2	**0.02**
1481	Lingamurty V	2	**0.02**
1482	Lo H C	2	**0.02**
1483	Lowe P	2	**0.02**
1484	Lucas P G J	2	**0.02**
1485	Magnusson G	2	**0.02**
1486	Mahanty S	2	**0.02**
1487	Mahapatra B	2	**0.02**
1488	Maiti Ashim Kumar	2	**0.02**
1489	Maiti C R	2	**0.02**
1490	Maiti H S	2	**0.02**
1491	Maitra S	2	**0.02**
1492	Maity A	2	**0.02**
1493	Maity G	2	**0.02**
1494	Maji S	2	**0.02**
1495	Majumdar G	2	**0.02**
1496	Majumdar J	2	**0.02**
1497	Majumder C K	2	**0.02**
1498	Majumder H S	2	**0.02**
1499	Majumder S K	2	**0.02**
1500	Mak T C	2	**0.02**
1501	Malhotra G L	2	**0.02**
1502	Malik B	2	**0.02**
1503	Malik G K	2	**0.02**
1504	Mandal A K	2	**0.02**
1505	Mandal Sankar	2	**0.02**
1506	Manik S K	2	**0.02**
1507	Mascaranhas A J	2	**0.02**
1508	Mathews T	2	**0.02**
1509	Matsukata M	2	**0.02**
1510	Mayers G L	2	**0.02**
1511	Mazumdar B	2	**0.02**
1512	Mazumdar P	2	**0.02**
1513	Minato T	2	**0.02**
1514	Mishra R	2	**0.02**
1515	Mishra S	2	**0.02**
1516	Misra C R	2	**0.02**
1517	Misra K	2	**0.02**
1518	Mitra C	2	**0.02**
1519	Mitra I	2	**0.02**
1520	Mitra M K	2	**0.02**
1521	Mitra M S	2	**0.02**
1522	Mitra S N	2	**0.02**
1523	Mohanta K	2	**0.02**
1524	Molla N H	2	**0.02**
1525	Mondal G	2	**0.02**
1526	Mondal K	2	**0.02**
1527	Mondal Monika	2	**0.02**
1528	Moore R E	2	**0.02**
1529	Mortier J	2	**0.02**
1530	Msezane A S	2	**0.02**
1531	Mukerjee K M	2	**0.02**
1532	Mukherjee Prabir K	2	**0.02**
1533	Mukherji A K	2	**0.02**
1534	Mukhkerjee A K	2	**0.02**
1535	Mukhkerjee D	2	**0.02**
1536	Mukhkerjee M	2	**0.02**
1537	Mukhopadhyay C	2	**0.02**
1538	Mukhopadhyay G	2	**0.02**
1539	Mukhopadhyay J K	2	**0.02**
1540	Mukhopadhyay Sailes Ch.	2	**0.02**
1541	Mukhopadhyay T K	2	**0.02**
1542	Nag D K	2	**0.02**
1543	Nag S	2	**0.02**
1544	Nakayama M	2	**0.02**
1545	Nandi S P	2	**0.02**
1546	Nandy M K	2	**0.02**
1547	Nandy S	2	**0.02**
1548	Narayan M V	2	**0.02**
1549	Naskar J	2	**0.02**
1550	Naskar M K	2	**0.02**
1551	Nath B K	2	**0.02**
1552	Nazimuddin MD	2	**0.02**
1553	Neuefeind J	2	**0.02**
1554	Newlands M J	2	**0.02**
1555	Nilsson U	2	**0.02**
1556	Niyogi S	2	**0.02**
1557	Ohno Kimio	2	**0.02**
1558	Ohtsuki K	2	**0.02**
1559	Okabe E	2	**0.02**
1560	Okamoto K I	2	**0.02**
1561	Okuno H	2	**0.02**
1562	Oppeneer P M	2	**0.02**
1563	Ostrovsky S M	2	**0.02**
1564	OSullivan D	2	**0.02**
1565	Ozterbacka T	2	**0.02**
1566	Paine T K	2	**0.02**
1567	Pal Arun K	2	**0.02**
1568	Pal N	2	**0.02**
1569	Pal Prabitra	2	**0.02**
1570	Pal Sourav	2	**0.02**
1571	Pal Sudipta	2	**0.02**
1572	Palanirelu N	2	**0.02**
1573	Palnivelu N	2	**0.02**
1574	Panda M	2	**0.02**
1575	Pardhan S K	2	**0.02**
1576	Pardo S N	2	**0.02**
1577	Patra S K	2	**0.02**
1578	Paul B	2	**0.02**
1579	Pelleg J	2	**0.02**
1580	Phatak G K	2	**0.02**
1581	Pinkerton A A	2	**0.02**
1582	Poissant Y	2	**0.02**
1583	Potter B S	2	**0.02**
1584	Prakash A	2	**0.02**
1585	Prakash Ram	2	**0.02**
1586	Pratibha Pal	2	**0.02**

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Sl No	Author	No of Authorship	%
1587	Purkayastha S	2	**0.02**
1588	Que L	2	**0.02**
1589	Raman J	2	**0.02**
1590	Rao	2	**0.02**
1591	Rao B K	2	**0.02**
1592	Rao D N	2	**0.02**
1593	Rao P N	2	**0.02**
1594	Ray Chaudhuri A K	2	**0.02**
1595	Ray P N	2	**0.02**
1596	Ray U K	2	**0.02**
1597	Razak A	2	**0.02**
1598	Righi Lara	2	**0.02**
1599	Roy C S	2	**0.02**
1600	Roy Chaudhuri Benoy Chandra	2	**0.02**
1601	Roy D P	2	**0.02**
1602	Roy H	2	**0.02**
1603	Roy H P	2	**0.02**
1604	Roy K K	2	**0.02**
1605	Roy Karmakar P	2	**0.02**
1606	Roy P K	2	**0.02**
1607	Roy Subir K	2	**0.02**
1608	Roy Sudip K	2	**0.02**
1609	Roy T	2	**0.02**
1610	Roychaudhury H	2	**0.02**
1611	Russell D R	2	**0.02**
1612	Saha P R	2	**0.02**
1613	Sahu S	2	**0.02**
1614	Sahu T	2	**0.02**
1615	Samajpati K	2	**0.02**
1616	Samajpati S	2	**0.02**
1617	Samanata H S	2	**0.02**
1618	Samanta C	2	**0.02**
1619	Santra B K	2	**0.02**
1620	Santra K	2	**0.02**
1621	Sanyal D	2	**0.02**
1622	Sanyal M K	2	**0.02**
1623	Sanyal U	2	**0.02**
1624	Sarkar B	2	**0.02**
1625	Sarkar K P	2	**0.02**
1626	Sarkar P K	2	**0.02**
1627	Sarkar Sasabindhu	2	**0.02**
1628	Sarma D D	2	**0.02**
1629	Sarma U U M	2	**0.02**
1630	Sastry P U	2	**0.02**
1631	Satoh T	2	**0.02**
1632	Sawoo S	2	**0.02**
1633	Schadt M	2	**0.02**
1634	Schrader W	2	**0.02**
1635	Seal A	2	**0.02**
1636	Seal B K	2	**0.02**
1637	Sen Gupta A	2	**0.02**
1638	Sen Gupta A K	2	**0.02**
1639	Sen Gupta Suparna	2	**0.02**
1640	Sen N	2	**0.02**
1641	Senent M L	2	**0.02**
1642	Sengupta S K	2	**0.02**

Sl No	Author	No of Authorship	%
1643	Sensharma A	2	**0.02**
1644	Shahinian A H	2	**0.02**
1645	Shamala N	2	**0.02**
1646	Sharma R B	2	**0.02**
1647	Shashidhara Prasad J	2	**0.02**
1648	Shiga M	2	**0.02**
1649	Short R P	2	**0.02**
1650	Shrivastava A	2	**0.02**
1651	Sidhanta J	2	**0.02**
1652	Singh A N	2	**0.02**
1653	Singh N R	2	**0.02**
1654	Singh S J	2	**0.02**
1655	Singh S N	2	**0.02**
1656	Sinha K K	2	**0.02**
1657	Sinha Mahapatra D K	2	**0.02**
1658	Sinha Sachidulal	2	**0.02**
1659	Sinha T P	2	**0.02**
1660	Sircar S C	2	**0.02**
1661	Sitzmann E V	2	**0.02**
1662	Smeyers Y G	2	**0.02**
1663	Som J N	2	**0.02**
1664	Somoc M	2	**0.02**
1665	Srimal S	2	**0.02**
1666	Srivastava R C	2	**0.02**
1667	Takeshita K	2	**0.02**
1668	Taliani C	2	**0.02**
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1670	Thompson A	2	**0.02**
1671	Traversa E	2	**0.02**
1672	Uhlenbruck G	2	**0.02**
1673	Upadhyay S	2	**0.02**
1674	Vanderhaghen R	2	**0.02**
1675	Vava N	2	**0.02**
1676	Vebly S C	2	**0.02**
1677	Vicente R	2	**0.02**
1678	Vig O P	2	**0.02**
1679	Wagner M	2	**0.02**
1680	Walt D R	2	**0.02**
1681	Wong W-T	2	**0.02**
1682	Zagorski M G	2	**0.02**
1683	Zamboni R	2	**0.02**
1684	Abrahamsson M	1	**0.01**
1685	Acharya A	1	**0.01**
1686	Acharya B S	1	**0.01**
1687	Acharya P K	1	**0.01**
1688	Acharya T K	1	**0.01**
1689	Acharyya M	1	**0.01**
1690	Adam W	1	**0.01**
1691	Adhikari M	1	**0.01**
1692	Adhikary T	1	**0.01**
1693	Adhya A	1	**0.01**
1694	Adhya M	1	**0.01**
1695	Adimurthy S	1	**0.01**
1696	Adnar S	1	**0.01**
1697	Aerschot Van A	1	**0.01**
1698	Agarwal P	1	**0.01**
1699	Agudo P	1	**0.01**

Sl No	Author	No of Authorship	%
1700	Ahake T	1	**0.01**
1701	Aich S	1	**0.01**
1702	Aktas Y	1	**0.01**
1703	Alauddin M M	1	**0.01**
1704	Ali Robin	1	**0.01**
1705	Amin R	1	**0.01**
1706	Andersson M	1	**0.01**
1707	Andrei G	1	**0.01**
1708	Anjaneyulu G	1	**0.01**
1709	Annamalai N	1	**0.01**
1710	Anorg Z	1	**0.01**
1711	Aoki Y	1	**0.01**
1712	Ardron M R	1	**0.01**
1713	Arlauskas K	1	**0.01**
1714	Arunachalam L M	1	**0.01**
1715	Asgharian B	1	**0.01**
1716	Ashok K	1	**0.01**
1717	Ashok V D	1	**0.01**
1718	Ashwin V	1	**0.01**
1719	Asolkae L V	1	**0.01**
1720	Avolos M	1	**0.01**
1721	Awana V P S	1	**0.01**
1722	Babiano R	1	**0.01**
1723	Babu B R S	1	**0.01**
1724	Babu L G	1	**0.01**
1725	Babuyaima M	1	**0.01**
1726	Badhra K	1	**0.01**
1727	Bading J R	1	**0.01**
1728	Bag B	1	**0.01**
1729	Bag J K	1	**0.01**
1730	Bag K	1	**0.01**
1731	Bag M R	1	**0.01**
1732	Bag N K	1	**0.01**
1733	Bag S	1	**0.01**
1734	Bagchi J	1	**0.01**
1735	Bagchi S	1	**0.01**
1736	Bahttacharyya S N	1	**0.01**
1737	Bahumik M L	1	**0.01**
1738	Bainik B K	1	**0.01**
1739	Bajaj S K	1	**0.01**
1740	Baker A J	1	**0.01**
1741	Bakonyi I	1	**0.01**
1742	Balasubramaniam D	1	**0.01**
1743	Bandopadhyay T S	1	**0.01**
1744	Bandyopadhyay AP	1	**0.01**
1745	Banerjea Probuddha	1	**0.01**
1746	Banerjee Aritra	1	**0.01**
1747	Banerjee B S	1	**0.01**
1748	Banerjee H D	1	**0.01**
1749	Banerjee Naba Kumar	1	**0.01**
1750	Banerjee R R	1	**0.01**
1751	Banerjee Soomit	1	**0.01**
1752	Banerjee U R	1	**0.01**
1753	Banerjee(Chakraborty) D	1	**0.01**
1754	Banik T K	1	**0.01**
1755	Bannerjee P	1	**0.01**
1756	Barat P	1	**0.01**
1757	Barick K C	1	**0.01**
1758	Barik R	1	**0.01**
1759	Barkar H D	1	**0.01**
1760	Bartolome J	1	**0.01**
1761	Barua A R	1	**0.01**
1762	Barua B	1	**0.01**
1763	Basak S	1	**0.01**
1764	Basu A N	1	**0.01**
1765	Basu Chowdhury K	1	**0.01**
1766	Basu G	1	**0.01**
1767	Basu N K	1	**0.01**
1768	Basu R	1	**0.01**
1769	Basu S N	1	**0.01**
1770	Basu Samita	1	**0.01**
1771	Basu Saradhikary S	1	**0.01**
1772	Basu Susanta	1	**0.01**
1773	Basumallick A	1	**0.01**
1774	Batabyal S	1	**0.01**
1775	Bator G	1	**0.01**
1776	Baus S	1	**0.01**
1777	Bawagan A O	1	**0.01**
1778	Bedekar A V	1	**0.01**
1779	Beiler	1	**0.01**
1780	Bencini A	1	**0.01**
1781	Benelli C	1	**0.01**
1782	Benieere F	1	**0.01**
1783	Bera D C	1	**0.01**
1784	Bera Subhas Ch.	1	**0.01**
1785	Berg A	1	**0.01**
1786	Bernassau J M	1	**0.01**
1787	Bertolasi V	1	**0.01**
1788	Bertolotti S G	1	**0.01**
1789	Bhaduri G C	1	**0.01**
1790	Bhake T	1	**0.01**
1791	Bhar M	1	**0.01**
1792	Bharma P	1	**0.01**
1793	Bhatacharyya D M	1	**0.01**
1794	Bhattacharaya S	1	**0.01**
1795	Bhattacharjayya D P	1	**0.01**
1796	Bhattacharjee A K	1	**0.01**
1797	Bhattacharjee B P	1	**0.01**
1798	Bhattacharjee B R	1	**0.01**
1799	Bhattacharjee J	1	**0.01**
1800	Bhattacharjee N	1	**0.01**
1801	Bhattacharjee T	1	**0.01**
1802	Bhattacharjee U	1	**0.01**
1803	Bhattacharrya S P	1	**0.01**
1804	Bhattacharya B K	1	**0.01**
1805	Bhattacharya D N	1	**0.01**
1806	Bhattacharya Debajyoti	1	**0.01**
1807	Bhattacharya G N	1	**0.01**
1808	Bhattacharya P K	1	**0.01**
1809	Bhattacharya S B	1	**0.01**
1810	Bhattacharya S C	1	**0.01**
1811	Bhattacharya Soma	1	**0.01**
1812	Bhattacharya Sulava	1	**0.01**

Sl No	Author	No of Authorship	%
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1814	Bhattacharyya D N	1	**0.01**
1815	Bhattacharyya G N	1	**0.01**
1816	Bhattacharyya Kanan	1	**0.01**
1817	Bhattacharyya N	1	**0.01**
1818	Bhattacharyya R G	1	**0.01**
1819	Bhattacharyya Ramendranarayan	1	**0.01**
1820	Bhattacharyya Subir Nath	1	**0.01**
1821	Bhattacharyya Subrata	1	**0.01**
1822	Bhattacharyya U	1	**0.01**
1823	Bhattachatya S	1	**0.01**
1824	Bhattachatyya S P	1	**0.01**
1825	Bhattachrjee A	1	**0.01**
1826	Bhattarcharjee A	1	**0.01**
1827	Bhattarchrya S	1	**0.01**
1828	Bhattarjee B	1	**0.01**
1829	Bhattcharjee J K	1	**0.01**
1830	Bhattcharyya S N	1	**0.01**
1831	Bhattecharjee D	1	**0.01**
1832	Bhatterjee A	1	**0.01**
1833	Bhaumik D	1	**0.01**
1834	Bhide R S	1	**0.01**
1835	Bhoraskar S V	1	**0.01**
1836	Bhoumick S	1	**0.01**
1837	Bhowmick K	1	**0.01**
1838	Bhowmik S R	1	**0.01**
1839	Bhyattacharya S N	1	**0.01**
1840	Bialas H	1	**0.01**
1841	Bimanand A	1	**0.01**
1842	Birney D	1	**0.01**
1843	Bishnu P K	1	**0.01**
1844	Biswas S G	1	**0.01**
1845	Biswas D	1	**0.01**
1846	Biswas D K	1	**0.01**
1847	Blake A J	1	**0.01**
1848	Bloom	1	**0.01**
1849	Blout	1	**0.01**
1850	Bnadyopadhyay P K	1	**0.01**
1851	Bochme P H	1	**0.01**
1852	Bock W	1	**0.01**
1853	Bordeau M F	1	**0.01**
1854	Borowski K	1	**0.01**
1855	Bose A K	1	**0.01**
1856	Bose A N	1	**0.01**
1857	Bose M K	1	**0.01**
1858	Bose T K	1	**0.01**
1859	Boulli Galrelle	1	**0.01**
1860	Bowron DT	1	**0.01**
1861	Brama P K	1	**0.01**
1862	Braslavsky S E	1	**0.01**
1863	Bravo J L	1	**0.01**
1864	Bregant F	1	**0.01**
1865	Brennessel W W	1	**0.01**
1866	Bridson J N	1	**0.01**
1867	Brion C E	1	**0.01**

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1869	Brooks M S S	1	**0.01**
1870	Brown N M D	1	**0.01**
1871	Brown S D	1	**0.01**
1872	Buckin V	1	**0.01**
1873	Busseman R	1	**0.01**
1874	Cahaudhuri B K	1	**0.01**
1875	Cahudhuri P	1	**0.01**
1876	Canerjea D	1	**0.01**
1877	Caneschi A	1	**0.01**
1878	Canoboquera J	1	**0.01**
1879	Capdevielle J N	1	**0.01**
1880	Casati G	1	**0.01**
1881	Caselloto U	1	**0.01**
1882	Castanet A-S	1	**0.01**
1883	Castevens M	1	**0.01**
1884	Caudhuri A K	1	**0.01**
1885	Centore R	1	**0.01**
1886	Chackraburttty D M	1	**0.01**
1887	Chahine R	1	**0.01**
1888	Chakaborty M	1	**0.01**
1889	Chakarvorty Lily	1	**0.01**
1890	Chaki S	1	**0.01**
1891	Chakrabarti	1	**0.01**
1892	Chakrabarty B	1	**0.01**
1893	Chakrabarty B K	1	**0.01**
1894	Chakraborthy A N	1	**0.01**
1895	Chakraborti B	1	**0.01**
1896	Chakraborti B R	1	**0.01**
1897	Chakraborti G	1	**0.01**
1898	Chakraborti M	1	**0.01**
1899	Chakrabory R	1	**0.01**
1900	Chakraburtty A K	1	**0.01**
1901	Chakrabvorti S	1	**0.01**
1902	Chakravarti D	1	**0.01**
1903	Chakravarti J	1	**0.01**
1904	Chakravarti R	1	**0.01**
1905	Chakravarti S	1	**0.01**
1906	Chakravarty S	1	**0.01**
1907	Chakravorty A N	1	**0.01**
1908	Chakravorty J	1	**0.01**
1909	Chakravorty K	1	**0.01**
1910	Chakravorty P	1	**0.01**
1911	Chakrobarti I	1	**0.01**
1912	Chakrvorty D	1	**0.01**
1913	Chanda S C	1	**0.01**
1914	Chang J	1	**0.01**
1915	Chang-Chien G P	1	**0.01**
1916	Charandas P	1	**0.01**
1917	Charkravorty M	1	**0.01**
1918	Chattaapadhyay S	1	**0.01**
1919	Chattapadhyay A K	1	**0.01**
1920	Chatterjee T K	1	**0.01**
1921	Chattopadhyay B	1	**0.01**
1922	Chattopadhyay J	1	**0.01**
1923	Chattopadhyay K	1	**0.01**
1924	Chattopadhyaya S	1	**0.01**

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Sl No	Author	No of Authorship	%
1925	Chattopadyay K K	1	**0.01**
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1927	Chaudhuri M	1	**0.01**
1928	Chaudhuri N	1	**0.01**
1929	Chaudhuri S N	1	**0.01**
1930	Chaudhuri S S	1	**0.01**
1931	Chaudhury A	1	**0.01**
1932	Chaudhury A K	1	**0.01**
1933	Chaudhury K B	1	**0.01**
1934	Chaudhury P P	1	**0.01**
1935	Chaudhyry B K	1	**0.01**
1936	Chel G	1	**0.01**
1937	Chen H K	1	**0.01**
1938	Cheng F	1	**0.01**
1939	Chiang M Y	1	**0.01**
1940	Chis M	1	**0.01**
1941	Chkaravorti S	1	**0.01**
1942	Choi K Y	1	**0.01**
1943	Choi K-Y	1	**0.01**
1944	Chopra K L	1	**0.01**
1945	Choudhuri A K	1	**0.01**
1946	Choudhuri B K	1	**0.01**
1947	Choudhuri K	1	**0.01**
1948	Choudhuri L N	1	**0.01**
1949	Choudhury Biva	1	**0.01**
1950	Choudhury J	1	**0.01**
1951	Choudhury M B	1	**0.01**
1952	Choudhury P	1	**0.01**
1953	Choudhury Pijush Kanti	1	**0.01**
1954	Choudhury R	1	**0.01**
1955	Chowdhry M	1	**0.01**
1956	Chowdhury D	1	**0.01**
1957	Chowdhury I	1	**0.01**
1958	Chowdhury K R	1	**0.01**
1959	Chowdhury N	1	**0.01**
1960	Chowdhury P Roy	1	**0.01**
1961	Chowdhury R	1	**0.01**
1962	Chowdhury Roy C	1	**0.01**
1963	Chowdhury S M M R	1	**0.01**
1964	Chowdhuy K	1	**0.01**
1965	Chutterjee B K	1	**0.01**
1966	Cilento G	1	**0.01**
1967	Cinquantini A	1	**0.01**
1968	Cintas P	1	**0.01**
1969	Clark K B	1	**0.01**
1970	Claue D	1	**0.01**
1971	Clercq E De	1	**0.01**
1972	Cleveland Forrest F	1	**0.01**
1973	Cocke C L	1	**0.01**
1974	Consta S	1	**0.01**
1975	Conti P S	1	**0.01**
1976	Corbella M	1	**0.01**
1977	Cornelis P	1	**0.01**
1978	Corsetti A	1	**0.01**
1979	Cotton A	1	**0.01**
1980	Coughlin D J	1	**0.01**

Sl No	Author	No of Authorship	%
1981	Crame C J	1	**0.01**
1982	Crees M A	1	**0.01**
1983	Cross L E	1	**0.01**
1984	Cuinik Z	1	**0.01**
1985	Cziraki A	1	**0.01**
1986	D e D K	1	**0.01**
1987	Damon-lacoste J	1	**0.01**
1988	Dar A A	1	**0.01**
1989	Darius M	1	**0.01**
1990	Das A K	1	**0.01**
1991	Das Arati	1	**0.01**
1992	Das Birendranath	1	**0.01**
1993	Das D K	1	**0.01**
1994	Das Ghosh A C	1	**0.01**
1995	Das Gupta K	1	**0.01**
1996	Das Gupta R	1	**0.01**
1997	Das Gupta S	1	**0.01**
1998	Das K C	1	**0.01**
1999	Das M L	1	**0.01**
2000	Das M S	1	**0.01**
2001	Das N C	1	**0.01**
2002	Das N N	1	**0.01**
2003	Das Nita	1	**0.01**
2004	Das Sarma S	1	**0.01**
2005	Das Swati	1	**0.01**
2006	Das-gupta P K	1	**0.01**
2007	Dasgupta Sulav	1	**0.01**
2008	Das-Sharma M	1	**0.01**
2009	Datta Anindya	1	**0.01**
2010	Datta D P	1	**0.01**
2011	Datta Dipankar	1	**0.01**
2012	Datta M N	1	**0.01**
2013	Datta Roy R	1	**0.01**
2014	Datta Sunil K	1	**0.01**
2015	Datta vD	1	**0.01**
2016	Dattagupta N	1	**0.01**
2017	Davies D L	1	**0.01**
2018	De Asish	1	**0.01**
2019	De B	1	**0.01**
2020	De B C	1	**0.01**
2021	De Clercq E	1	**0.01**
2022	De H S C	1	**0.01**
2023	De R L	1	**0.01**
2024	De Ranjit	1	**0.01**
2025	De Rina	1	**0.01**
2026	De T K	1	**0.01**
2027	Deb A	1	**0.01**
2028	Deb B M	1	**0.01**
2029	Deb Nath M	1	**0.01**
2030	Deb P	1	**0.01**
2031	Debi W G	1	**0.01**
2032	Debnath A	1	**0.01**
2033	Debnath A K	1	**0.01**
2034	Debnath C	1	**0.01**
2035	Dechsser H	1	**0.01**
2036	Desplanches C	1	**0.01**
2037	Dev Pramil Chandra	1	**0.01**

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Sl No	Author	No of Authorship	%
2038	Dey G C	1	**0.01**
2039	Dhar G C	1	**0.01**
2040	Dhar S N	1	**0.01**
2041	Dileesh S	1	**0.01**
2042	Dinda B	1	**0.01**
2043	Direcksen Geerd H F	1	**0.01**
2044	Domelsmith L N	1	**0.01**
2045	Drees M	1	**0.01**
2046	Drew M G B	1	**0.01**
2047	Duin E	1	**0.01**
2048	Dunmur D A	1	**0.01**
2049	Dunn L C	1	**0.01**
2050	Dunseath K	1	**0.01**
2051	Durocher D	1	**0.01**
2052	Dutt Ahmed A	1	**0.01**
2053	Dutt P	1	**0.01**
2054	Dutta P K	1	**0.01**
2055	Dutta Ajit Kumar	1	**0.01**
2056	Dutta D P	1	**0.01**
2057	Dutta M B	1	**0.01**
2058	Dutta P R	1	**0.01**
2059	Dutta R N	1	**0.01**
2060	Dutta Roy B	1	**0.01**
2061	Dutta S N	1	**0.01**
2062	Dutta Sankar	1	**0.01**
2063	E.Haque	1	**0.01**
2064	Elekte R E	1	**0.01**
2065	Eppinger E	1	**0.01**
2066	Equer B	1	**0.01**
2067	Ewiing D F	1	**0.01**
2068	Ewing D	1	**0.01**
2069	Fadoujou S	1	**0.01**
2070	Falcon E	1	**0.01**
2071	Falvello A R	1	**0.01**
2072	Fardi H Z	1	**0.01**
2073	Felner I	1	**0.01**
2074	Figge H M	1	**0.01**
2075	Fish K	1	**0.01**
2076	Fleming S	1	**0.01**
2077	Foldeaki M	1	**0.01**
2078	Formar L	1	**0.01**
2079	Frampton C S	1	**0.01**
2080	Frazier J.O	1	**0.01**
2081	Frefer A	1	**0.01**
2082	Fricke B	1	**0.01**
2083	Fritzsche S	1	**0.01**
2084	Fronczek F R	1	**0.01**
2085	Front-Bardia M	1	**0.01**
2086	Frost L	1	**0.01**
2087	Froumin N	1	**0.01**
2088	Fujimura Y	1	**0.01**
2089	Funahashi S	1	**0.01**
2090	Furuya K	1	**0.01**
2091	Gabris A	1	**0.01**
2092	Gangapadhyay U	1	**0.01**
2093	Gangopadhyay D	1	**0.01**
2094	Ganguli Goutam	1	**0.01**
2095	Ganguly B K	1	**0.01**
2096	Ganguly N K	1	**0.01**
2097	Gangyly B K	1	**0.01**
2098	Gani D	1	**0.01**
2099	Gantain M	1	**0.01**
2100	Ganzke D	1	**0.01**
2101	Gapdevielle J N	1	**0.01**
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2103	Gardner A	1	**0.01**
2104	Garratt S	1	**0.01**
2105	Gartner C A	1	**0.01**
2106	Gauthier S	1	**0.01**
2107	Gayen A K	1	**0.01**
2108	Gebe E J	1	**0.01**
2109	Geib S	1	**0.01**
2110	George M V	1	**0.01**
2111	Gerocs I	1	**0.01**
2112	Ghorai S K	1	**0.01**
2113	Ghosal N	1	**0.01**
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2117	Ghosh K	1	**0.01**
2118	Ghosh K B	1	**0.01**
2119	Ghosh Mita	1	**0.01**
2120	Ghosh N R	1	**0.01**
2121	Ghosh P N	1	**0.01**
2122	Ghosh Premamoy	1	**0.01**
2123	Ghosh S B	1	**0.01**
2124	Ghosh Saktiprosad	1	**0.01**
2125	Ghosh Sanjib	1	**0.01**
2126	Ghosh Sukumar	1	**0.01**
2127	Ghosh Susmita (Hazra)	1	**0.01**
2128	Giannasio V R	1	**0.01**
2129	Giannotti R	1	**0.01**
2130	Giri S	1	**0.01**
2131	Giri D	1	**0.01**
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2133	Glandemans J	1	**0.01**
2134	Glaudemans C P J	1	**0.01**
2135	Gnaser H	1	**0.01**
2136	Goh M C	1	**0.01**
2137	Golub V O	1	**0.01**
2138	Gomez-de-Anderez D	1	**0.01**
2139	Gongopadhyay S	1	**0.01**
2140	Goodby J W	1	**0.01**
2141	Goodman J W	1	**0.01**
2142	Gopal B R	1	**0.01**
2143	Gopalakrishnan R	1	**0.01**
2144	Gorczyca T W	1	**0.01**
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2148	Goswami Sreebrata	1	**0.01**
2149	Goudie A C	1	**0.01**
2150	Grabvel D	1	**0.01**
2151	Grace M	1	**0.01**

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2152	Graham K L	1	**0.01**
2153	Gravel L	1	**0.01**
2154	Grayson M	1	**0.01**
2155	Graziani R	1	**0.01**
2156	Grilli M L	1	**0.01**
2157	Grisogono A M	1	**0.01**
2158	Gross Z	1	**0.01**
2159	Guarneri I	1	**0.01**
2160	Gudovskikh A S	1	**0.01**
2161	Guha Madhuri	1	**0.01**
2162	Guha A	1	**0.01**
2163	Guha Biswas Usha Rani	1	**0.01**
2164	Guha Neogi S C	1	**0.01**
2165	Guha Sankarananda	1	**0.01**
2166	Guha Thakurta Debjani	1	**0.01**
2167	Guha Tilak	1	**0.01**
2168	Guhakhakurta B	1	**0.01**
2169	Guhu R	1	**0.01**
2170	Gula Evelyn	1	**0.01**
2171	Gummi Kautsch	1	**0.01**
2172	Gun S R	1	**0.01**
2173	Gundu Roa T R	1	**0.01**
2174	Gupta A K	1	**0.01**
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2176	Gupta G P	1	**0.01**
2177	Gupta S	1	**0.01**
2178	Gupta S B	1	**0.01**
2179	Gupta S Dutta	1	**0.01**
2180	Gupta Sen S P	1	**0.01**
2181	Gupta Y N	1	**0.01**
2182	Guru T N	1	**0.01**
2183	Gutlich P	1	**0.01**
2184	Hadar D	1	**0.01**
2185	Hagde R P	1	**0.01**
2186	Hajra A K	1	**0.01**
2187	Haldar A	1	**0.01**
2188	Haldar S H	1	**0.01**
2189	Haldar T K	1	**0.01**
2190	Halder J	1	**0.01**
2191	Hall C E	1	**0.01**
2192	Hall E A H	1	**0.01**
2193	Halstenberg S	1	**0.01**
2194	Hammarstrom L	1	**0.01**
2195	Han O H	1	**0.01**
2196	Han S	1	**0.01**
2197	Handy E S	1	**0.01**
2198	Hanzawa H	1	**0.01**
2199	Hao H	1	**0.01**
2200	Hasegawa J	1	**0.01**
2201	Hazra D	1	**0.01**
2202	Hazra Susmita	1	**0.01**
2203	Hegde R P	1	**0.01**
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2205	Heinz T F	1	**0.01**
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2208	Helliwell J R	1	**0.01**
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2212	Higgs L A	1	**0.01**
2213	Hiller S	1	**0.01**
2214	Hirao K	1	**0.01**
2215	Hohmann Judit	1	**0.01**
2216	Hoque M E	1	**0.01**
2217	Horsdal-Pederse E	1	**0.01**
2218	Howard J A K	1	**0.01**
2219	Hsin S H	1	**0.01**
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2221	Hulliger F	1	**0.01**
2222	Hulme A	1	**0.01**
2223	Hundt A	1	**0.01**
2224	Huntington H B	1	**0.01**
2225	Hunyadi I	1	**0.01**
2226	Hursthouse M B	1	**0.01**
2227	Hussain M	1	**0.01**
2228	Hussain S	1	**0.01**
2229	Hynes R	1	**0.01**
2230	Ikeda R	1	**0.01**
2231	Ikeda Y	1	**0.01**
2232	Ikedia R	1	**0.01**
2233	Imae T	1	**0.01**
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2235	Inagaki I	1	**0.01**
2236	Inagaki S	1	**0.01**
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2238	Inganas O	1	**0.01**
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2243	Jadav S K	1	**0.01**
2244	Jain J K	1	**0.01**
2245	Jain Kapur Mal	1	**0.01**
2246	Jain S	1	**0.01**
2247	Jaisankar P	1	**0.01**
2248	Jakli A	1	**0.01**
2249	Jana A	1	**0.01**
2250	Jana A D	1	**0.01**
2251	Jana Kumar P	1	**0.01**
2252	Jankum Jerzy	1	**0.01**
2253	Janssen E	1	**0.01**
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2255	Jaykumar J	1	**0.01**
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2263	Johnson M	1	**0.01**
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2265	Join J K	1	**0.01**
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2268	Joshi B S	1	**0.01**
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2270	Juan-Clements J M	1	**0.01**
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2273	Kabiraj A	1	**0.01**
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2277	Kajiwar Setsuo	1	**0.01**
2278	Kalita C	1	**0.01**
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2280	Kalman Alajes	1	**0.01**
2281	Kanjilal A	1	**0.01**
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2283	Kapoor M P	1	**0.01**
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2287	Karan Susmita	1	**0.01**
2288	Karpha R K	1	**0.01**
2289	Kartha G	1	**0.01**
2290	Kasturi S R	1	**0.01**
2291	Kaufman G B	1	**0.01**
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2295	Kees G	1	**0.01**
2296	Kelm S	1	**0.01**
2297	Kemnitz K	1	**0.01**
2298	Keng T-C	1	**0.01**
2299	Khaled J	1	**0.01**
2300	Khalil Md.	1	**0.01**
2301	Khan B A	1	**0.01**
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2304	Kharchenko A V	1	**0.01**
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2312	Kim J	1	**0.01**
2313	Kinoshita M	1	**0.01**
2314	Kinoshita Minoru	1	**0.01**
2315	Kirkman E	1	**0.01**
2316	Kishan H	1	**0.01**
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2319	Klieder J P	1	**0.01**
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2324	Kochanowski H	1	**0.01**
2325	Kochel A	1	**0.01**
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2327	Kolar C	1	**0.01**
2328	Kometani N	1	**0.01**
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2330	Kopeoler	1	**0.01**
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2333	Kotlyar R	1	**0.01**
2334	Kovaces J	1	**0.01**
2335	Koyama T	1	**0.01**
2336	Krishnakoli	1	**0.01**
2337	Kshirsagar S T	1	**0.01**
2338	Kshirsagar A	1	**0.01**
2339	Kshirsagar S K	1	**0.01**
2340	Kudryashov E	1	**0.01**
2341	Kuila B	1	**0.01**
2342	Kukherjee M	1	**0.01**
2343	Kulkarni A K	1	**0.01**
2344	Kumar A	1	**0.01**
2345	Kumar Ashok	1	**0.01**
2346	Kumar K	1	**0.01**
2347	Kumari K	1	**0.01**
2348	Kundu K	1	**0.01**
2349	Kundu K K	1	**0.01**
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2351	Kunes J	1	**0.01**
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2353	Kuwabara H	1	**0.01**
2354	Kuzmin M D	1	**0.01**
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2372	Legendziewicz J	1	**0.01**
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2374	Levision B S	1	**0.01**
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2376	Liao F-L	1	**0.01**
2377	Lieber M	1	**0.01**
2378	Light M E	1	**0.01**

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2383	Luo Bao-Sheng	1	**0.01**
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2385	Madak D K	1	**0.01**
2386	Madhusudan S	1	**0.01**
2387	Mahammad A	1	**0.01**
2388	Maiiti N	1	**0.01**
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2391	Maiti Amalendu	1	**0.01**
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2419	Mandal Hannan SK	1	**0.01**
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2423	Mandal Sunil K	1	**0.01**
2424	Mandal U	1	**0.01**
2425	Mandal U K	1	**0.01**
2426	Maniekam N	1	**0.01**
2427	Manju U	1	**0.01**
2428	Maruta G	1	**0.01**
2429	Matsuo T	1	**0.01**
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2446	Meer R K Vander	1	**0.01**
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2460	Miguel De	1	**0.01**
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2487	Mohan Roy R J R	1	**0.01**
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2490	Moitra S	1	**0.01**
2491	Momoj N	1	**0.01**

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2492	Mondal B	1	**0.01**
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2494	Mondal N B	1	**0.01**
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2513	Mukherjee Amal K.	1	**0.01**
2514	Mukherjee Ashoka	1	**0.01**
2515	Mukherjee Asish R	1	**0.01**
2516	Mukherjee B B	1	**0.01**
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2519	Mukherjee Kanamoni	1	**0.01**
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2522	Mukherjee Prasanta K	1	**0.01**
2523	Mukherjee R	1	**0.01**
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2525	Mukherjee S P	1	**0.01**
2526	Mukherjee Sanghamitra	1	**0.01**
2527	Mukherjee Sushil Kumar	1	**0.01**
2528	Mukherjee T Pal	1	**0.01**
2529	Mukhin S I	1	**0.01**
2530	Mukhkerjee S	1	**0.01**
2531	Mukhopadhyay Anuradha	1	**0.01**
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2533	Mukhopadhyay Sudip	1	**0.01**
2534	Mukhopadhyay Sumita	1	**0.01**
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2580	Okamot Ken-ichi	1	**0.01**
2581	Olah G A	1	**0.01**
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2595	Palacios J C	1	**0.01**
2596	Palanichamy P	1	**0.01**
2597	Pall P	1	**0.01**
2598	Palnavelu P	1	**0.01**
2599	Pan F	1	**0.01**
2600	Pan Mandal S	1	**0.01**
2601	Panda G C	1	**0.01**
2602	Panda R N	1	**0.01**

Sl No	Author	No of Authorship	%
2603	Panda S	1	**0.01**
2604	Pandey P	1	**0.01**
2605	Panja U	1	**0.01**
2606	Pant A K	1	**0.01**
2607	Panwar O S	1	**0.01**
2608	Parkanyi Laszlo	1	**0.01**
2609	Parui D	1	**0.01**
2610	Parya C	1	**0.01**
2611	Patel	1	**0.01**
2612	Patra S K	1	**0.01**
2613	Patra H K	1	**0.01**
2614	Patra S	1	**0.01**
2615	Patwari G	1	**0.01**
2616	Patwari G N	1	**0.01**
2617	Paul A R	1	**0.01**
2618	Paul I	1	**0.01**
2619	Paul R L	1	**0.01**
2620	Pearson J C	1	**0.01**
2621	Peters J C	1	**0.01**
2622	Peterson M R	1	**0.01**
2623	Petterson D	1	**0.01**
2624	Physik Annalen der	1	**0.01**
2625	Piaggi A	1	**0.01**
2626	Pinto G R	1	**0.01**
2627	Piyasena H	1	**0.01**
2628	Plant A K	1	**0.01**
2629	Poddar S K	1	**0.01**
2630	Podder A	1	**0.01**
2631	Pogany L	1	**0.01**
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2634	Porting S	1	**0.01**
2635	Pradha S K	1	**0.01**
2636	Pramanick S	1	**0.01**
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2641	Prout K	1	**0.01**
2642	Puchalska M	1	**0.01**
2643	Purakayastha G	1	**0.01**
2644	Purohit Sanchita	1	**0.01**
2645	Quapp W	1	**0.01**
2646	Rabitz H	1	**0.01**
2647	Rabold A	1	**0.01**
2648	Ragendran V	1	**0.01**
2649	Raghavendra B S	1	**0.01**
2650	Raghuram P V R	1	**0.01**
2651	Raha A K	1	**0.01**
2652	Rahman H	1	**0.01**
2653	Rai R S	1	**0.01**
2654	Raittila J	1	**0.01**
2655	Raj B	1	**0.01**
2656	Rajadurai S	1	**0.01**
2657	Rajagopalan K V	1	**0.01**
2658	Rajakannan V	1	**0.01**
2659	Rajappa S	1	**0.01**

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2660	Rajopadhye N R	1	**0.01**
2661	Raju M S	1	**0.01**
2662	Rakshit A K	1	**0.01**
2663	Rakshit S C	1	**0.01**
2664	Ram M L	1	**0.01**
2665	Ramachandraiah G	1	**0.01**
2666	Ramaiah D	1	**0.01**
2667	Ramamurthy V	1	**0.01**
2668	Ramanathan V	1	**0.01**
2669	Ramasamy P	1	**0.01**
2670	Ramaswamy R	1	**0.01**
2671	Ramaswamy S	1	**0.01**
2672	Ramchandra K V	1	**0.01**
2673	Ramchandran	1	**0.01**
2674	Ramm M	1	**0.01**
2675	Rammurthy V	1	**0.01**
2676	Randaccio L	1	**0.01**
2677	Ranjan P A	1	**0.01**
2678	Rao H Shripati	1	**0.01**
2679	Rao K R P M	1	**0.01**
2680	Rao M V	1	**0.01**
2681	Rashid H Md	1	**0.01**
2682	Rastogi R P	1	**0.01**
2683	Rastogi V K	1	**0.01**
2684	Rath A K	1	**0.01**
2685	Rath Jatindra Kumar	1	**0.01**
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2687	Rather G M	1	**0.01**
2688	Rathore R S	1	**0.01**
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2690	Ray Anil B	1	**0.01**
2691	Ray Chaudhury M	1	**0.01**
2692	Ray Manoj	1	**0.01**
2693	Ray S R	1	**0.01**
2694	Ray Tanusree	1	**0.01**
2695	Raychoudhuri Manasi	1	**0.01**
2696	Raychoudhury N	1	**0.01**
2697	Reddy M K	1	**0.01**
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2700	Reeves T	1	**0.01**
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2704	Ribeyron P S	1	**0.01**
2705	Rigby H L	1	**0.01**
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2707	Rillo C	1	**0.01**
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2710	Riy Choudhury A	1	**0.01**
2711	Roa B K	1	**0.01**
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2714	Rochanowski H	1	**0.01**
2715	Rodrigues N	1	**0.01**
2716	Rodriguez L O	1	**0.01**

Sl No	Author	No of Authorship	%
2717	Rodriguez O	1	**0.01**
2718	Rossi L	1	**0.01**
2719	Roy Ajoy	1	**0.01**
2720	Roy Arati	1	**0.01**
2721	Roy Asit Kumar	1	**0.01**
2722	Roy C	1	**0.01**
2723	Roy Chaudhuri M	1	**0.01**
2724	Roy Chawdhury H	1	**0.01**
2725	ROy Choudhury Dilip Kumar	1	**0.01**
2726	Roy Choudhury K	1	**0.01**
2727	Roy Choudhury N	1	**0.01**
2728	Roy Chowdhury R	1	**0.01**
2729	Roy Chowdhury V M	1	**0.01**
2730	Roy D S	1	**0.01**
2731	Roy G	1	**0.01**
2732	Roy G P	1	**0.01**
2733	Roy Gupta Subhas C	1	**0.01**
2734	Roy K B	1	**0.01**
2735	Roy M M	1	**0.01**
2736	Roy P	1	**0.01**
2737	Roy P N	1	**0.01**
2738	Roy S M	1	**0.01**
2739	Roy Siddhartha	1	**0.01**
2740	Roy Subhas	1	**0.01**
2741	Roy Sukla	1	**0.01**
2742	Roy U	1	**0.01**
2743	Roychoudhury A K	1	**0.01**
2744	Roychowdhury N	1	**0.01**
2745	Roychowdhury P K	1	**0.01**
2746	Roym D S	1	**0.01**
2747	Rruseckas A	1	**0.01**
2748	Ruani G	1	**0.01**
2749	Rubner M F	1	**0.01**
2750	Rudra K	1	**0.01**
2751	S Bhar	1	**0.01**
2752	Saadane O	1	**0.01**
2753	Sachnivala N D	1	**0.01**
2754	Sadhu S	1	**0.01**
2755	Safayet Karim, Chowdhury	1	**0.01**
2756	Sagear P	1	**0.01**
2757	Saha A M	1	**0.01**
2758	Saha B S	1	**0.01**
2759	Saha Bijali	1	**0.01**
2760	Saha Chanpa Dolan	1	**0.01**
2761	Saha Chowdhury P	1	**0.01**
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2775	Samanta G C	1	**0.01**
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2782	Sarkar Arindam	1	**0.01**
2783	Sarkar Ashoke	1	**0.01**
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2811	Sen Gupta Malabika	1	**0.01**
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2816	Sen Jyotindranath	1	**0.01**
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2831	Sgamelloti A	1	**0.01**
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2872	Sinha Parsathi	1	**0.01**
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2876	Smith A E	1	**0.01**
2877	Sneh L	1	**0.01**
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2879	Sokolowski R S	1	**0.01**
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2883	Srinivasan K	1	**0.01**
2884	Srivastava A K	1	**0.01**
2885	Srivastava B	1	**0.01**

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2886	Srivastava S K	1	**0.01**
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2888	Stannarius R	1	**0.01**
2889	Statitsky E	1	**0.01**
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2893	Subbarao E C	1	**0.01**
2894	Subramaniam U	1	**0.01**
2895	Sugawara M	1	**0.01**
2896	Sun H-L	1	**0.01**
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2907	Sutter J P	1	**0.01**
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2919	Thierry A	1	**0.01**
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2930	Tuhina K	1	**0.01**
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2936	Uszpolewicz M	1	**0.01**
2937	Varadachari C	1	**0.01**
2938	Vardeny Z V	1	**0.01**
2939	Varma	1	**0.01**
2940	Venugopal D	1	**0.01**
2941	Verma A S	1	**0.01**
2942	Verma N K	1	**0.01**

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Sl No	Author	No of Authorship	%
2943	Vertes A	1	**0.01**
2944	Veschetti Y	1	**0.01**
2945	Vetterl O	1	**0.01**
2946	Victor G Y V	1	**0.01**
2947	Vidyarthi N	1	**0.01**
2948	Vigato P A	1	**0.01**
2949	Viswanatha R	1	**0.01**
2950	Voelz Fred L	1	**0.01**
2951	Wadgaonkar P P	1	**0.01**
2952	Wang D	1	**0.01**
2953	Wang J-C	1	**0.01**
2954	Wang X Q	1	**0.01**
2955	Wang X Y	1	**0.01**
2956	Wang Y	1	**0.01**
2957	Ward M D	1	**0.01**
2958	Watanabe Tsutomu	1	**0.01**
2959	Wategaonker S	1	**0.01**
2960	Watts C R	1	**0.01**
2961	Way R W	1	**0.01**
2962	Waz D B	1	**0.01**
2963	Weier G K	1	**0.01**
2964	Weigold E	1	**0.01**
2965	Wenkery E	1	**0.01**
2966	Wierzbicki A	1	**0.01**
2967	Williams Sain L	1	**0.01**
2968	Williamson D	1	**0.01**
2969	Wong W	1	**0.01**
2970	Woodcraft A L	1	**0.01**
2971	Woodward	1	**0.01**
2972	Woolfson W	1	**0.01**
2973	Worrall David R	1	**0.01**
2974	Wu A M	1	**0.01**
2975	Wu Bomu	1	**0.01**
2976	Wu Bo-Mu	1	**0.01**
2977	Wu C T	1	**0.01**
2978	Wu J H	1	**0.01**
2979	Wu Y-D	1	**0.01**
2980	Yadav S	1	**0.01**
2981	Yamasaki T	1	**0.01**
2982	Yan Mahmood W A K	1	**0.01**
2983	Yang Z H	1	**0.01**
2984	Yazawa T	1	**0.01**
2985	Yeap-G-Y	1	**0.01**
2986	Yokoyama E	1	**0.01**
2987	Yoon M	1	**0.01**
2988	Youngs W J	1	**0.01**
2989	Zaitsevskii Andrie	1	**0.01**
2990	Zanello P	1	**0.01**
2991	Zelent B	1	**0.01**
2992	Zhang Y-Z	1	**0.01**
2993	Zhou G Y	1	**0.01**
2994	Zimmer M	1	**0.01**
2995	Zinner K	1	**0.01**
Total		22408	

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
1	Ind. J.Phys.	819	1	10.20
2	Phys.RevB	303	2	3.78
3	Indian J.Chem.	280	3	3.49
4	Chem.Phys.Lett.	214	4	2.67
5	Inorg. Chem	164	5	2.04
6	J.Chem.Phys.	159	6	1.98
7	J.Appl.Phys.	139	7	1.73
8	Acta. Cryst.	137	8	1.71
9	Tetrahedron Lett.	136	9	1.69
10	J.Chem.Soc.Dalton Trans.	127	10	1.58
11	J.Phys.B.:At.Mol.Opt.Phys.	105	11	1.31
12	J.Phys.Chem.	99	12	1.23
13	J.Phys.D:Appl.Phys.	99	12	1.23
14	J.Phys.C:Sloid State Physics	99	12	1.23
15	Phys.Rev.C.	99	12	1.23
16	Sci & Cult.	99	12	1.23
17	Proc.Indian Acad.Sci.	99	12	1.23
18	J.Org.Chem.	90	13	1.12
19	Phys.Stat.Sol.	90	13	1.12
20	Spectrochim Acta	80	14	1.00
21	Physics Letts.	80	14	1.00
22	Polyhedron	80	14	1.00
23	Carbohydr.Res.	80	14	1.00
24	Solid State Commun.	80	14	1.00
25	J.Indian Chem.Soc.	78	15	0.97
26	J.Polymer.Sci.	78	15	0.97
27	Thin Solid Films	77	16	0.96
28	Tetrahedron	77	16	0.96
29	J.I.N.C.	73	17	0.91
30	Chem.Commumn	70	18	0.87
31	Phys.Rev.A.	68	19	0.85
32	Synth.Commun.	66	20	0.82
33	Int.J.Quantum Chem.	66	21	0.82

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
34	J.Am.Chem.Soc.	65	22	0.81
35	Polymer J	65	22	0.81
36	Biochem.Arch.	65	22	0.81
37	Bull.Chem.Soc.Jpn.	62	23	0.77
38	Ind.J.Pure and Appl.Phys.	58	24	0.72
39	Mater.Lett.	57	25	0.71
40	J.Non-Cryst. Solids	56	26	0.70
41	Synth.Met.	56	26	0.70
42	Zeit.fur.Krist	56	26	0.70
43	J.Photochem.Photoboil	55	27	0.69
44	J.Inorg.Nucl.Chem.	54	28	0.67
45	Vacuum	54	28	0.67
46	J.Coll.Int.Sci.	54	28	0.67
47	Z.Anorg.Chem.	54	28	0.67
48	Inorg.Chim.Acta	48	29	0.60
49	J.Sci.Ind.Res.	47	30	0.59
50	J.Phys.Soc.Jpn.	46	31	0.57
51	J.Chem.Res.	46	31	0.57
52	Promana	46	31	0.57
53	Jpn.J.Appl.Phys.	45	32	0.56
54	J.Phys.Cond.Matter	45	32	0.56
55	Thermochim.Acta	44	33	0.55
56	Appl.Phys. Lett	43	34	0.54
57	Canad.J.Phys.	43	34	0.54
58	Nuovo Cimento	41	35	0.51
59	Solar En.Mater.And Solar Cells	41	35	0.51
60	J.C.S.Chem.Comm.	37	36	0.46
61	J.Mater.Sci.Letts.	37	36	0.46
62	Trans.Met.Chem.	37	36	0.46
63	J.Mater.Res	37	36	0.46
64	Langmuir	37	36	0.46
65	Physica A	37	36	0.46
66	Fizika	36	37	0.45
67	Ind.J.Cryogenics	35	38	0.44
68	Eur.Phys.J.	34	39	0.42
69	J.Mol.Struct.	34	39	0.42
70	J.Cryst.Growth	34	39	0.42

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
71	J.Magn.Magn.Mater.	33	40	0.41
72	Mod.Phys.Lett.	33	40	0.41
73	Makromol Chem.	33	40	0.41
74	Macromolecules	33	40	0.41
75	J.C.S.Farad II	30	41	0.37
76	Hadronic Journal	30	41	0.37
77	Rubber Chem.Technol	30	41	0.36
78	Bull.Mater.Sci.	30	41	0.37
79	J.Luminescence	29	42	0.36
80	J.Mater.Sci.	22	43	0.27
81	Mol.Cryst.Liq.Cryst.	22	43	0.27
82	Phil.Mag.	22	43	0.27
83	Synlett.	22	43	0.27
84	Theo.Chim.Acta.	22	43	0.27
85	Hadronic Journal Suppl.	21	44	0.26
86	J.Phys.G:Nucl.Phys.	21	44	0.26
87	Kautschuk Gummi Kunst	21	44	0.26
88	Current Science	21	44	0.26
89	Nature	19	45	0.24
90	Euro Phys.Lett.	18	46	0.22
91	Ind.J.Biochem.Bio-phys.	18	46	0.22
92	Jour.Raman Spectroscopy	18	46	0.22
93	New J.Chem.	18	46	0.22
94	Ind.J.Appl.Chem.	16	47	0.20
95	Ind.Jour.Appl.Chem.	16	47	0.20
96	J.Phys.F:Metal Phys.	16	47	0.20
97	Trans.Faraday Sco.	16	47	0.20
98	J.Phys.A.:Math Gen.	15	47	0.19
99	Mater.Sci.Eng.	15	47	0.19
100	Phys.Rev.Lett.	15	47	0.19
101	Can.J.Chem.	14	48	0.17
102	Acta.Chem.Scand.	13	49	0.16
103	Cryst.Growth Des.	13	49	0.16
104	Annals of Physics	12	50	0.15
105	Aust.J.Chem.	12	50	0.15
106	Chem.&Ind.	12	50	0.15
107	Int.J.Mod.Phys.	12	50	0.15

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
108	J.Appl.Cryst.	12	50	0.15
109	J.I.C.S.	12	50	0.15
110	Physical Rev.	12	50	0.15
111	Res.Chem.Interned	12	50	0.15
112	J.Less-common Metals	12	50	0.15
113	J.Math.Phys.	12	50	0.15
114	J.Phys.E:Sci.Instrum.	12	50	0.15
115	Molecular Crystals	12	50	0.15
116	Czech.J.of Phys.	11	51	0.14
117	J.Alloys and Compds.	11	51	0.14
118	J.Nanosci.Nanotech.	11	51	0.14
119	Molecular Phys.	11	51	0.14
120	Nucl.Instr.Meth.B	11	51	0.14
121	J.Acoust.Soc.Ind.	11	51	0.14
122	J.Biol.Chem.	11	51	0.14
123	J.Biosci.	11	51	0.14
124	J.Electroanal.Chem.	11	51	0.14
125	Astrophys.J.	10	52	0.12
126	Chem.Lett.	10	52	0.12
127	Ferroelectrics	10	52	0.12
128	Int.J.Chem.Kinet.	10	52	0.12
129	Lett.Nuovo.Cinemto	10	52	0.12
130	Macromol.Symp.	10	52	0.12
131	Organometallics	10	52	0.12
132	ARKIVOC	9	53	0.11
133	Aust.J.Chem.	9	53	0.11
134	Inorg.Chem.Com.	9	53	0.11
135	J.Indian Inst.Sci.	9	53	0.11
136	J.Polym.Sci.Polym.Chem.	9	53	0.11
137	Metallurg.Trans.	9	53	0.11
138	Optical Materials	9	53	0.11
139	Org.Lett.	9	53	0.11
140	Phys.Lett.A.	9	53	0.11

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
141	Phys.Scr.	9	53	0.11
142	Pure & Appl.Chem.	9	53	0.11
143	Anal.Chem.	8	54	0.10
144	Brit.J.Appl.Phys.	8	54	0.10
145	Coord.Chem.Rev.	8	54	0.10
146	Mater.Res.Bull.	8	54	0.10
147	Mol.Cell.Biochem.	8	54	0.10
148	Phase Transitions	8	54	0.10
149	Science Reporter	8	54	0.10
150	Anal.Chem.Acta.	7	55	0.09
151	Cryst.Eng.Comm.	7	55	0.09
152	Cryst.Res.Technol	7	55	0.09
153	Die.Makromol.Chemic.	7	55	0.09
154	J.Inorg.Biochem	7	55	0.09
155	Liq.Cryst.	7	55	0.09
156	Mat.Res.Bull.	7	55	0.09
157	Physica Scripta	7	55	0.09
158	Acta Physica Polonica	6	56	0.07
159	J.Polymer Sci.,Polymer Letters	6	56	0.07
160	Mol.Materials	6	56	0.07
161	Nanostructured Materials	6	56	0.07
162	Phys.Rev.D.	6	56	0.07
163	Phys.Rev.E.	6	56	0.07
164	Cryogencis	5	57	0.06
165	Diam.and.Re.Mater.	5	57	0.06
166	Green Chemistry	5	57	0.06
167	Hyper.Inter.	5	57	0.06
168	Inorg.Nucl.Chem.Letters	5	57	0.06
169	Inorg.Reacn.Mechanism.	5	57	0.06

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
170	Int.J.Theor.Phys.Group Theor.	5	57	0.06
171	and Nonliner Optics	5	57	0.06
172	J.Chem.Soc	5	57	0.06
173	J.Inland Fisheries Soc.of India	5	57	0.06
174	Low Temp.Phys.	5	57	0.06
175	Phys.Chem.	5	57	0.06
176	Phys.Fluids	5	57	0.06
177	Phytochemistry	5	57	0.06
178	Process Biochemistry	5	57	0.06
179	Z.Fur Physik	5	57	0.06
180	Z.Phys.D	4	58	0.05
181	Acta Physica Hungarica	4	58	0.05
182	Adv.Mol.Relax.and	4	58	0.05
183	Int.Processes	4	58	0.05
184	Astrophysics ansd Space Science	4	58	0.05
185	Biochimie	4	58	0.05
186	Chem Mater	4	58	0.05
187	IJQC	4	58	0.05
188	Ind.Eng.Chem.Res	4	58	0.05
189	Ind.J.Technol.	4	58	0.05
190	J.Chem. & Engg.Data	4	58	0.05
191	J.Coord.Chem.	4	58	0.05
192	J.Indian Ocean Studies	4	58	0.05
193	J.Macromol.Sci.Chem.	4	58	0.05
194	J.Mol.Liquids.	4	58	0.05
195	J.Phys.and Chem.of Solids	4	58	0.05
196	J.Polymer Mater	4	58	0.05
197	J.Quant.Chem.	4	58	0.05
198	Journ.Ind.Chem.Soc.	4	58	0.05

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
199	Journal of Chemical Physics	4	58	0.05
200	Journal of Materials Research	4	58	0.05
201	Nanotechnology	4	58	0.05
202	Nuclear Physics	4	58	0.05
203	Phys.Chem.Glasses	4	58	0.05
204	Prog.Theor.Phys.	4	58	0.05
205	Scripta.Metall.	4	58	0.05
206	Supramolecular Chem.	3	59	0.04
207	Trans.Ind.Ceram.Soc.	3	59	0.04
208	Acta.Mat.	3	59	0.04
209	Adv.Synth.Catal.	3	59	0.04
210	Ann.Agr.Envirn.Med.	3	59	0.04
211	Appl.Catal.	3	59	0.04
212	Biochem.Biophys.Res.Commun.	3	59	0.04
213	Bioorg.Med.Chem.Letts.	3	59	0.04
214	Bull.Laser Spec.Soc.	3	59	0.04
215	Bullitin of the National Institute of Science of India	3	59	0.04
216	Chem.C.Petrochem.J.	3	59	0.04
217	Composites	3	59	0.04
218	Everyman's Science	3	59	0.04
219	FEMS Immunol.Med.Microbiol.	3	59	0.04
220	Ind.J.Environ.Ecoplanning	3	59	0.04
221	Indian Acad.Sci.	3	59	0.04
222	Indian Plastics Review	3	59	0.04
223	Indian Science Cruiser	3	59	0.04
224	Int.J.Heat & Mass.Trans.	3	59	0.04
225	Israel J.Chem.	3	59	0.04
226	J.A.C.S.	3	59	0.04
227	and Liquid Crystals	3	59	0.04

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
228	National Acad. Sci.India	3	59	0.04
229	Phys.Chem.Minerals	3	59	0.04
230	Phys.Repts.	3	59	0.04
231	Phys.Rev. :journal	3	59	0.04
232	Physica B	3	59	0.04
233	Physica C	3	59	0.04
234	Physica E.	3	59	0.04
235	Physics Teacher	3	59	0.04
236	Polymer Letters	3	59	0.04
237	Radiation Effects Express	3	59	0.04
238	Sea Explorers	3	59	0.04
239	Sensors and Actuators	3	59	0.04
240	Speey.Lett.	3	59	0.04
241	Synthesis React, Inorg.Metal-org.Chem.	2	60	0.02
242	Z.Krist.	2	60	0.02
243	Zbl.Bact.Hyg.	2	60	0.02
244	Acustica	2	60	0.02
245	Ap.J.	2	60	0.02
246	Applid Organometallic Chemistry	2	60	0.02
247	Astron & Astrophys.	2	60	0.02
248	Biochemistry	2	60	0.02
249	Biomaterials	2	60	0.02
250	Chem,Phys.Lett.	2	60	0.02
251	Chem.Comm.	2	60	0.02
252	Chem.Eng.Sci	2	60	0.02
253	Chem.Eur.J.	2	60	0.02
254	Chem.Rev.	2	60	0.02
255	Class Quant. Grav	2	60	0.02
256	Clinical Biochemistry	2	60	0.02

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
257	Colloid Surf.B-Biointerfaces	2	60	0.02
258	Comments on Inorg.Chem.	2	60	0.02
259	Comput.Mater.Sci.	2	60	0.02
260	Eur J Med Chem	2	60	0.02
261	Europhys J.C.	2	60	0.02
262	Experientia	2	60	0.02
263	Fusion Technology	2	60	0.02
264	Heterocycles	2	60	0.02
265	I.J.Q.C.	2	60	0.02
266	Ind.J.Diary.Sci.	2	60	0.02
267	Indian Rubber and Plastics Age	2	60	0.02
268	Int.Arch.Allergy Immunol	2	60	0.02
269	Int.J.Mol.Sc	2	60	0.02
270	Int.J.Plast.Tech.	2	60	0.02
271	Inter Cream	2	60	0.02
272	J Plasma & Fussion Res.	1	61	0.01
273	J.Chem.Cryst.	1	61	0.01
274	J.Chem.Edu.	1	61	0.01
275	J.Chem.Thermodynamics	1	61	0.01
276	J.Comp.Chem.	1	61	0.01
277	J.Comput.Bio.	1	61	0.01
278	J.E.S.C.	1	61	0.01
279	J.Electrochem.Soc.	1	61	0.01
280	J.Fluorescence	1	61	0.01
281	J.Ind.Acad.Forensic.	1	61	0.01
282	J.Mat.Sc.Mol.in Electronics	1	61	0.01
283	J.Photochemistry	1	61	0.01
284	J.Phys. & Coll.Chem.	1	61	0.01
285	J.Phys.Org.Chem.	1	61	0.01

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
286	Journal of Materials Science	1	61	0.01
287	Journal of Megnetism and Megnatic Materials	1	61	0.01
288	Journal of Nanoscience & Nanotechnology	1	61	0.01
289	Journal of Non-Crystalline Solids	1	61	0.01
290	Journal of the Inland Fisharies Societies of India	1	61	0.01
291	Kolloid Z.u.Z.Polymere	1	61	0.01
292	Letters Peptide Sci.	1	61	0.01
293	Maters. Chem & Phys	1	61	0.01
294	Medical Hypothesies	1	61	0.01
295	Microporous and Mesoporous Mater.	1	61	0.01
296	Nano.Lett.	1	61	0.01
297	NEWS LETTERS : Physis	1	61	0.01
298	Org.Biomol.Chem.	1	61	0.01
299	Organic Electronics	1	61	0.01
300	Physica D	1	61	0.01
301	Polym. Adv. Technol.	1	61	0.01
302	Polymer International	1	61	0.01
303	Polymer Plastic Technology and Engineering	1	61	0.01
304	Res.J.Microboil	1	61	0.01
305	Resonance	1	61	0.01
306	Rubber India	1	61	0.01
307	Seshaiyanana	1	61	0.01
308	Trans.Inst.Rubber Ind.	1	61	0.01
309	Trends in Carbohydr.Chem	1	61	0.01
310	Ultra Science	1	61	0.01
311	Vij.Par.Anusa.Pat.	1	61	0.01
312	Z.Physik	1	61	0.01
313	Acc.Chem.Res.	1	61	0.01

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
314	Acoustic Letts.	1	61	0.01
315	Adv.Mater.	1	61	0.01
316	Adv.Quantum.Chem.	1	61	0.01
317	Allgn.Chem.	1	61	0.01
318	Anal.Biochem.	1	61	0.01
319	Analytical Sciences	1	61	0.01
320	Anticancer Research	1	61	0.01
321	Appl.Biochem.Biotechnol.	1	61	0.01
322	Appl.Phys.A.	1	61	0.01
323	Atomic Collision Research in Japan	1	61	0.01
324	Behring Research Communication	1	61	0.01
325	Biochem.Biophys. Acta	1	61	0.01
326	Bio-Factors	1	61	0.01
327	Biol.Chem.Hoppe-Seyler	1	61	0.01
328	Biomed Lett.	1	61	0.01
329	Bochum	1	61	0.01
330	British Ceramic Trans	1	61	0.01
331	Bul.Pure and Appl.Sci.	1	61	0.01
332	Bull.Amer.Phys.Soc.	1	61	0.01
333	Bull.Chem.Soc.Jpn.	1	61	0.01
334	Bull.De.Soc.Chimic	1	61	0.01
335	Bull.Electrochem	1	61	0.01
336	Bulletin of Thermodynamics and Thermochemistry	1	61	0.01
337	Cancer Therapy	1	61	0.01
338	Ceram.Int.	1	61	0.01
339	Ceramic Transactions	1	61	0.01
340	Chaos	1	61	0.01
341	Chem Mater	1	61	0.01

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
342	Chem.Asain J.	1	61	0.01
343	Chem.Mater.	1	61	0.01
344	Chem.Phys.Scripta	1	61	0.01
345	Chemical Kinetics and Reaction Mechanism	1	61	0.01
346	Chemical Research in Toxicology	1	61	0.01
347	Chemistry Education	1	61	0.01
348	Chemistry-An Asain Journal	1	61	0.01
349	Chinese Journal of Physics	1	61	0.01
350	Colloid and Ploymer Science	1	61	0.01
351	Colloids and Surface A: Physiochem.Engineering	1	61	0.01
352	Coments At.Mol.Phys.	1	61	0.01
353	Comp.Func.Genomies.	1	61	0.01
354	Current Topics in Medicinal Chemistry	1	61	0.01
355	Cytobios	1	61	0.01
356	Defect and Diffusion Forum	1	61	0.01
357	Dev.Comp.Immunal.	1	61	0.01
358	Die Natureelssenschaften	1	61	0.01
359	DNA Research	1	61	0.01
360	Ecology and Env.	1	61	0.01
361	Environmental Entomology	1	61	0.01
362	Enzymologia	1	61	0.01
363	European Journal of Solid State & Inorg.Chem	1	61	0.01
364	European Polymer Journal	1	61	0.01
365	FEBS Letts.	1	61	0.01
366	FEMS Microbiology Letters	1	61	0.01
367	Fishery Tech.	1	61	0.01
368	Fluid Phase Equilibria	1	61	0.01
369	Food Microboil.	1	61	0.01

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
370	Foundations of Physics	1	61	0.01
371	GEOBIOS	1	61	0.01
372	Glycobiology	1	61	0.01
373	Glyconjugate	1	61	0.01
374	Heavy Ion Physics	1	61	0.01
375	I Phys.	1	61	0.01
376	IJBB	1	61	0.01
377	IJP	1	61	0.01
378	Immunochemistry	1	61	0.01
379	Ind.Chem.Phys.	1	61	0.01
380	Ind.J.Chem.Special Issue	1	61	0.01
381	Ind.J.Chem.Technol.	1	61	0.01
382	Ind.J.Engineers	1	61	0.01
383	Ind.J.Exptl.Biol.	1	61	0.01
384	Ind.J.Gastroenteril	1	61	0.01
385	Ind.J.Luminescence	1	61	0.01
386	Ind.Journal of Technology	1	61	0.01
387	Indian J. Environ	1	61	0.01
388	Indian Journal of Readiation Research	1	61	0.01
389	Indian Photobiology Society News Letter	1	61	0.01
390	Indian Soap Journal	1	61	0.01
391	Indian Surface Finishing	1	61	0.01
392	Indian Vac.Soc.Bulletin	1	61	0.01
393	Inorganic Molecular Photochemistry	1	61	0.01
394	Int.J.Cancer	1	61	0.01
395	Int.J.Vib.Spectroscopy	1	61	0.01
396	Int.Jour.Theore.Phys.	1	61	0.01
397	Int-Silico Biology	1	61	0.01

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
398	IRAPS BULL	1	61	0.01
399	ISRAPS Bulletin	1	61	0.01
400	IUCr News Letter	1	61	0.01
401	Izuvest.Akad.Nauk.U.S.S.R.Ser.Fix	1	61	0.01
402	J Lumin	1	61	0.01
403	J Materials Education	1	61	0.01
404	J Mol. Spectros	1	61	0.01
405	J.Appl.Sci.	1	61	0.01
406	J.Bacteriol	1	61	0.01
407	J.Biol.Inorg.Chem.	1	61	0.01
408	J.Chim.Phys.	1	61	0.01
409	J.Chin.Chem.Soc.	1	61	0.01
410	J.clin.Microbiol	1	61	0.01
411	J.Cosmo.and Astropart.Phys.	1	61	0.01
412	J.Elec.Micro.Technique	1	61	0.01
413	J.Electr.Mater	1	61	0.01
414	J.Heterocyclic Chem.	1	61	0.01
415	J.High Energy Phys.	1	61	0.01
416	J.Indian.Chem.Soc.	1	61	0.01
417	J.Inst.Eng.(India)	1	61	0.01
418	J.Mad.Chem.	1	61	0.01
419	J.Mat.	1	61	0.01
420	J.Materials Engineering	1	61	0.01
421	J.Mod.Optics	1	61	0.01
422	J.Nanoparticle Research	1	61	0.01
423	J.of Nuclear Medicine	1	61	0.01
424	J.Opt.Soc.of Am.	1	61	0.01
425	J.Phys.IV France	1	61	0.01
426	J.Polym.Sci.Polym.Phys.	1	61	0.01

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
427	J.Polymer Sci.-Revs.Macromol.Chem.	1	61	0.01
428	J.Sci & Engg.	1	61	0.01
429	Journal of Biomaterials	1	61	0.01
430	Journal of Chemical Crystallography	1	61	0.01
431	Journal of Chin Chem	1	61	0.01
432	Journal of Fudan University	1	61	0.01
433	Journal of High Energy Physics	1	61	0.01
434	Journal of Inorganic Biochemistry	1	61	0.01
435	Journal of Materials Science Letters	1	61	0.01
436	Journal of Megnatic Materials	1	61	0.01
437	Journal of Organometallic Chemistry	1	61	0.01
438	Journal of Peptide Research and Therapetics	1	61	0.01
439	Journal of the Indian Institute of Science	1	61	0.01
440	Journal of the Physical Society of Japan	1	61	0.01
441	JQSRT	1	61	0.01
442	Key.Eng.Materials	1	61	0.01
443	Kristallogr	1	61	0.01
444	Kunstoff.	1	61	0.01
445	Letters in Org.Chem	1	61	0.01
446	M.Phys.Rev.B.	1	61	0.01
447	Macromol.Biosci.	1	61	0.01
448	Markomol.Chem.Rapid Commun.	1	61	0.01
449	Mat Sc.Eng.B	1	61	0.01
450	Mat.Chem.Phys.	1	61	0.01
451	Materials Science Forum	1	61	0.01
452	Materials Transactions	1	61	0.01
453	Math.Biosc.	1	61	0.01
454	Mendeleev Com	1	61	0.01

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
455	Micro-electronics Journal	1	61	0.01
456	Mol.Immunology	1	61	0.01
457	Mol.Struct.	1	61	0.01
458	Molecules	1	61	0.01
459	N Carbohydr Chem.	1	61	0.01
460	Naturwissenchaften	1	61	0.01
461	New Materials	1	61	0.01
462	Noncryst. Solids	1	61	0.01
463	Nonliner Dynamics and Computational Physics	1	61	0.01
464	Nuclear Phys. & Solid St.Phys.	1	61	0.01
465	Optica.i.Spectrscopia	1	61	0.01
466	Org.Mag.Resonance	1	61	0.01
467	Org.Prep.Proced.	1	61	0.01
468	Org.Prep.Proced.Int.	1	61	0.01
469	Org.Proc.Res.Dev.	1	61	0.01
470	Organometallic Route to Nanocomposite Synthesis	1	61	0.01
471	Oxidation Communications	1	61	0.01
472	Paint India	1	61	0.01
473	Perkin Trans	1	61	0.01
474	Phosphorous Res.Bull.	1	61	0.01
475	Photochemistry	1	61	0.01
476	Photosciences	1	61	0.01
477	Phys.Chem.Lett.	1	61	0.01
478	Phys.Letts.B.	1	61	0.01
479	Phys.Res.	1	61	0.01
480	Phys.Stat.Status	1	61	0.01
481	Physics Education	1	61	0.01
482	Plant Growth Regulation	1	61	0.01

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
483	Plastics,Rubber and Composites	1	61	0.01
484	Poly.Sci.	1	61	0.01
485	Polymer Bulletin	1	61	0.01
486	Polymer Commun	1	61	0.01
487	Polymer Engg.Sci.	1	61	0.01
488	Polymer India	1	61	0.01
489	Popular Plastic	1	61	0.01
490	Prog.Theo.Chem.Phys.	1	61	0.01
491	Rad.Phys.Chem.	1	61	0.01
492	Res.J.Chem.and Envirn.	1	61	0.01
493	Research & Industry	1	61	0.01
494	Rev.A	1	61	0.01
495	Review of Sold State Science.	1	61	0.01
496	Reviews in Fluresence	1	61	0.01
497	RIKEN REVIEW,JAPAN	1	61	0.01
498	Rubber News	1	61	0.01
499	Sadhana	1	61	0.01
500	Semicond.Sci.Technol	1	61	0.01
501	Soil.Sci.	1	61	0.01
502	Sov.Phys.JETP Lett.	1	61	0.01
503	Struct.Bonding	1	61	0.01
504	Struct.Chem.	1	61	0.01
505	Stud.Surf.Sci.Catal	1	61	0.01
506	Sulfer Letters	1	61	0.01
507	System.Appl.Microbiol.	1	61	0.01
508	Toxicol.Appl.Pharmacolo.	1	61	0.01
509	Trans.Bose.Res.Inst.	1	61	0.01
510	Trans.Royal Soc.Trop.Med.	1	61	0.01
511	Transactions of the Indian Ceramic Society	1	61	0.01

RANK LIST OF TOTAL JOURNALS OF IACS, KOLKATA, 1947-2006

Sl No	Journal Name	No of Articles Percentage	Rank	Percentage
512	Trop.Med.Int.Health	1	61	0.01
513	Veit.f.Krist	1	61	0.01
514	Vibrational Spectroscopy	1	61	0.01
515	Viets.f.Astrophysik	1	61	0.01
516	Viets.f.Physik	1	61	0.01
517	Virtual Journal of Ultradfast Science	1	61	0.01
518	Zeit fiir Krista Uogr	1	61	0.01
519	Zeit.anal.Chem.	1	61	0.01
520	Zur. Fir. Phys.	1	61	0.01

SL No	Country Name	No of Articles	Rank	Percentage
1	India	1978	1	24.64
2	USA	1801	2	22.44
3	UK	1732	3	21.58
4	Nederland	1228	4	15.30
5	Germany	371	5	4.62
6	China	254	6	3.16
7	Japan	204	7	2.54
8	Denmark	139	8	1.73
9	France	59	9	0.74
10	Italy	52	10	0.65
11	Singapore	43	11	0.54
12	Canada	41	12	0.51
13	Yugoslavia	36	13	0.45
14	Swizerland	17	14	0.21
15	Australia	13	15	0.16
16	Israel	9	22	0.11
17	Hungarica	7	16	0.09
18	Poland	7	16	0.09
19	USSR	7	16	0.09
20	Switzerland	7	16	0.09
21	Pakistan	5	17	0.06
23	Belgium	3	18	0.04
24	South Africa	3	18	0.04
25	Greece	2	19	0.02
26	Prague	2	19	0.02
27	Bulgeria	1	20	0.01
28	Egypt	1	20	0.01
29	hong Kong	1	20	0.01
30	Korea	1	20	0.01
31	Solvacia	1	20	0.01
32	Sweeden	1	20	0.01
		8026		100.00

Rank list of Productive Authors of Conference papers of IACS, Kolkata, 1947-2006

SL No	Name of Author	No of authorship
1	CHAUDHURI B K	166
2	PAL A K	142
3	BHATTACHARYYA D P	136
4	CHAUDHURI S	124
5	SEN GUPTA S P	100
6	RAY S	99
7	RAI DASTIDAR K	92
8	MISRA T N	89
9	CHATTERJEE B P	83
10	BARUA A K	81
11	CHATTERJEE S	62
12	GHOSH S	61
13	GHOSH A	58
14	DAS D	51
15	MUKHERJEE S C	49
16	CHAUDHURI P	47
17	DE M	46
18	MUKHERJEE P K	45
19	RANU B C	44
20	GHOSH D	43
21	DE S K	42
22	MANDAL B M	42
23	GANGULY T	40
24	SIL N C	40
25	NANDI A K	39
26	SINHA C	38
27	SEN S K	37
28	GHOSH A S	36
29	DAS A K	35
30	DAS A R	35
31	ROY N	34
32	MUKHERJEE M	33
33	BHATTACHARYYA S S	32
34	GHATAK U R	30
35	MALLIK B	30
36	RAI DASTIDAR T K	30
37	GUHA A K	29
38	GHOSH M	28
39	BASU B	27
40	CHATTOPADHYAY S	27
41	DUTTA A K	27
42	MUKHERJEE A K	27
43	PAL P	27
44	PRADHAN S K	27
45	ROY K	26
46	SARKAR S	25
47	CHATTERJEE P	24
48	SAHA S	24
49	MITRA A	23

SL No	Name of Author	No of authorship
50	MUKHOPADHYAY S	23
51	PAL S	23
52	MUKHERJEE S	22
53	RAY SWATI	22
54	BHATTACHARYA S	21
55	BASU D K	21
56	DASGUPTA A	20
57	DE A	20
58	MANDAL T K	20
59	PAL A J	20
60	ROY S	20
61	BANERJEE A	19
62	BANERJEE S	19
63	BASU S	19
64	ROY S K	19
65	BANDYOPADHYAY A K	18
66	BASAK D	18
67	BISWAS S	18
68	GAUTAM V P	18
69	MANDAL S K	18
70	CHAKRAVORTI S	17
71	DAS P K	17
72	DATTA S	17
73	MAJUMDAR C K	17
74	MUKHERJEE R K	17
75	SANYAL S	17
76	SOM K K	17
77	TALAPATRA G B	17
78	MAIITI A K	16
79	MUKHERJEE D	16
80	MUKHOPADHYAY A	16
81	PAL PRATIBHA	16
82	ADHYA L	15
83	BANDYOPADHYAY S	15
84	DAS A	15
85	GIRI S	15
86	KAR S	15
87	KAR T	15
88	KUNDU N G	15
89	MAITY A K	15
90	MITRA M	15
91	PAL H	15
92	SINHA P K	15
93	BANERJEE S B	14
94	CHAUDHURI K	14
95	HAQUE M E	14
96	HAZRA S	14
97	KARAN S	14
98	NANDI U S	14
99	SENGUPTA A	14

Rank list of Productive Authors of Conference papers of IACS, Kolkata, 1947-2006

SL No	Name of Author	No of authorship
100	VENKATESWARAN R V	14
101	BANERJEE R	13
102	BASU C	13
103	DAS S K	13
104	JANA M	13
105	MEIKAP A K	13
106	NASKAR N	13
107	PAL D	13
108	SARKER A	13
109	SINHA S	13
110	BHATTACHARJEE A	12
111	DAS R	12
112	GANGULY S	12
113	KUNDU B	12
114	LAHIRI S	12
115	MODAK D K	12
116	PAL PRABIR	12
117	SAHA S C	12
118	SENGUPTA S P	12
119	AHMED H	11
120	BHAUMIK A	11
121	GHOSH A K	11
122	JANA T	11
123	KOLA S	11
124	PALIT S R	11
125	RAY D	11
126	RAY SIDDHARTHA	11
127	SEN GUPTA S	11
128	BATABYAL A K	10
129	BOSE I	10
130	CHATTOPADHYAY K K	10
131	BANERJEE D	10
132	BARMAN A	10
133	BASU M	10
134	BOSE A	10
135	DAS BARMAN A	10
136	DAS S	10
137	DEY T	10
138	DUTTA GUPTA N	10
139	GHOSH R	10
140	MUKHERJEE K M	10
141	PALIT N	10
142	RAKDHIT R	10
143	RAY P P	10
144	ROY R	10
145	ROYCHOWDHURY R K	10
146	SARKAR A	10
147	SEN S	10
148	TARAN S	10
149	BANGAL P R	9
150	BHATTACHARYYA D	9
151	CHAKRABORTY M	9
152	CHOWDHURY K	9
153	CHOWDHURY S	9
154	DAS K	9
155	DAS K K	9
156	DAS R K	9
157	DATTA SARMILA	9
158	DUTTA P C	9
159	GHORAI A	9
160	M RAHAMAN	9
161	MAJUMDAR R	9
162	MANDAL C R	9
163	MIDDYA A R	9
164	MUKHERJEE T K	9
165	PAL R	9
166	Ray M	9
167	ROY D	9
168	SAHA B	9
169	SAHOO S	9
170	SHARMA S N	9
171	SIKDAR S	9
172	SINHA ROY S	9
173	TRIPATHI S	9
174	BRAHMA S K	8
175	BERA R N	8
176	CHAKRABORTI K	8
177	CHATTERJEE PARTHA	8
178	CHAUDHURI C	8
179	CHOWDHURY A	8
180	DAS U K	8
181	DASGUPTA P	8
182	DE R	8
183	DE S C	8
184	DEB N C	8
185	DEBNATH S C	8
186	G MOSTAFA	8
187	GHOSH T K	8
188	KARMAKAR S	8
189	KUNDU S K	8
190	KUNDU T	8
191	LONGEAUD C	8
192	MALAKAR B	8
193	MOLLAH S	8
194	MONDAL S	8
195	MUKHERJEE A	8
196	NAKAMURA H	8
197	SAMANTA REKHA	8
198	SARKAR S K	8
199	BANERJEE C	7
200	BERA N C	7
201	BHADURI A	7
202	BISWAS S C	7
203	CHAKRABORTY S	7

Rank list of Productive Authors of Conference papers of IACS, Kolkata, 1947-2006

SL No	Name of Author	No of authorship
204	CHAKRAVORTY D	7
205	CHAKRAVORTY S	7
206	DAS C	7
207	DATTA A	7
208	DATTA SHYAMAL	7
209	DUTTA S	7
210	GANGULI D	7
211	GHOSAL A K	7
212	GHOSH S K	7
213	JANA S	7
214	KOHARA T	7
215	KOTAL A	7
216	MAITI M	7
217	MAITY A B	7
218	MALIK S	7
219	MALLIK G K	7
220	PAL MAJUMDER T	7
221	PANJA S	7
222	PARICHHA T K	7
223	RAY K	7
224	ROY A	7
225	SAHA G C	7
226	SAKATA H	7
227	SEAL A	7
228	SI S	7
229	STHANAPATI J	7
230	CHAKRABARTI S	6
231	BANERJEE K	6
232	BASU D	6
233	BHATTACHARJEE D	6
234	BHATTACHARYYA I	6
235	BHATTACHARYYA K	6
236	BATABYAL S K	6
237	BERA S K	6
238	BHATTACHARYA M	6
239	BHATTACHARYYA S P	6
240	BISWAS T	6
241	CHATTERJEE U	6
242	CHATTOPADHYAY A	6
243	CHOWDHURY J	6
244	DASGUPTA D	6
245	DASGUPTA S	6
246	DE S	6
247	DEY A	6
248	DUTTA A	6
249	DUTTA D	6
250	GANGULY A K	6
251	GHOSH D B	6
252	GHOSH Z	6
253	GUHA S	6
254	H AHMED	6
255	KARAR M	6
256	KUNDU S	6
257	MALLIK P K	6
258	MANDAL P	6
259	MITRA G B	6
260	MITRA R N	6
261	MONDAL A	6
262	MUKHERJEE MONIKA	6
263	NAG J	6
264	PAUL A	6
265	RAY A K	6
266	ROY A C	6
267	ROY S C	6
268	SAHA M	6
269	Sarkar A K	6
270	SARKAR B K	6
271	SENGUPTA S	6
272	STUBB H	6
273	VIGNOLI S	6
274	YANG H D	6
275	BHATTACHARYYA S	5
276	BHATTACHARYYA T	5
277	CHAKRABARTI J	5
278	BERA P	5
279	CHAKRABORTY A K	5
280	Chakravarty A S	5
281	CHOWDHURY C	5
282	DAS DEBAJYOTI	5
283	DAS G P	5
284	DAS T K	5
285	DAWN A	5
286	DE K	5
287	DEOGHURIA S	5
288	DUTTA J	5
289	FUJII M	5
290	GHOSH DEB S	5
291	J KHATUN	5
292	KAR TANUSREE	5
293	KUNDU S N	5
294	MANDAL S	5
295	MANNA S	5
296	MIDDA S	5
297	MUKHERJEE D C	5
298	MUKHOPADHYAY ANURADHA	5
299	NANDY M	5
300	PAL SUDIPTA	5
301	PANDA S K	5
302	RAY R	5
303	ROY B	5
304	ROY KARMAKAR P	5
305	SAHA D C	5
306	SANYAL G S	5
307	SARKAR SASABINDU	5

Rank list of Productive Authors of Conference papers of IACS, Kolkata, 1947-2006

SL No	Name of Author	No of authorship
308	SHEE S K	5
309	SUR S	5
310	TALAPATRA D	5
311	BASU BASUDHARA	4
312	BHATTACHARYA R	4
313	CHAKRABORTI S	4
314	BANERJEA D	4
315	BERA A K	4
316	BHAR S	4
317	BHATTACHARJEE R R	4
318	BHATTACHARYYA R	4
319	BHOWAL J	4
320	CABARROCAS P ROCA I	4
321	CARIUS R	4
322	CHATTERJEE D P	4
323	CHAUDHURI A K	4
324	CHAUDHURI K R	4
325	CHOWDHURY JOYDEEP	4
326	DAS GUPTA ARUP	4
327	DAS MANASI	4
328	DE A K	4
329	DHAR A	4
330	DURGAPRASAD N	4
331	DUTTA K	4
332	DUTTA-GUPTA N	4
333	GANGOPADHYAY A	4
334	GHOSAL S K	4
335	GHOSH S C	4
336	GHOSHAL A K	4
337	GORAI S	4
338	GUPTA S N	4
339	HALDAR T K	4
340	HUDLICKY T	4
341	JANA A R	4
342	JANA TAPATI	4
343	LAHA S	4
344	MAHANTY J S	4
345	MAITI B C	4
346	MAITI S	4
347	MALLICK B	4
348	MANDAL MITA	4
349	MISRA A K	4
350	MITRA BANI	4
351	MITRA S	4
352	MUKHERJEE SOMA	4
353	NAG A	4
354	NANDY S K	4
355	NATH A	4
356	PAL M	4
357	PODDAR A	4
358	RAO K R P M	4
359	RATH J K	4
360	RAY CHAUDHURI N	4
361	ROYCHOUDHURY P	4
362	SADHUKHAN M	4
363	SARKAR K	4
364	SEN GUPTA R	4
365	SURAL M	4
366	TALUKDAR D	4
367	THAKUR M	4
368	THANDER A	4
369	XAVIER J	4
370	BAHUMIK A	3
371	BANERJEE DIPALI	3
372	BASU S N	3
373	BHATTACHARYYA M	3
374	CHAKRABARTY S	3
375	CHATTERJEE K	3
376	ADHYA M	3
377	BANERJEE BIRESWAR	3
378	Bhattacharyya S N	3
379	BHAUMIK S	3
380	BOSE E	3
381	CHAKRABARTI K	3
382	CHAKRABORTI R	3
383	CHAKRABORTI SUBHASIS	3
384	CHAKRABORTY K	3
385	CHAKRABORTY MITALI	3
386	CHATTERJEE P	3
387	CHATTOPADHYAY U	3
388	Chaudhuri A	3
389	CHAUDHURI B	3
390	CHAUDHURI G	3
391	CHUDHURI S	3
392	DAS K L	3
393	DAS P	3
394	DASGUPTA S K	3
395	DE B	3
396	DE T K	3
397	DEB A K	3
398	DEY P K	3
399	DIKSHIT A K	3
400	DUNMUR D A	3
401	DUTTA	3
402	DUTTA B	3
403	DUTTA P	3
404	GHOSAL A K	3
405	GHOSH URMI	3
406	GOSWAMI K	3
407	GUHA P	3
408	GUPTAROY P	3
409	HAASE W	3
410	IFTIQUAR S M	3
411	JAINAB KHATUN	3

Rank list of Productive Authors of Conference papers of IACS, Kolkata, 1947-2006

SL No	Name of Author	No of authorship
412	JANA J	3
413	JANA R	3
414	JANA Y M	3
415	JEWRAJKA S K	3
416	KAR K	3
417	KASTHA G S	3
418	KHAN P	3
419	MAITRA S	3
420	MAJUMDER T P	3
421	MAL N K	3
422	MALLICK P K	3
423	MANDAL U K	3
424	MANNA A	3
425	MCGUIRE J H	3
426	MOLLA N H	3
427	MONDAL U K	3
428	MRIDHA S	3
429	MUKHERJEE K	3
430	MUKHOPADHYAY R	3
431	MUKHOPADHYAY SUMITA	3
432	NAG D K	3
433	NEOGI SUBHRA	3
434	PAL T	3
435	PAL T K	3
436	PALOHEIMO J	3
437	PATRA D	3
438	Paul D	3
439	PAUL G K	3
440	PAUL N	3
441	RAW SWATI	3
442	RAY B	3
443	RAY D S	3
444	RAY H	3
445	RAY J K	3
446	RAY T	3
447	ROZENBERG E	3
448	SAHA T	3
449	SAMANTA S	3
450	SANYAL B	3
451	SARKAR M	3
452	SARMA A S	3
453	SEN A K	3
454	SENGUPTA P	3
455	SETT P	3
456	SINHA G	3
457	SRIVASTAVA B N	3
458	SUR S K	3
459	SURAL D P	3
460	WILLIAMSON D L	3
461	BANERJEE G	2
462	BISWAS S K	2

SL No	Name of Author	No of authorship
463	CHAKRABARTI R	2
464	CHAKRAVORTY D	2
465	ADHIKARY T	2
466	BANERJEE ARITRA	2
467	BHATTACHARYA D M	2
468	BHATTACHARYYA S	2
469	CHAKRABARTI M K	2
470	CHAKRABORTY D	2
471	CHATTERJEE L	2
472	ACHARYA A	2
473	ACHARYA S	2
474	Bagchi B	2
475	BANDYOPADHYAY C	2
476	BANERJEE ARINDAM	2
477	BHATTACHARYA B	2
478	BHATTACHARYA K	2
479	BHATTACHARYAY S	2
480	BHATTACHARYYA P K	2
481	BHATTACHARYYA S P	2
482	BHAUMIK SUCHANDRA	2
483	CHAKRABORTY R	2
484	CHAKRABURTTY AMIYA KUMAR	2
485	CHANDRA A	2
486	CHATTERJEE ELA	2
487	CHATTOPADHYAY T	2
488	CHOWDHURY M	2
489	DABROWSKI R	2
490	DAS B	2
491	DAS M M	2
492	DAS RAJESH	2
493	DATTA B	2
494	DATTA J	2
495	DATTA R N	2
496	DE ABHIJIT	2
497	DE D K	2
498	DE SUKANTA	2
499	DEB B	2
500	DEB N	2
501	DEB S	2
502	DEB S K	2
503	DENG X J	2
504	DEV A	2
505	DEY D K	2
506	DEY G	2
507	DEY K K	2
508	DEY P K	2
509	DUTTA ROY R	2
510	DUTTA U	2
511	DUTTARAY R	2
512	FINGER F	2
513	GANGOPADHYAY R	2

Rank list of Productive Authors of Conference papers of IACS, Kolkata, 1947-2006

SL No	Name of Author	No of authorship
514	GANGULY A	2
515	GANGULY G	2
516	GARAI A	2
517	GHOSAL P K	2
518	GHOSAL PROBIR	2
519	GHOSH DILIP	2
520	GHOSH N	2
521	Ghosh U S	2
522	GHOSHAL T	2
523	GOMATHY V	2
524	GOSWAMI R	2
525	GUHA THAKURTA S R	2
526	GUPTA N	2
527	GUPTA R	2
528	HALDAR K	2
529	HANDY E S	2
530	HAQUE A	2
531	HASSAN	2
532	JACKSON L C	2
533	JAIN K M	2
534	JANA P	2
535	JANA P K	2
536	JANA PRADIP	2
537	KAR M	2
538	KAR P	2
539	KHATUN J	2
540	KOMATSU T	2
541	KONER S	2
542	KSHIRSAGAR S T	2
543	KUILA B	2
544	Kundu K K	2
545	Lahiri A	2
546	MAHAPATRA B	2
547	MAITI G	2
548	MAITI P	2
549	MAITY A	2
550	MAITY S K	2
551	MAJUMDAR S SOM	2
552	Majumdar D	2
553	MAJUMDAR S	2
554	MAJUMDER M	2
555	MAJUMDER R	2
556	MANDAL A	2
557	MANDAL T	2
558	MATHEW	2
559	MAZUMDAR S K	2
560	MEDHI K C	2
561	MISRA T	2
562	MITRA S N	2
563	MOULIK S P	2
564	Mukhopadhyay A K	2
565	MUKHOPADHYAY B	2
566	MUKHOPADHYAY G	2
567	NAMBISSAN P M G	2
568	NANDI B	2
569	NANDI M	2
570	NANDY S	2
571	NATH D	2
572	NATH M	2
573	OSTERBACKA R	2
574	OSTERGARD T	2
575	PAL J N	2
576	PAN A	2
577	PANDA J	2
578	PARIYA C	2
579	PERRIN J	2
580	PODDAR S N	2
581	PRADHAN T K	2
582	RAHAMAN M	2
583	RAJENDRAN V	2
584	RAO C V N	2
585	ROUTH H	2
586	ROY ARPITA	2
587	ROY CHOWDHURY C	2
588	ROY M	2
589	ROY SUBHAS C	2
590	SAHA R K	2
591	SAMAJPATI S	2
592	SANTRA A K	2
593	SANYAL SUSMITA	2
594	SARBAJNA S	2
595	SARKAR D	2
596	SARKAR D C	2
597	SARKAR DEEPALI	2
598	SARKAR J	2
599	SARKAR P B	2
600	SARKAR U K	2
601	SARMA S	2
602	SATYANARAYANA G O S V	2
603	SEN N	2
604	SHARMA M K	2
605	SIDDHANTA J	2
606	SINGHA B	2
607	Sinha R K	2
608	SIRKAR S	2
609	SOM K	2
610	Srimal S	2
611	SUN C P	2
612	TCHAKAROV S	2
613	TEWARY M	2
614	TSUO Y S	2
615	WILLIAMSON D	2
616	WOOLFSON M M	2

Rank list of Productive Authors of Conference papers of IACS, Kolkata, 1947-2006

SL No	Name of Author	No of authorship
617	XU Y	2
618	YADAV S	2
619	ADHIKARI S	1
620	CHANDRA D	1
621	CHATTOPADHYAY D	1
622	BHADURI G C	1
623	BHATTACHARYA P K	1
624	ALLKOFER O C	1
625	BANERJEE A K	1
626	BANERJEE P	1
627	BHASKARA RAO M L	1
628	BHATTACHARYA T	1
629	BHATTACHARYYA J	1
630	BOCELLI G	1
631	BOSE K	1
632	CHAKRABORTI G	1
633	CHAKRABORTI J	1
634	CHAKRABORTY A	1
635	CHAKRAVARTY M	1
636	CHAKRAVORTY MITALI	1
637	CHANDA A	1
638	CHATTERJEE PARSATHI	1
639	CHATTOPADHYAY K	1
640	CHATTOPADHYAY P	1
641	SAHA S C	1
642	ABBAS E D	1
643	ACHARYYA T	1
644	ACHARYYA T K	1
645	AHMED Z	1
646	AICH A	1
647	Aiyar Lakshmi	1
648	ANJANEYULU G	1
649	ASH S	1
650	ASHER S E	1
651	BAHUMIK S	1
652	BALARAM P	1
653	BANDHOPADHYAY A K	1
654	BANERJEE P C	1
655	BANERJEE R R	1
656	BANERJEE UJJAL K.	1
657	BASAK R L	1
658	BASU M K	1
659	BASUCHOUDHURY K	1
660	BATYABAL S	1
661	BHANOT O S	1
662	BHAR R	1
663	BHATTACHARJEE J K	1
664	BHATTACHARYA D	1
665	BHATTACHARYA RAMENDRANARAYAN	1
666	BHATTACHARYYA B	1
667	BHATTACHARYYA BHARATI	1
668	BHATTACHARYYA D	1
669	BHATTACHARYYA PARTHA	1
670	BHATTACHARYYA S	1
671	BHATTACHARYYA SUBHRA	1
672	BHATTACHARYYA SULAVA	1
673	BHAUMIK M L	1
674	BHOWMIK B B	1
675	BISWAS A B	1
676	BISWAS ALOKA	1
677	Biswas M	1
678	BISWAS SHIPRA	1
679	BISWAS SUBHAYAN	1
680	Bose C	1
681	BOSE ESA	1
682	BOSE S	1
683	BOSE T K	1
684	BRAHMA P	1
685	CHAKRABARTI B R	1
686	CHAKRABORTI P C	1
687	CHAKRABORTY B R	1
688	CHAKRABORTY D K	1
689	CHAKRABORTY KINKINI	1
690	CHAKRABURTTY A A	1
691	CHAKRABURTTY A K	1
692	CHAKRABURTTY A M	1
693	CHAKRAVORTY A	1
694	CHANDA M	1
695	CHANDRA ARUNIMA	1
696	Chattanathan N	1
697	CHATTERJEE B	1
698	CHATTERJEE D	1
699	CHATTERJEE L B P	1
700	CHATTERJEE P K	1
701	Chatterjee R	1
702	CHATTERJEE SANDIP	1
703	CHATTOPADHYAY A K	1
704	CHATTOPADHYAY N	1
705	CHAUDHURI S	1
706	CHAUDHURI L N	1
707	CHAUDHURI PARTHA	1
708	Chaudhuri R K	1
709	CHAUDHURY C	1
710	CHAUDHURY PINAKI	1
711	CHAUDHURY S	1
712	CHEN K H	1
713	CHEN L C	1

Rank list of Productive Authors of Conference papers of IACS, Kolkata, 1947-2006

SL No	Name of Author	No of authorship
714	CHIHARA H	1
715	CHINTALAPUDI S N	1
716	CHONG D P	1
717	CHOU H	1
718	CHOUDHURI K	1
719	CHOUDHURI L N	1
720	CHOUDHURY D	1
721	CHOUDHURY JAYASRI	1
722	CHOUDHURY P P	1
723	CHOUDHURY R K	1
724	CHOUDHURY S	1
725	CHOWDHURI J	1
726	CHOWDHURY B	1
727	CHOWDHURY BIVA	1
728	CHOWDHURY I	1
729	CHOWDHURY N	1
730	Chowdhury P K	1
731	CHOWDHURY PUSPITAPALLAB	1
732	CHOWDHURY RAJAT	1
733	CHOWDHURY S K	1
734	CHOWDHURY SAFAYET KARIM	1
735	COUTTS T J	1
736	D GUPTA N	1
737	DAMON-LACOSTE J	1
738	DAS B K	1
739	Das Gupta T P	1
740	DAS H	1
741	DAS KALPANA	1
742	DAS M	1
743	Dasgupta R	1
744	DASKHAN S	1
745	DASS A K	1
746	DATTA S	1
747	DATTA A K	1
748	DATTA AVIJIT	1
749	DATTA M	1
750	DATTA P K	1
751	DATTA S K	1
752	DE ASISH	1
753	DEB A	1
754	Deb B M	1
755	DEB C	1
756	DEB O C	1
757	DEBNATH M	1
758	DEBNATH MITASRI	1
759	DEBNATH N C	1
760	DEV V ASHOK	1
761	DEY S S	1
762	DEY J	1
763	DEY M	1
764	DEY S N	1
765	DEY S S	1
766	DHAR D	1
767	DHERE R G	1
768	DINDA S SI E	1
769	DURAN A	1
770	DURGAPRASAD M	1
771	DUROCHER G	1
772	DUTT GUPTA N B	1
773	DUTT J	1
774	DUTT M B	1
775	DUTT P K	1
776	Dutta Gupta N B	1
777	DUTTA H	1
778	DUTTA R N	1
779	DUTTA ROY S K	1
780	DUTTA S K	1
781	DUTTA SARMILA	1
782	DUTTA SULAGNA	1
783	EHARA M	1
784	EPPINGER S	1
785	FAISAL F H M	1
786	FISH K	1
787	FOLSCHE G	1
788	G AMIN	1
789	GANGULI A	1
790	Ganguli S	1
791	GANGULY D	1
792	GANGULY P	1
793	GANGULY PARTHASARATHI	1
794	GANTAIT M	1
795	GAYEN A K	1
796	GHATAK A	1
797	GHOSH A R	1
798	GHOSH ASWINI	1
799	GHOSH B	1
800	GHOSH DEBJANI	1
801	GHOSH G	1
802	GHOSH J	1
803	GHOSH K	1
804	GHOSH MITA	1
805	Ghosh Premamoy	1
806	GHOSH SOMA	1
807	GHOSH SUKUMAR	1
808	GHOSH SWARALIPI	1
809	GHOSHAL M	1
810	GHOSHAL PALLAB	1
811	GIRI A	1
812	GMELIN E	1
813	GOLAM MOSTAFA	1
814	GOSWAMI P	1

Rank list of Productive Authors of Conference papers of IACS, Kolkata, 1947-2006

SL No	Name of Author	No of authorship
815	GRANHOLM P	1
816	GROB A	1
817	GROVER P S	1
818	Guchhait N	1
819	GUCHHAIT S K	1
820	GUENET J M	1
821	Guha B C	1
822	GUHA E	1
823	GUHA MAJUMDER D N	1
824	Guha T	1
825	Guhaniyogi S C	1
826	GUIN C	1
827	GUPTA A	1
828	GUPTA I	1
829	GUPTA M	1
830	GUPTA ROY P	1
831	GUPTA S	1
832	GUPTA S P	1
833	GUPTA SAKUNTALA	1
834	HAJRA A	1
835	HALDAR D	1
836	HALDAR J	1
837	HALDAR K R	1
838	Haldar M	1
839	HALDAR T	1
840	HALDER JYOTSNABARAN	1
841	HAPKE P	1
842	HAQUE E	1
843	HIGGS L A	1
844	HOHMANN J	1
845	HOOPE U	1
846	HUNDET ANIY	1
847	HWANG J S	1
848	IMAE T	1
849	ISAAC J	1
850	ISOTALO H	1
851	Jamaddar Y A	1
852	Jana D	1
853	JANA MADHUSUDAN	1
854	JARDIN C	1
855	JASH S S	1
856	JEWRAJKA S	1
857	JOSHI B S	1
858	JULICH	1
859	JURADO J R	1
860	KAIL F	1
861	KAJIWARA S	1
862	Kalidas C	1
863	KALLMAN K M	1
864	KAMILYA T	1
865	KANDAR A	1
866	KANJILAL P R	1
867	KAR B	1
868	KAR S C	1
869	KAR SWATI	1
870	KARMAKAR B	1
871	KARMAKAR M	1
872	KARMAKAR P R	1
873	KASTHA G K	1
874	KATO M	1
875	KAVKA M	1
876	KAZMERSKI L L	1
877	KELM S	1
878	KHAN B A	1
879	KHARCHENKO A V	1
880	KIKUCHI T	1
881	Kleteke R E	1
882	KOBAYASHI H	1
883	KOGERLER R	1
884	KOHRER C	1
885	Konar R S	1
886	KRANOLD R	1
887	KSHIRSAGAR A	1
888	KUILA B K	1
889	KULESSA T	1
890	KUMARI K	1
891	LAHIRI S K	1
892	LAMBERTZ A	1
893	LAMBROPOULES P	1
894	LO H C	1
895	LONGEAUD CHRISTOPHE	1
896	MACKENZIE NEIL	1
897	MADDALI U B	1
898	MAITI B	1
899	MAITRA G B	1
900	MAJEE A	1
901	MAJI D	1
902	MAJI K	1
903	MAJI RAJIB	1
904	MAJI S	1
905	MAJI S K	1
906	MAJUMDAR A	1
907	MAJUMDAR D N G	1
908	MAJUMDAR K C	1
909	MAJUMDAR P S	1
910	MAL J	1
911	MALIIK P K	1
912	MALLICK V	1
913	Mallik A	1
914	MALLIK T	1
915	MALTENS C	1
916	MANDA P	1

Rank list of Productive Authors of Conference papers of IACS, Kolkata, 1947-2006

SL No	Name of Author	No of authorship
917	MANDAL D	1
918	MANDAL K	1
919	MANDAL P K	1
920	Manna P K	1
921	MARTY O	1
922	MATI A	1
923	MAYER H	1
924	MAYER HUBERT	1
925	MAZUMDAR K C	1
926	MAZUMDAR P S	1
927	MAZUMDAR T P	1
928	MAZUMDER GOURI	1
929	MEDHI C	1
930	MIRA T N	1
931	MISRA C R	1
932	MITRA M	1
933	MITRA B C	1
934	MITRA D P	1
935	MITRA I	1
936	MITRA M K	1
937	MITRA MALA	1
938	MITRA S C	1
939	MITRA S S	1
940	MIYA A R	1
941	Mnondal A	1
942	MOITRA S	1
943	MONDAL MONIKA	1
944	MONDAL N K	1
945	MONDAL U	1
946	Mookherji A	1
947	MOSTAFA G	1
948	MSEZANE A Z	1
949	MUKHERJEE P M	1
950	MUKHERJEE PRASANTA K.	1
951	MUKHERJEE S L	1
952	MUKHERJEE T P	1
953	MUKHERJI S	1
954	MUKHERJI SEDESHNA	1
955	MUKHOPADHYAY P K	1
956	MUKHOPADHYAY RITA	1
957	MUKHOPADHYAY S K	1
958	MULLICK K	1
959	MUTO Y	1
960	NAG APARAJITA	1
961	NANDI P K	1
962	NANDI S	1
963	NANDY A	1
964	NANDY P	1
965	NARAYAN P S	1
966	NATH B	1
967	NATH P	1

SL No	Name of Author	No of authorship
968	NAYEK A	1
969	NEGRU R	1
970	NELSON A J	1
971	NEUEFEIND J	1
972	NEYOGI SUBHRA	1
973	NIGAM A K	1
974	OHBA S	1
975	OSKRLEIN S C	1
976	PACOR S	1
977	PAL AMLAN	1
978	PAL MAZUMDAR T	1
979	PAL P K	1
980	Pal R K	1
981	PAL SAMAPTI	1
982	PAL TANUSRI	1
983	PALANIVELU N	1
984	Palit S R	1
985	PANDA A K	1
986	PARDHAN S K	1
987	PAUL D K	1
988	PAUL G	1
989	PAUL R	1
990	PRADHAN B	1
991	PRADHAN S	1
992	PRAMANIK B	1
993	PUROHIT T	1
994	QUIC C	1
995	RABOLD A	1
996	RAI D K	1
997	RAI DASTIDAR D	1
998	RAI R S	1
999	RAJBHANDARY U	1
1000	RAMASAMY P	1
1001	RANA A K	1
1002	RAO A S	1
1003	RASHID H	1
1004	RAY A	1
1005	RAY A C	1
1006	RAY CHOUDHURY K	1
1007	RAY CHOWDHURI M	1
1008	RAY KARMAKAR P	1
1009	RAY KRISHANU	1
1010	RAY P	1
1011	RAY P N	1
1012	RAY PRIYAADARANJAN	1
1013	RAY S C	1
1014	RAYCHAUDHURI A	1
1015	REVOL J N	1
1016	RIGI L	1
1017	RINDANI S	1
1018	ROCHAS C	1

Rank list of Productive Authors of Conference papers of IACS, Kolkata, 1947-2006

SL No	Name of Author	No of authorship
1019	RODRIGUES NELSON	1
1020	ROY A K	1
1021	ROY ABHIJIT	1
1022	ROY C	1
1023	ROY CHOUDHURY H	1
1024	ROY CHOUDHURY K	1
1025	ROY G	1
1026	ROY K B	1
1027	ROY KANIKA	1
1028	ROY P	1
1029	ROY P K	1
1030	ROY P N	1
1031	ROY RITA	1
1032	ROY SIDDHARTA	1
1033	ROY SUMAN	1
1034	RUBNER M F	1
1035	RUDRA P	1
1036	S IWAMI	1
1037	SAADANE O	1
1038	SAHA A C	1
1039	SAHA B C	1
1040	SAHA C G	1
1041	SAHA G	1
1042	SAHA R	1
1043	SAHA RAJENDRA	1
1044	SAHA ROY S	1
1045	SAHA S K	1
1046	SAITO Y	1
1047	SAMANTA A	1
1048	SAMANTA B	1
1049	SAMANTA C	1
1050	SAMANTA S S	1
1051	SAMPATHKUMARAN E V	1
1052	SANTRA K	1
1053	SANTRA KALPANA	1
1054	SANYAL D	1
1055	SANYAL I	1
1056	SARAN A	1
1057	SARKAR ARINDAM	1
1058	SARKAR ARINDOM	1
1059	SARKAR C	1
1060	SARKAR D K	1
1061	SARKAR N	1
1062	SARKAR N K	1
1063	SARKAR U	1
1064	SARMA R	1
1065	SARMA S N	1
1066	SATPATHI T	1
1067	SATPATI B	1
1068	SATYAM P V	1
1069	SAVA G	1

SL No	Name of Author	No of authorship
1070	SCHAUER R	1
1071	SCHROTTER H W	1
1072	SEAL B K	1
1073	SEBASTIAN M T	1
1074	Sen Gupta	1
1075	SEN P	1
1076	SEN SANJAY	1
1077	SEN SUCHITRA	1
1078	SENGUPTA D	1
1079	Sengupta S K	1
1080	SENGUPTA SUMITA	1
1081	SENGUPTA SUPARNA	1
1082	SENGUPTA T	1
1083	Shaha R K	1
1084	SHARKAR N K	1
1085	SHARMA K K	1
1086	SHINGAL R	1
1087	SHORT R P	1
1088	SIKDAR REKHA	1
1089	SINGH A	1
1090	SINGH G	1
1091	SINGH R	1
1092	SINGH R N	1
1093	SINGH T	1
1094	SINGHA P K	1
1095	SINHA A	1
1096	SINHA B	1
1097	SINHA DHIMAN	1
1098	Sinha P	1
1099	Sirkar S C	1
1100	SK. RASIDUL AMIN	1
1101	SOKOLOWAKI R S	1
1102	SOM MAJUMDAR S	1
1103	SPEARS C P	1
1104	SPEARS P	1
1105	SRAMAN A S	1
1106	SRINIVASAN G	1
1107	SRINIVASAN K	1
1108	SRIVASTAVA R C	1
1109	SRNAK A	1
1110	SUDARSHAN S	1
1111	SUENDO V	1
1112	SUMA S	1
1113	SUR SUKANYA	1
1114	SUZUKI I	1
1115	Swamy H N	1
1116	SWATI RAY	1
1117	TANDON N	1
1118	TARAFDAR S	1
1119	TAULBJERG K	1
1120	TEMPLETON DAVID H	1
1121	TEWARI A K	1

Rank list of Productive Authors of Conference papers of IACS, Kolkata, 1947-2006

SL No	Name of Author	No of authorship
1122	THAKKAR AJIT J	1
1123	TOKII T	1
1124	TRIPATHI D N	1
1125	UEKUSA H	1
1126	UHLENBRUCK G	1
1127	UPADHYAY S	1
1128	USZPOLEWICZ M	1
1129	VETTERL O	1
1130	VICTOR GYV	1
1131	WANGER H	1
	Total	6063

Rank list of Productive Supervisors of theses at IACS, Kolkata 1947-2006

Sl. No.	Supervisor	No. of Theses guided	Percentage	Rank
1	Palit S R	73	6.54	I
2	Chakraborty A	48	4.30	2
3	Barua A K	46	4.12	3
4	Dutta P C	31	2.78	4
5	Ghatak U R	30	2.69	5
6	Sil N C	27	2.42	6
7	Chaudhuri B K	25	2.24	7
8	Pal A K	25	2.24	8
9	Chaudhury M	24	2.15	9
10	Mishra T N	23	2.06	10
11	Mandal B M	22	1.97	11
12	Bose A	21	1.88	12
13	Ghosh S	21	1.88	12
14	Mukherjee D	21	1.88	12
15	Rao C V N	21	1.88	12
16	Sarkar S C	21	1.88	12
17	Ray Chaudhuri N	19	1.70	13
18	Sen Gupta S P	18	1.61	14
19	Srivastava B N	17	1.52	15
20	Ghosh A S	16	1.43	16
21	Poddar S N	16	1.43	16
22	Roy N	16	1.43	16
23	Banerjee P	15	1.34	17
24	Bhattacharyya D P	15	1.34	17
25	Chattejee B P	15	1.34	17
26	Nag K	15	1.34	17
27	Chakraborty D	14	1.25	18
28	Chaudhuri A K	14	1.25	18
29	Dutta N K	14	1.25	18
30	Gautam V P	14	1.25	18
31	Ranu B C	14	1.25	18
32	Banerjea D	12	1.08	19
33	Banerjee S B	12	1.08	19
34	Bhattacharyya K	12	1.08	19
35	Chatterjee S	12	1.08	19
36	Ghosh D	12	1.08	19
37	Bhattacharya S P	11	0.99	20
38	Kastha G S	11	0.99	20
39	Chaudhuri S	10	0.90	21
40	De A	9	0.81	22
41	Kundu N G	9	0.81	22
42	Venkateswaran R V	9	0.81	22
43	Basu D K	8	0.72	23
44	Dutta A K	8	0.72	23

Rank list of Productive Supervisors of theses at IACS, Kolkata 1947-2006

Sl. No.	Supervisor	No. of Theses guided	Percentage	Rank
45	Ganguly T	8	0.72	23
46	Ghosh U S	8	0.72	23
47	Ray P	8	0.72	23
48	Bhattacharya S N	7	0.63	24
49	Ghosh A	7	0.63	24
50	Nandi A K	7	0.63	24
51	Nandi U S	7	0.63	24
52	Sirkar A K	7	0.63	24
53	Bagchi P	6	0.54	25
54	Ray D S	6	0.54	25
55	Ray M	6	0.54	25
56	Ray S	6	0.54	25
57	Ray Swati	6	0.54	25
58	Saha S	6	0.54	25
59	Goswami S	5	0.45	26
60	Guha A K	5	0.45	26
61	Kundu Tapanendu	5	0.45	26
62	Lahiri S	5	0.45	26
63	Mukherjee P K	5	0.45	26
64	Mukherjee S C	5	0.45	26
65	Rai dastidar T K	5	0.45	26
66	Roy S C	5	0.45	26
67	Sirkar S C	5	0.45	26
68	Basu D	4	0.36	27
69	Bhattacharjee J K	4	0.36	27
70	Mallik B	4	0.36	27
71	Mukherjee A K	4	0.36	27
72	Banerjee R	3	0.27	28
73	Basu C	3	0.27	28
74	Basu S	3	0.27	28
75	Bhattacharyya S S	3	0.27	28
76	Chakravorti S	3	0.27	28
77	Chaudhuri P	3	0.27	28
78	Chowdhuri D	3	0.27	28
79	Das A R	3	0.27	28
80	De M	3	0.27	28
81	Dutta Ahmed A K	3	0.27	28
82	Mukherjee S	3	0.27	28
83	Mukherjee S K	3	0.27	28
84	Mukherjee S M	3	0.27	28
85	Rai Dastidar Krishna	3	0.27	28
86	Ray S B	3	0.27	28
87	Ray S K	3	0.27	28

Rank list of Productive Supervisors of theses at IACS, Kolkata 1947-2006

Sl. No.	Supervisor	No. of Theses guided	Percentage	Rank
88	Sen S K	3	0.27	28
89	Talapatra G B	3	0.27	28
90	Saha S C	3	0.27	28
91	Bhattacharya D P	2	0.18	29
92	De S K	2	0.18	29
93	Ganguly D	2	0.18	29
94	Ghosh S P	2	0.18	29
95	Mukherjee R K	2	0.18	29
96	Pal A J	2	0.18	29
97	Sharma A S	2	0.18	29
98	Sinha C	2	0.18	29
99	Banerjee A	1	0.09	30
100	Batabyal A K	1	0.09	30
101	Battacharyya R	1	0.09	30
102	Bera S	1	0.09	30
103	Bhattacharya K	1	0.09	30
104	Bhattacharyya Ramendranarayan	1	0.09	30
105	Bhowmik A	1	0.09	30
106	Chatterjee B P	1	0.09	30
107	Chatterjee S C	1	0.09	30
108	Chatterjee S K	1	0.09	30
109	Dutta D	1	0.09	30
110	Goswami K	1	0.09	30
111	Kar T	1	0.09	30
112	Majumder C K	1	0.09	30
113	Mitra T K	1	0.09	30
114	Mondal S K	1	0.09	30
115	Mukherjee M	1	0.09	30
116	Pal A	1	0.09	30
117	Roy K	1	0.09	30
118	Roy S K	1	0.09	30
119	Others*	21	1.88	
	Total	1116	100.00	

**** Supervisors name was not found during the periods***

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