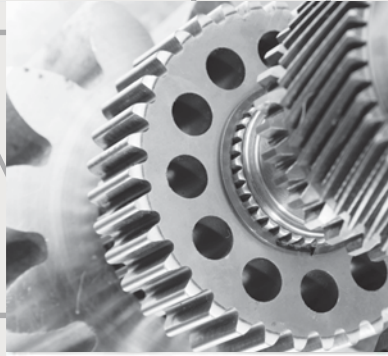




सत्यमेव जयते



Annual Report

2017-18



विज्ञान और
इंजीनियरी
अनुसंधान बोर्ड



Science and
Engineering
Research Board



विज्ञान और
इंजीनियरी
अनुसंधान बोर्ड



Science and
Engineering
Research Board

वार्षिक रिपोर्ट 2017-18 **Annual Report**

From the Secretary's Desk



It is indeed a privilege and pleasure for me to present the 7th Annual Report of the Science and Engineering Research Board (SERB) giving a comprehensive account of the efforts and achievements of the organization in the year 2017-18.

SERB in a short span of its constitution as an independent entity has progressively spread its wings to rise ever higher and make a tangible and meaningful impact on S&T ecosystem of the country. The increasing diversity and reach of SERB's programmes, schemes and fellowships, has ensured that we not only connect with all nooks and corners of this vast nation, but also balance its interventions towards the needs of our stakeholders across various disciplines, institutions and beyond physical boundaries.

It's been an interesting journey for the SERB, wherein we are trying to ensure that the new organization is enriched with requisite infused energy and vigor. This is being achieved through revamping of the existing schemes, as well as conceiving and implementing new schemes to cater to the diverse needs of scientific community.

Indian science scenario has seen rapid and unprecedented changes in the past few years and SERB has constantly endeavored and innovated to respond to this ever dynamic environment. This is reflected in many new initiatives launched by SERB in the year under review. SERB has formally announced and launched few new schemes, Teacher Associateship for Research Excellence, Overseas Visiting Doctoral Fellowship & Distinguished Investigator Award and Mathematical Research Impact-Centric Support.

Having been entrusted with the responsibility of steering the organization in recent times, I take pride in leading SERB's committed team of dedicated scientists, administration and other support staff in propelling the organization to play a useful role in the country's quest to achieve developmental targets for the good of its citizens. I would like to put on record my sincere gratitude and genuine appreciation to the SERB governing team of members, SERB officers, members of the Programme Advisory / Expert committees, all partners and stake holders for their steadfast support and encouragement.

I am confident that with everyone's shoulder to the wheel, SERB will continue to achieve its goals to position Science and Technology on the fulcrum of social and economic change in the country.

Dr. Rajiv Kumar Tayal
Secretary, SERB

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1 Organizational Structure

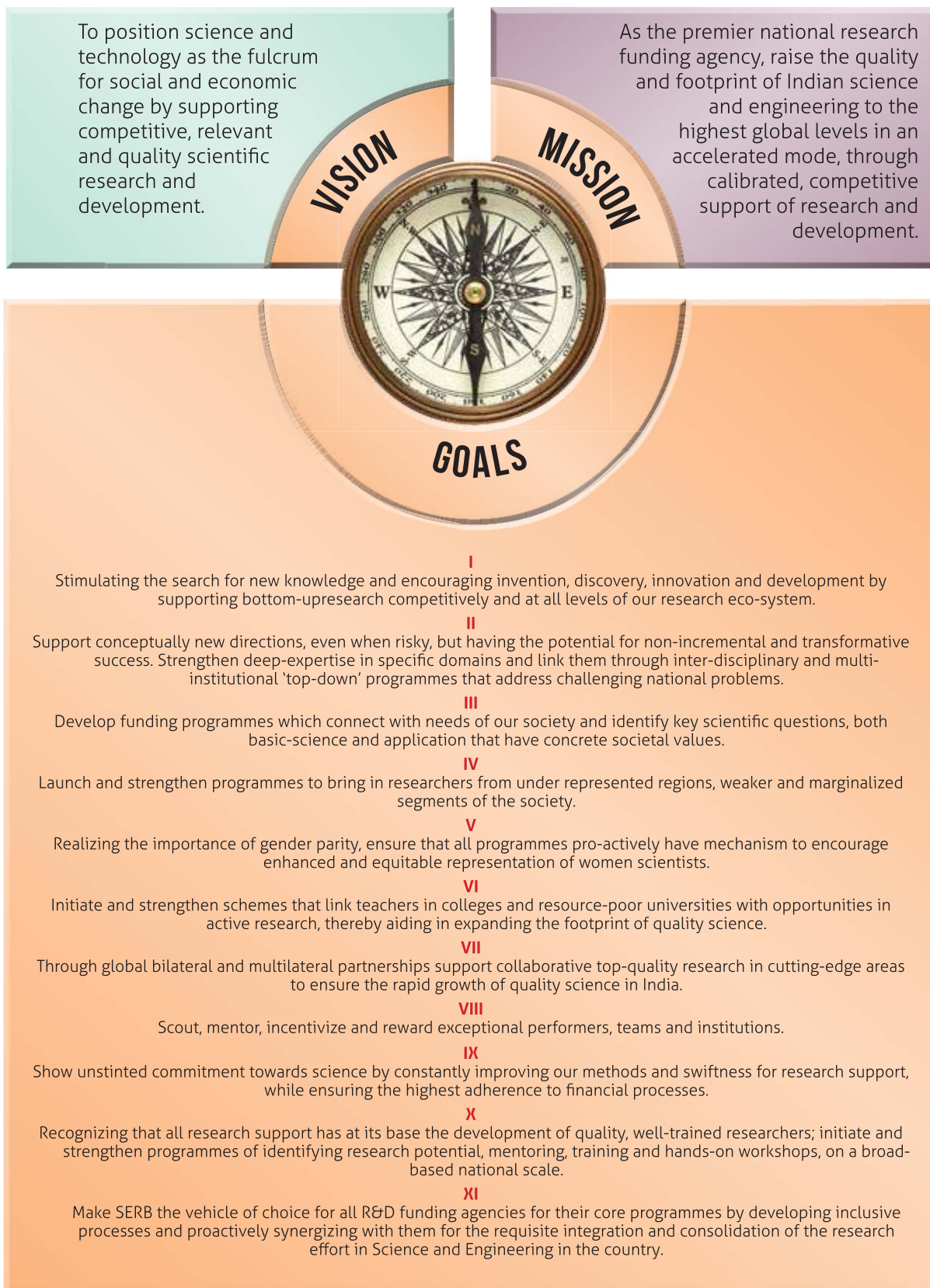
The origin of Science and Engineering Research Board (SERB) can be traced back to the erstwhile Science & Engineering Research Council (SERC), Department of Science and Technology (DST), Government of India, that provided extramural funding for S&T research in India for more than four decades. Creation of SERB, in the year 2011, is considered an important institutional milestone in the Indian S&T ecosystem. Established through an Act of Parliament, SERB is a statutory body with requisite financial autonomy for performing its mandated functions. Chaired by Secretary, DST, the Board comprises of few eminent members that includes seven Secretaries to the Government of India. An Oversight Committee advises and assists the Board. Figure 1 depicts the current office premises of SERB at Vasant Kunj, New Delhi.



Figure 1 : SERB office premises – where we support good science ideas grow and work

1.1 VISION, MISSION AND GOALS

To better focus its energies and resources on realisation of its mandate, SERB defined its vision, mission and goals during the year under review.



1.2 ORGANIZATION CHART

In the present organization structure of SERB, the Secretary is broadly assisted by Programme Advisors and Director (Fin. & Admin.) given in Figure 2.

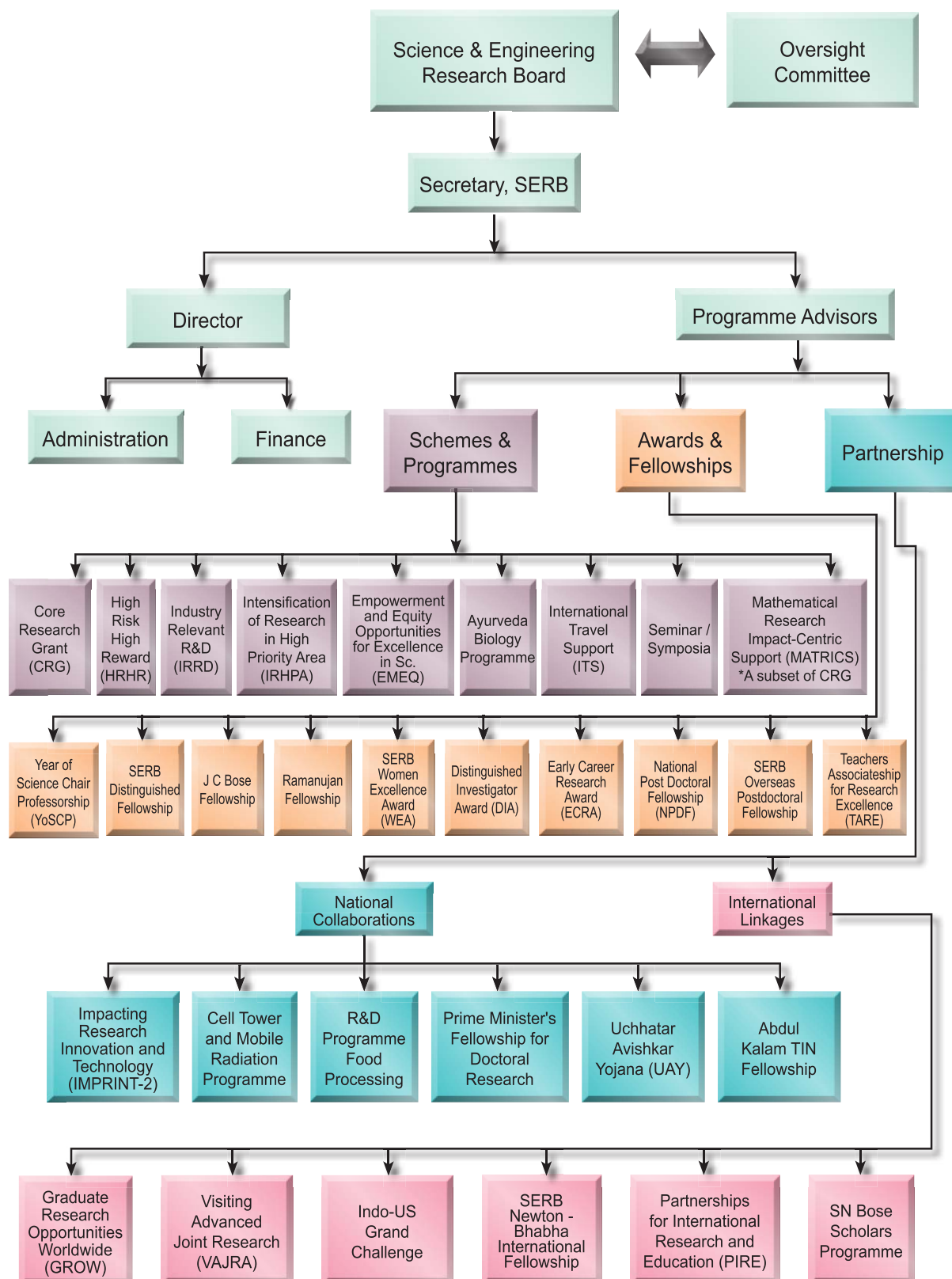


Figure 2 : Broad Organization Chart - SERB.

1.3 BOARD & OVERSIGHT COMMITTEE (2017-18)

The following members of the Board and Oversight Committee steered the organization during complete or major part of the year under review 2017-18 (Figure 3).

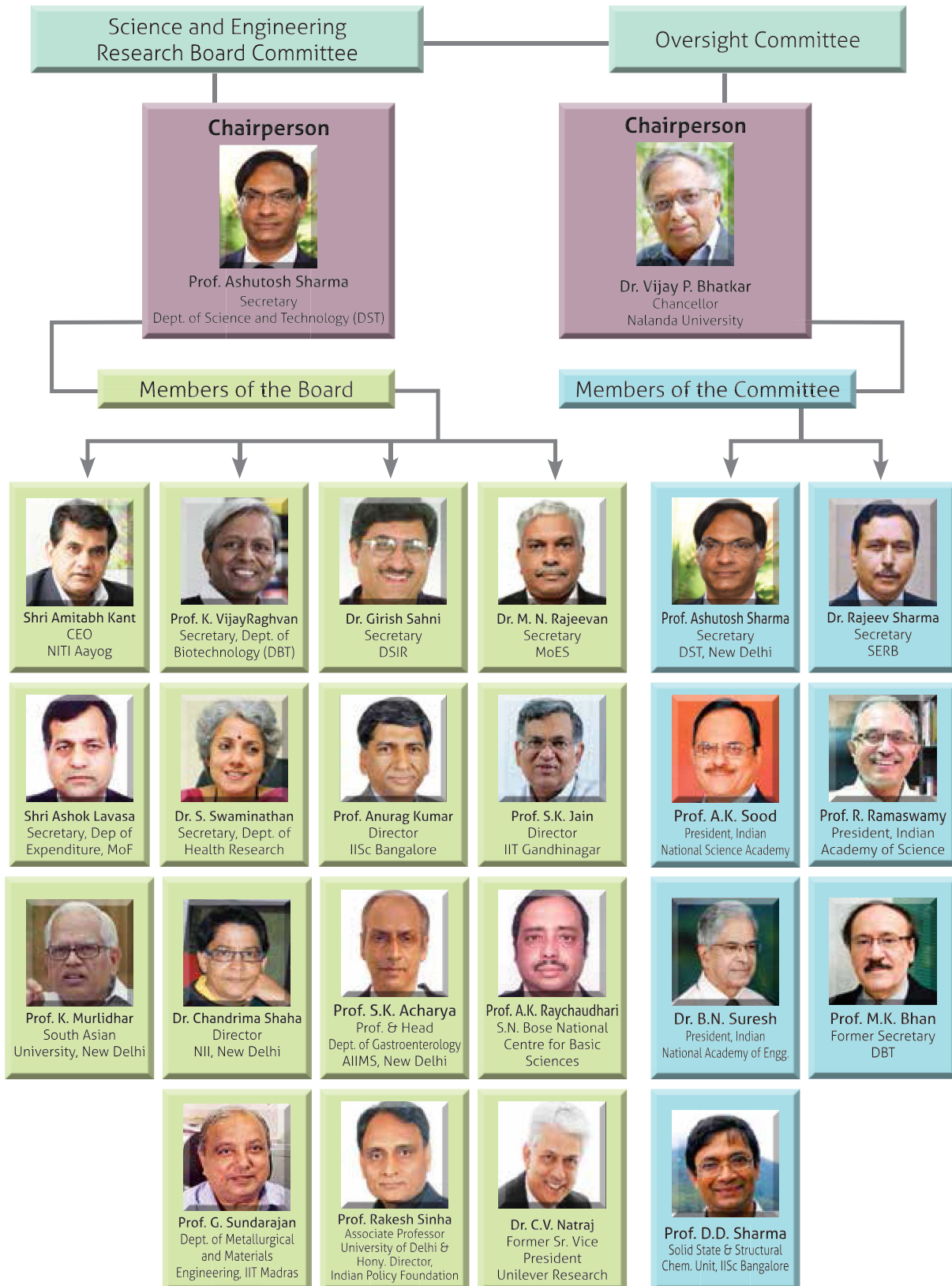


Figure 3 : Organization Structure; Board & Oversight Committee.

2 Overview

The mandate of SERB is to promote S&T research through appropriate policy interventions and to provide extramural funding to academic institutions, research laboratories and other R&D organisations for carrying out basic research in frontier areas of science and engineering. SERB strives to serve the needs of researchers through quick and responsive funding decisions. To achieve this, the Board has put in place the required policy and administrative framework that overrides conflicts of interest of grant seeking applicants, reviewers, committee members as well as SERB officers to bring its functioning at par with leading global R&D funding agencies. The aim is to bring-in greater transparency and increased accountability to assure the general public that processes followed are fair and non-discriminatory.

2.1 GROWTH PROFILE

2.1.1 MILESTONES

The Board has come a long way in its journey from the erstwhile SERC to its current profile as depicted. Some of the major milestones are shown in Figure 4.

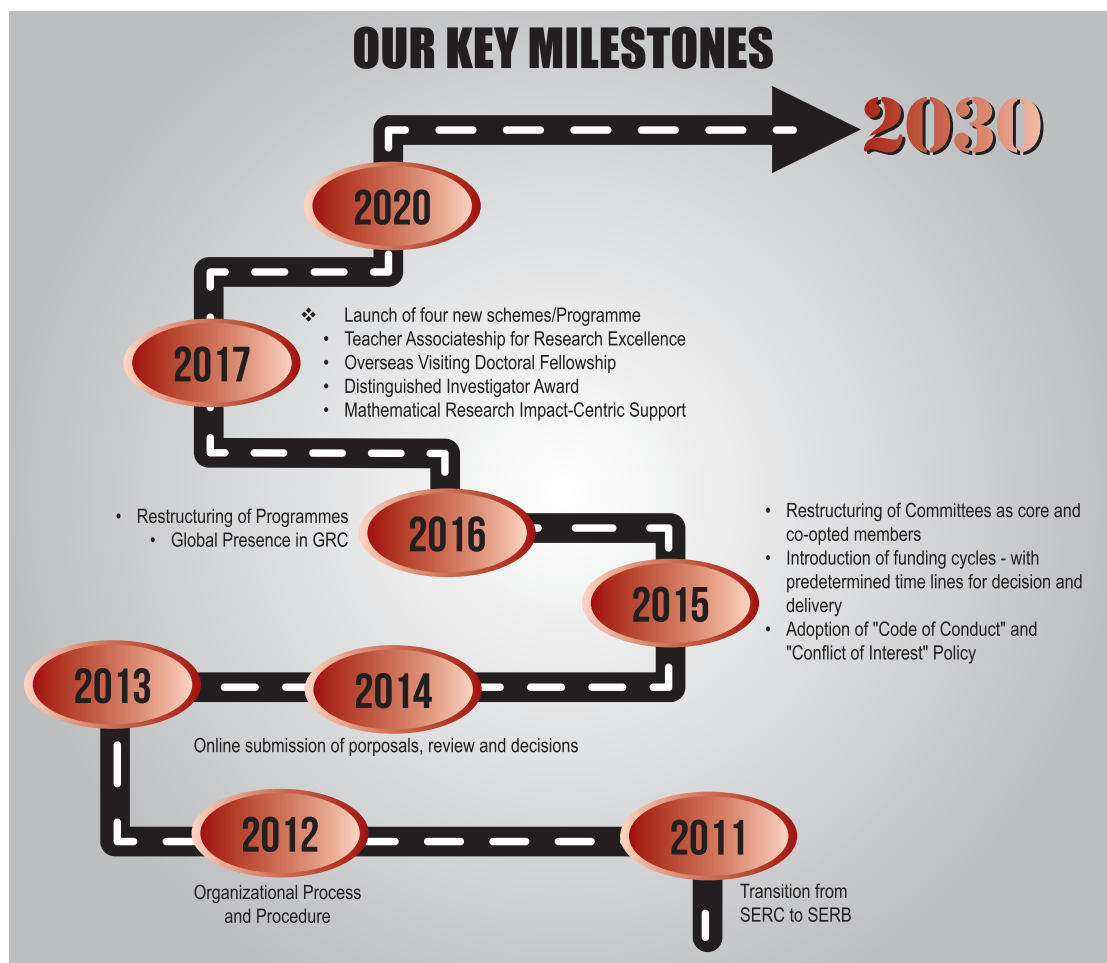


Figure 4 : Key Milestones of SERB since inception

2.1.2 NEW SCHEMES

Over the last seven years, SERB has grown manifold not only in terms of its budget outlays, but also in terms of number of schemes being implemented targeting various segments of the scientific community. On an average, SERB has been instrumental in initiating and implementing three to four new schemes, programmes or fellowships every year (Figure 5).

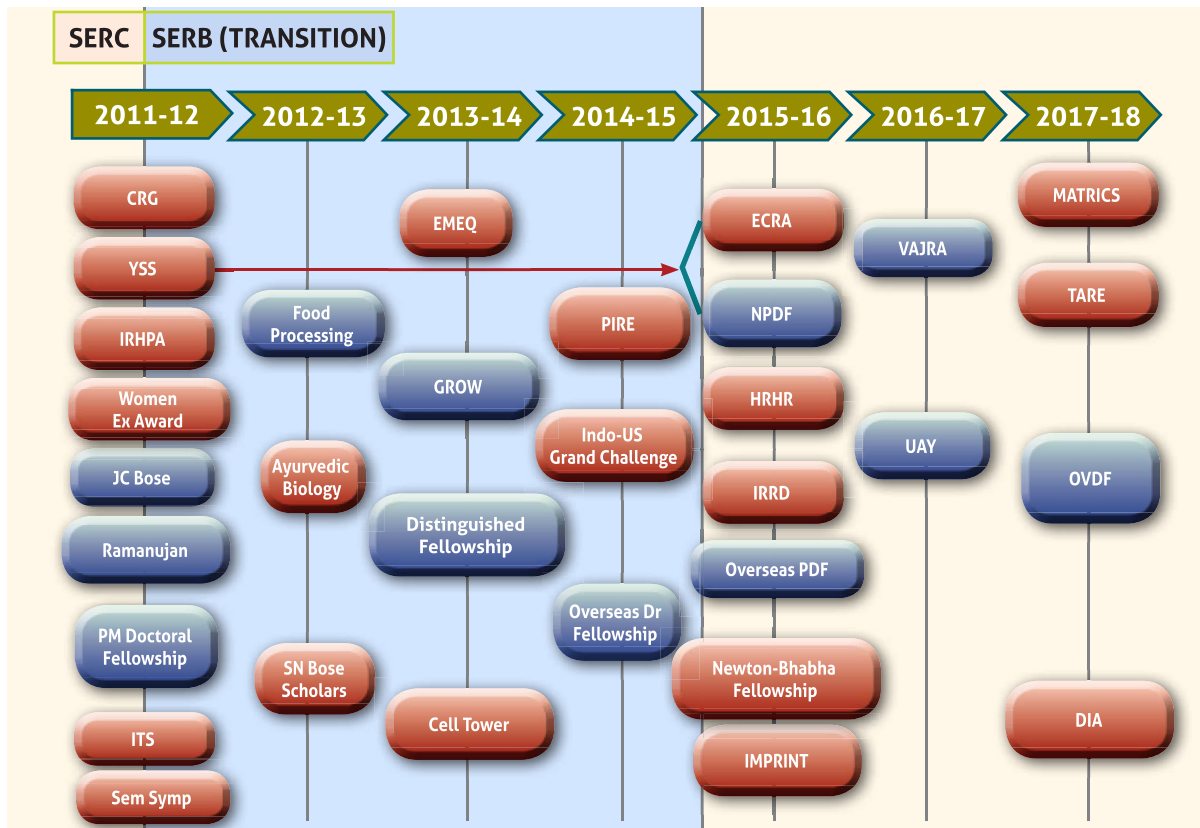


Figure 5 : The Growth Profile of SERB Programmes during last few years.

2.1.3 BUDGET TRANSITION

As can be seen from picture, there has been steady growth in SERBs budget during the last seven years. Almost all the budget allotted was disbursed during these years (Figure 6).

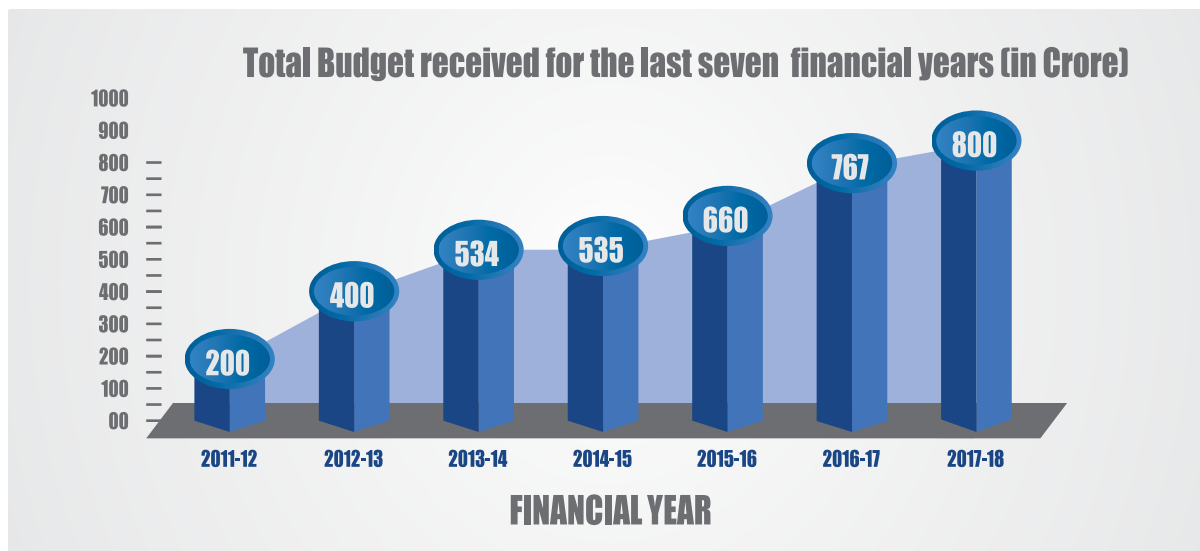


Figure 6 : Budget allocated as grant to SERB.

2.2 GOVERNANCE THROUGH VALUE SYSTEM

At SERB, we always believe that "Excellence"-contrary to the popular belief for being a fixed destination, is a moving target indeed. Taking this as cue, we are making all the efforts to deliver performance par excellence across all parameters through following mechanisms: -

Efficiency: R&D proposals are invited through "Call for Proposals" at regular periodicity with clear timelines announced for submission, review, decision and fund disbursal.

Timeliness: Efforts made to ensure that funding commitments do not get carried forward to the next funding cycle, by way of a single minded pursuit delivery of goals and tasks.

Optimal Resource Utilisation: Limited resources

in hand are utilized by the organization optimally to ensure the effectiveness of operational processes.

Innovation: As has always been the case, this year too several new innovative programmes and schemes have been initiated focusing on different segments/levels of researchers and teachers.

Code of conduct: A 'Code of Conduct' and 'Conflict of Interest' policy has been enunciated for all grant applicants (including collaborators), reviewers & committee members and officers associated with various programmes of the Board. The aim is to bring more transparency, increased accountability in funding mechanisms and provide assurance to the general public that processes followed are fair and non-discriminatory.

2.3 OUR SIX PILLARS OF SUCCESS

SERB seeks to achieve its mandated objectives through activities built around six programmatic themes, referred here as "pillars". The Board provides a dynamic vehicle of choice catering to

the diversified needs of institutions engaged in S&T research by developing inclusive processes to implement programmes and schemes listed under these pillars (Figure 7).

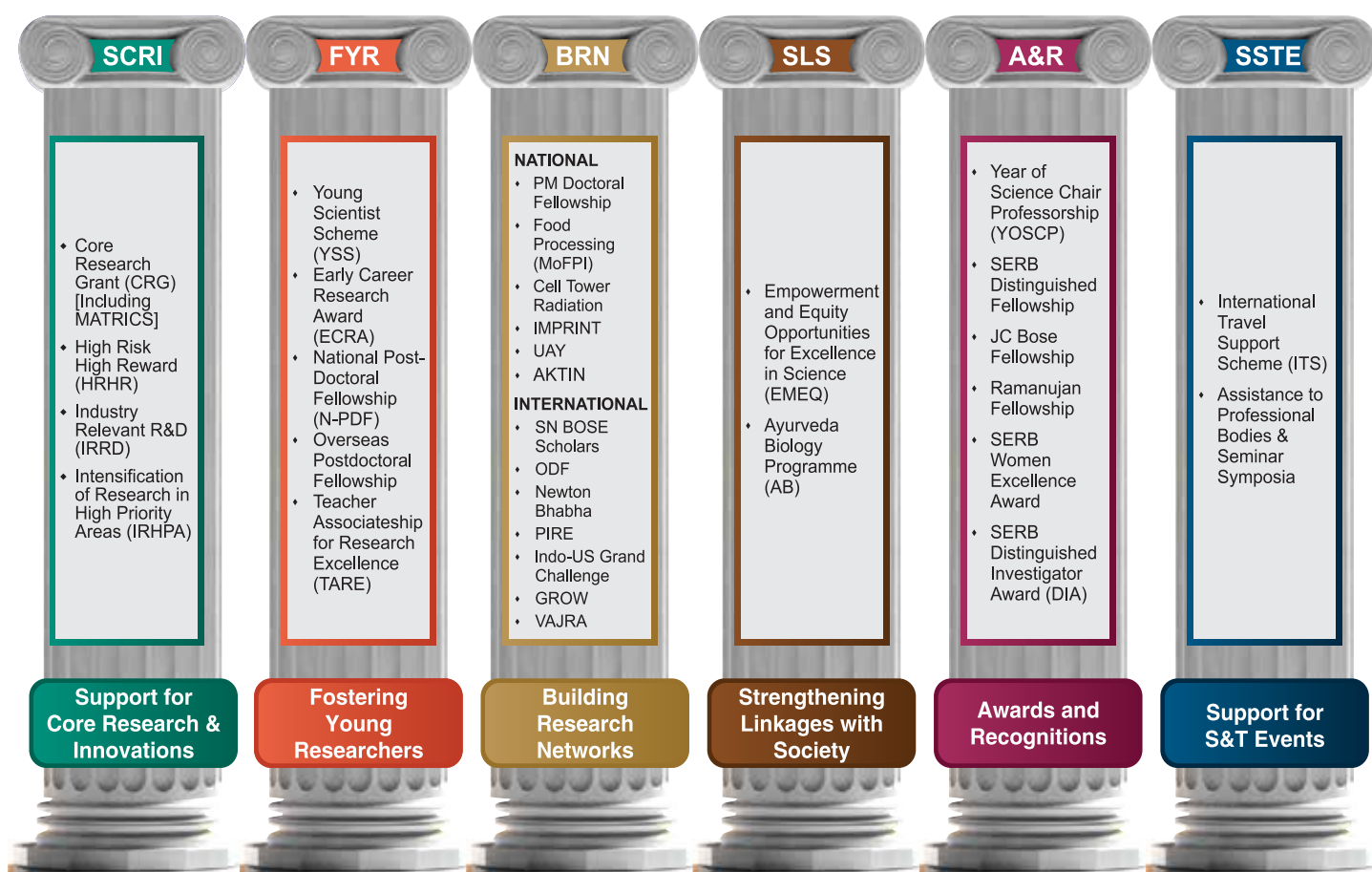


Figure 7 : Six Pillars of Success in SERB

2.3.1 PILLAR 1: SUPPORT FOR CORE RESEARCH & INNOVATIONS (SCRI)

SCRI is the most vital pillar of SERB. The activities are broadly centred around four of its components, namely individual centric Core Research Grant (CRG), High Risk High Reward (HRHR), Industry Relevant R&D (IRRD) and Intensification of Research in High Priority Areas (IRHPA). These schemes are described below:

❖ Core Research Grant (CRG)

Individual centric competitive mode of funding is provided under the CRG. The Board supports potential scientists, without any upper limit on funding, for undertaking research in frontier areas of S&T. The grant is provided for manpower, equipment, consumables, travel, contingencies and overheads. The call for proposals is solicited two times a year. A total of 5162 proposals were received and 746 have been funded under different disciplines during the year.

Another innovative scheme Mathematical Research Impact-Centric Support (MATRICS) with a cap on upper limit to funding was launched, as a subset of CRG group in the discipline of "Mathematical Sciences"; in order to further encourage research in the stream. The salient features of this scheme launched during 2017-18, are as follows: -

- **MATRICS** : The new grant scheme with a cap on upper limit to budget is aimed to provide fixed grant support to active researchers with good credentials in Mathematical Sciences. The main attribute of this scheme is to encourage R & D in mathematics through submission of a simple 1-2 page mathematical proposal. The grant provided would cater to the specific needs of Mathematical Sciences research. The funding is provided normally for a period of three years, with a limited budget of a total of Rs. 6.00 lakh as an upper

cap for three years (Rs. 2.00 Lakhs per year). A total of 2347 proposals were received and committee recommended 188 proposals during the year

❖ High Risk High Reward (HRHR)

The HRHR is aimed at supporting proposals that are new, challenge the existing hypothesis and provide 'out of box' thinking on important problems in Science and Technology. HRHR projects contain significant risk elements but promise of high reward, if the difficulties could be circumvented. The funding is provided normally for a period of three years. A total of 181 proposals were received and only one has been funded during the year.

❖ Industry Relevant R & D (IRRD)

The IRRD is aimed to support ideas that address a well-defined problem of industrial relevance. The proposal is jointly designed and implemented by the academic partner (which includes a partner from national laboratories/recognized R&D institutions as the case may be) and industry. The funding is shared between SERB and Industry. The industry share should not be less than 50 % of the total budget. A total of 36 proposals were received and three has been funded during the year.

❖ Intensification of Research in High Priority Areas (IRHPA)

The IRHPA supports proposals in high priority areas where multidisciplinary/ multi-institutional expertise is required and which will put our nation on international science map. Call for proposals in identified areas is made almost every year. One new project was funded and many other ongoing mega projects were continued to be supported during the year under review.

2.3.2 PILLAR 2: FOSTERING YOUNG RESEARCHERS (FYR)

This pillar FYR is aimed at providing young researchers in India an opportunity to focus on a freely chosen research theme based on their innovative ideas. The pillar achieved its target of fostering and securing young researchers through following segments:-

❖ Early Career Research Award (ECRA)

The scheme aims to provide research support to young researchers who are in their early career for pursuing exciting and innovative research in frontier areas of science and engineering. The

Early Career Research Award is a one-time award and carries a research grant of up to Rs. 50.00 Lakhs for a period of three years. A total of 2107 proposals were received and 426 have been funded under different disciplines.

❖ National Post-Doctoral Fellowship (NPDF)

The NPDF is aimed at identifying motivated young researchers and provide them support for doing research in frontier areas of science and engineering. The fellows are to work under

a mentor and this opportunity provides them a platform to develop as independent researchers. The fellowship is a temporary assignment tenable initially for a period of 2 years. A total of 3106 proposals were received and 1143 have been funded under different disciplines.

❖ **Overseas Postdoctoral Fellowship (OPDF)**

This fellowship is meant to enhance the research capacity and global prospective of Indian scholars. The applicants should have completed a Ph.D. degree within the past preceding two years from any recognized institution in India. Fellowship amount of US\$3000 per month and a one-time contingency/preparatory allowance

2.3.3 PILLAR 3: BUILDING RESEARCH NETWORKS (BRN)

The Pillar BRN is aimed at providing networks for collaborative research opportunities both within the country and abroad. This is also important for establishing long term relationships among scientists and technologists engaged in S&T research.

2.3.3.1 PARTNERSHIP PROGRAMMES-NATIONAL

❖ **Prime Minister's Fellowship for Doctoral Research**

The Prime Minister's Fellowship Programme for Doctoral Research is a Public-Private Partnership between SERB and the Confederation of Indian Industry. The scheme is for supporting aspiring Ph.D. scholars with a double scholarship, 50% of which is provided by government (SERB) and balance 50% by a sponsoring industry for doing industrial research for a period of four years. A total of 64 proposals were received and 19 fellows were supported during the year under two sanctions.

❖ **R & D Programme on Food Processing**

This programme developed in partnership with Ministry of Food Processing Industries (MoFPI), Govt. of India. It aims to extend financial assistance to individual scientists working in various institutions/universities, public funded organizations and recognized R&D laboratories both in public and private sector, to promote and undertake demand driven R&D work in the field of Food Processing Sector for product and process development, design and development of equipment, improved storage, shelf-life, packaging etc. A total of 19 projects are ongoing under the programme.

of Rs. 60,000/- is also are provided to each fellow. Overseas Medical Insurance in India and USA of Rs. 20,000/- and conference grants (if applicable) of Rs. 74,000 is also admissible. A total of 37 proposals were funded under different disciplines.

❖ **Teacher Associateship for Research Excellence (TARE)**

TARE is a new programme conceived and approved by the Board during the previous financial year. This scheme aims to facilitate mobility of faculty members working in a regular capacity in State University / Colleges and in private Academic Institutions to carryout research work in an established public funded institution.

❖ **Cell Tower and Mobile Radiation Programme**

The programme aims at studying the effects of EMF radiation exposed from the mobile towers and handsets on living beings. This study is jointly supported by SERB and Department of Telecommunication, Ministry of Communication. A total of 19 studies have been undertaken under the programme.

❖ **IMPacting Research INnovation and Technology (IMPRINT-2)**

IMPRINT, a national initiative of the Ministry of Human Resource Development (MHRD) is designed to address major engineering challenges relevant to India through an inclusive and sustainable mode of translational research has now reached its next phase IMPRINT-2. The phase 2 of the programme has been launched with a revised strategy wherein this national initiative shall be jointly funded and steered by MHRD and Department of Science and Technology (DST). An announcement was made for inviting preliminary proposals on March 23, 2018. 2145 proposals were received which pruned down to 1632 after initial scrutiny. These will now be further evaluated for decision making on funding.

❖ **Uchhatar Avishkar Yojana (UAY)**

The UAY has been launched by the MHRD with a view to promote innovation of a higher order that directly impacts the need of the industries, thereby improving the competitive edge of Indian manufacturing capabilities. While MHRD funds 50% of the project cost, industry and other participating ministries share the balance project

cost (25% each). At present, SERB is continuing to contribute partial funding support to 30 projects under the UAY.

❖ **Abdul Kalam Technology Innovation National (AKTIN) Fellowship**

AKTIN fellowship has been initiated during the year to recognize, encourage and support translational research by Indian Nationals. Indian National Academy of Engineering (INAE) will co-ordinate and award outstanding engineers for excellence in engineering, innovation and technology development in association with SERB-DST. All areas of engineering, innovation and technology will be covered by this fellowship. The duration of the fellowship will be initially for three years. The nominations can be sent by the Heads of the Institutions/Organizations, Presidents/ Fellows of National Science/ Engineering Academies, SS Bhatnagar Awardees and JC Bose Awardees. The proposals are accepted throughout the year. Maximum of 10 Fellowships will be awarded per year.

2.3.3.2 PARTNERSHIP PROGRAMMES – INTERNATIONAL

❖ **S. N. Bose Scholars Programme**

S.N. Bose Scholars is a dynamic student exchange programme developed in partnership with Indo-U.S. Science and Technology Forum (IUSSTF) and WINStep Forward, USA. It provides an opportunity to Indian and U.S. students to undertake a research internship. The internship is conducted for 50 Indian students to intern at partner universities in the US for a period of 10-12 weeks beginning each summer. The programme also supports 30 US students to intern at a recognized Indian educational institution for a similar duration. A total of 50 students have availed the Internship so far.

❖ **Overseas Doctoral Fellowship**

This fellowship aims to build national capacity where the talent supply of researchers in areas of interest is sub-critical by providing doctoral fellowship in selected areas in chosen overseas institutions, where an MoU exists between SERB and the international partner. Fellowship amount of US\$ 2000 per month for a period of 4 years (subject to satisfactory progress) and a contingency/preparatory allowance of Rs. 60,000/- are provided to each fellow. A total of 57 proposals were received and 7 have been funded under different disciplines in the scheme. A total of 5 students each were selected to do Ph.D. in Cambridge University & University of British Columbia and 2 each in Carnegie Mellon

University, University of California, Irvine and Rice University, Houston during the year under review.

❖ **Newton - Bhabha International Fellowship**

The Royal Society of the United Kingdom and SERB recently signed a MoU to encourage and support increased research capacity in the area of research and innovation. Accordingly, Newton - Bhabha International Fellowship Scheme which covers fields of Science, Technology, Engineering and Mathematics (STEM) has been instituted for Indian researchers. 15 fellowships are offered annually for Indian postdocs. A total of 14 researchers have been awarded the fellowship during the reporting period to carry out high quality research in leading universities and institutes of United Kingdom.

❖ **Partnership for International Research and Education (PIRE)**

PIRE is a highly prestigious international collaborative Programme of National Science Foundation (NSF) aimed at leveraging the monetary resources of funding agencies as well as intellectual capabilities of research groups all over the world in front line areas of research and education. India has joined the PIRE programme through a bilateral agreement between SERB and NSF. One project being implemented at Indian Institute of Astrophysics, Bengaluru under PIRE programme is progressing well.

❖ **Indo-US Grand Challenge**

The programme encourages research collaboration within and between India and USA through a framework (MOU) signed between SERB, India, and the National Institute of Bio Medical Imaging & Bioengineering (NIBIB), National Institute of Health (NIH), USA. The objective of the collaboration is to develop durable, reliable and affordable blood pressure measurement technologies for either passive or active monitoring of hypertension. A total of ten projects are ongoing under the scheme.

❖ **Graduate Research Opportunities Worldwide (GROW)**

GROW Programme is a partnership between SERB and the NSF, U.S.A. to provide Graduate Research Fellows of NSF with opportunities to enhance their professional development through research collaborations at top-caliber science and engineering research institutions in India. The broad objective of the GROW is to facilitate mutually beneficial research collaborations for

GROW Fellows and host researchers in India. GROW awardees have been placed at leading institutions across India. The binational Indo-U.S. Science and Technology Forum (IUSSTF) is administering the programme in India. One fellow from University of Notre Dame had undertaken research visit in National Centre for Biological Sciences, Bengaluru.

❖ **Visiting Advanced Joint Research (VAJRA) Faculty Scheme**

VAJRA Faculty scheme is a flagship programme of SERB exclusively meant for overseas scientists and academicians including Non-resident Indians (NRI) and Person of Indian Origin (PIO) /

Overseas Citizen of India (OCI) to work as adjunct / visiting faculty for a specific period of time in Indian public funded academic and research institutions. The scheme recognizes the value of collaborative research as a crucial element for information sharing among researchers for updating and acquiring knowledge and skills, and also to draw varied perspectives to solve a shared problem. During the year, 43 VAJRA faculty positions for scientists and researchers from various overseas countries were approved to work as adjunct / visiting faculty in renowned public funded academic and research institutions in India.

2.3.4 PILLAR 4: STRENGTHENING LINKAGES WITH SOCIETY (SLS)

For realising the full potential of individual talent, it is important to build inclusive, productive and nurturing bonds between various stakeholders amongst the scientific community. This is the main focus of the Pillar "Strengthening Linkages with Society (SLS)". Another aim is to develop and implement programmes that have a direct impact on the society. Various segments under the aegis of this pillar are as follows: -

❖ **Empowerment and Equity Opportunities for Excellence in Science (EMEQ)**

The EMEQ is constituted to ensure enhanced participation of weaker sections of the society in R & D. The applicant should be an active Indian researcher belonging to a Scheduled Caste/ Scheduled Tribe and working at any academic institution/ national lab or any other recognized R&D institution in the field of Science and Engineering. A total of 850 proposals were received, out of which 229 were supported for funding during the year.

2.3.5 PILLAR 5: AWARDS AND RECOGNITIONS (A&R)

In order to encourage serving as well as superannuated scientists to contribute their fullest might towards the cause of development of the Indian S&T sector, SERB offers various Awards and Fellowships to exceptionally distinguished individuals. The Pillar "Awards and Recognitions" is geared to make this happen through:-

❖ **Year of Science Chair Fellowship (YoSCP)**

This Chair Professorship was instituted to recognize outstanding contributions made by any of the Indian scientists towards excellence and highest impact in R&D in sciences at the national level as well as in the global context. It is to impart

❖ **Ayurveda Biology Programme**

The goals of the Ayurveda Biology Programme are as under:

- Development of a basic understanding of the concepts, procedures and products of Ayurveda in terms of modern sciences such as Molecular biology, Immunology and Chemistry.
- To promote Human resource development in Ayurveda Biology and related areas by offering fellowships, training opportunities, providing support to scientific meetings and workshops.
- To promote collaborative research with national institutions who are active in pursuing research activities on traditional medicine and may have shared interest in Ayurvedic biology.

A total of 75 proposals were received and only two were supported for funding during the year.

rightful glory to the profession and serve to elevate the aspirations of young and mid-career researchers. Earlier, the Chair Professorship was being looked after by DST. This year onwards, SERB has been entrusted with responsibility. A research grant of Rs. 25.00 Lakhs per annum and an honorarium of Rs. 1.00 lakh per month is given to each Fellow. The award is given initially for a period of 5 years and is extendable through assessment based on the performance and other such factors. A total of 4 ongoing and 3 new awards were supported during the financial year.

❖ **SERB Distinguished Fellowship**

SERB Distinguished Fellowship is meant for

eminent and performing senior scientists to continue active research beyond their superannuation. The scheme offers a fellowship amount of Rs. 60,000/- per month and a research grant of Rs. 20.00 Lakhs per annum for a period of 3 years, extendable by two more years. A total of 7 ongoing and 3 new awards were supported during the financial year.

❖ **J C Bose Fellowship**

J C Bose Fellowship is instituted to recognize active scientists and engineers for their outstanding performance and contributions. This fellowship is scientist-specific, very selective and are open to Indian nationals residing in India, with upper age limit of 68 years. The value of the fellowship is Rs. 25,000/- per month in addition to the fellow's regular income. Rs. 15.00 Lakhs per annum is provided as research grant for a period of 5 years. A total of 35 fellowships were awarded during the year.

❖ **Ramanujan Fellowship**

Ramanujan National Fellowships are offered to brilliant scientists (below 45 years) returning from all over the world to take up scientific research positions in India. The duration of

Ramanujan Fellowship is five years. The amount of the fellowship is Rs. 85,000/- per month. Each Fellow, in addition, receives a research grant of Rs. 7.00 lakh per annum. A total of 49 fellowships were awarded during the financial year.

❖ **SERB Women Excellence Award**

This is a one-time award given to women scientists below 40 years of age who have received recognition from any of the six national Indian science academies. These women researchers are supported with a research grant of Rs. 5.00 lakh per annum for a period of 3 years.

❖ **Distinguished Investigator Award (DIA)**

DIA has been launched to award best performing Principal Investigators (PIs) of completed SERB/DST projects which are rated "Excellent". Number of awards will be 35 per year, and total not exceeding 100 at any point in time. SERB's support will include fellowship of Rs. 15,000/- p.m for three years. In addition, as a mark of recognition of the good work PI can receive for an additional research grant, subject to submission of research proposal and its acceptance by SERB based on the peer review.

2.3.6 PILLAR 6: SUPPORT FOR SCIENCE AND TECHNOLOGY EVENTS (SSTE)

The development of science in an inter-disciplinary world depends to a very large extent, on dialogue and cross-fertilisation of ideas. This requires productive opportunities for scientists and researchers to come together to discuss issues of common interest and plan strategies to overcome challenges. The Pillar SSTE has been playing an instrumental role in fostering deliberations on pertinent scientific issues. International Travel Support (ITS) Scheme and Assistance to Professional Bodies & Seminar / Symposia are the two major categories of Support for Science and Technology Events.

❖ **International Travel Support (ITS) Scheme**

ITS is designed to provide financial assistance for presenting a research paper or chairing a

session or delivering a keynote address in an international scientific event held abroad for young scientists to attend training programmes and short-term schools/workshops/courses. A total of 1222 grants were sanctioned during the financial year.

❖ **Assistance to Professional Bodies & Seminar / Symposia**

The programme extends partial support for organizing seminar / symposia/ training programme /workshops/conferences at national as well as international level within the country. The programme also supports professional bodies in the field of S&T. A total of 568 grants under "Seminar/ Symposia" and 25 under "Professional Bodies" components were sanctioned during the year.

2.4 PROCESS AND PROCEDURAL FLOWS

The applications from the candidates in majority of the online programmes undergo the following process of scrutiny, selection and recommendation, prior to the funds are disbursed (Figure 8a & 8b).

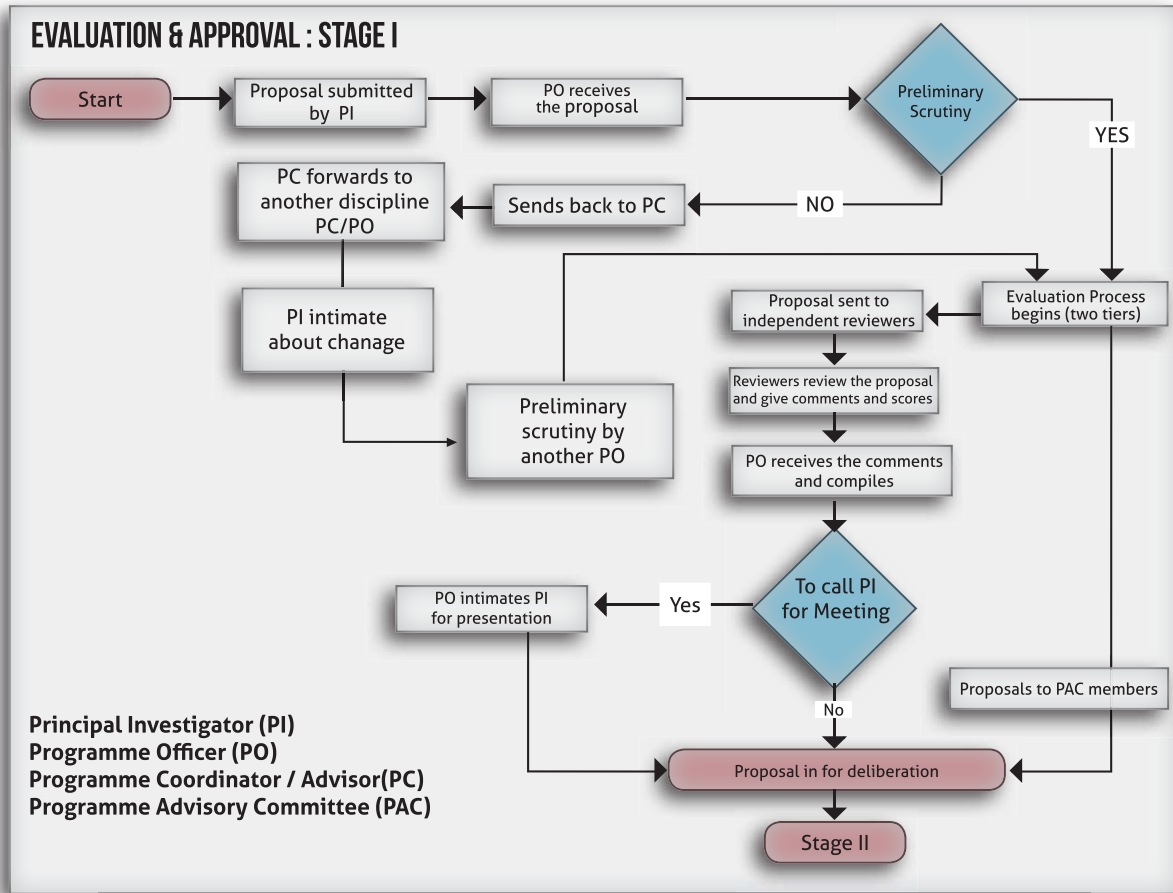


Figure 8a : Acceptance of proposal for final evaluation

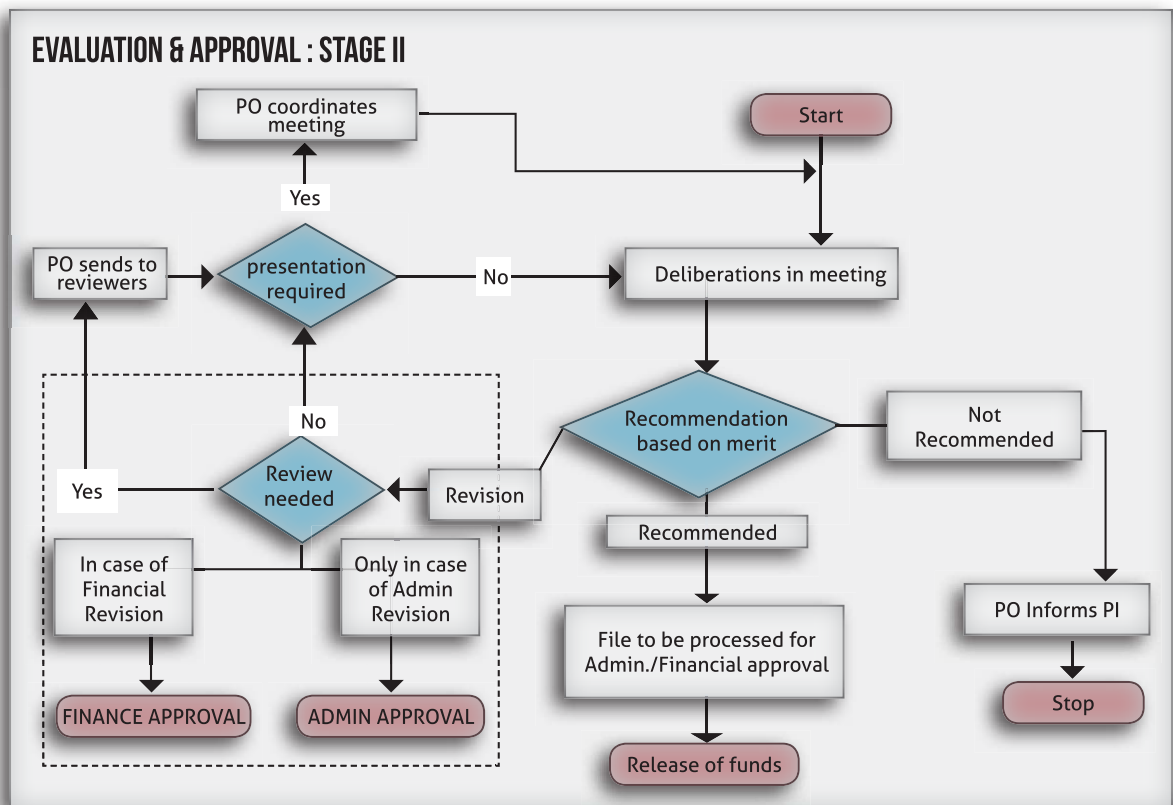


Figure 8b : Technical approval procedure prior to release of funds

2.5 NEW INITIATIVES

❖ New Schemes / Programmes

The Board has initiated new programmes having far reaching consequences in the scientific R&D sector. Some of the new schemes approved by the Board during the previous financial year and launched in the year under review as follows: -

- (a) Teacher Associateship for Research Excellence (TARE)
- (b) Distinguished Investigator Award (DIA)
- (c) Mathematical Research Impact-Centric Support (MATRICS)

First two schemes were formally announced for launch by Dr. Harsh Vardhan, Hon'ble Minister for Science and Technology on 21st January 2018, whereas MATRICS was launched earlier. Details of all these schemes have been already described in preceding paragraphs, under various pillars of success.



Dr. Harsh Vardhan, Hon'ble Minister for Science & Technology, with Secretary, DST & Secretary SERB on the launch day of new SERB schemes and programmes.

2.6 FUTURE SCHEMES

The Board has approved the following schemes during the year under review and they will be launched soon :

2.6.1 ACCELERATE VIGYAN

The objective of this inter-ministerial scheme is to have a systematic approach that can push high-end scientific research and prepare scientific manpower capable enough to venture into research careers. This programme has been

conceived and being implemented by SERB on the recommendation of Group of Secretaries (SGO-8) to give a boost to science (Figure 9). An Inter-Ministerial Committee has been constituted to steer the scheme in a mission mode.

COMPONENTS OF THE AV PROGRAM

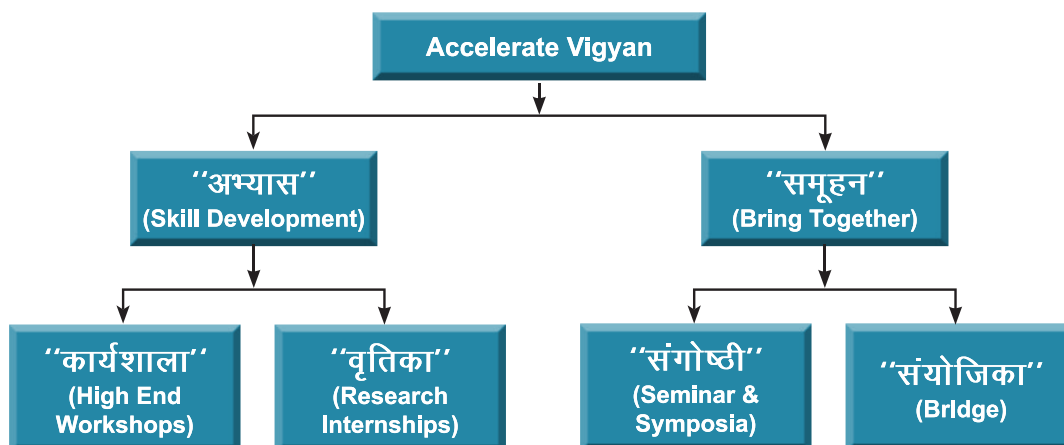


Figure 9 : Accelerate Vigyan Components

Component 1 - ABHYAAS

This mission is an attempt to boost research and development in the country by enabling and grooming potential PG / PhD level students by developing dedicated research skills in selected areas / disciplines / fields through high-end workshops and research internships. This is especially important for those researchers who have limited opportunities to access such learning capacities / facilities / infrastructure. 'ABHYAAS', as the name suggests, is about Skill Development and essentially has two components - High End Workshops & Research Internships.

Component 2 - SAMOOHAN

This mission marks the beginning of Accelerate Vigyan. It aims to encourage, aggregate and consolidate all scientific interactions in the country under one common roof. This part of the scheme through its wide knowledge base caters to a varied audience - R&D Departments, Institutes in Science & Technology as well as stakeholders - Mentors, Coordinators, Participants and Students. 'SAMOOHAN', as the name suggests, has two components - 'Seminar & Symposia' and 'Bridge', to bring the concerned stakeholders together at one platform.

2.6.2 SERB RESEARCH SCIENTISTS (SRS) SCHEME

The INSPIRE Faculty Scheme of Department of Science and Technology (DST) and Ramanujan Fellowship Scheme of the Board offer opportunities for young scientists to initiate and sustain research careers in various fields of science and engineering. However these schemes do not offer extension of the fellowship after completion of five years. In order to provide a platform for sustainment of their research for

some more time, SERB has recently approved a new 'SERB Research Scientists (SRS) Scheme' for these awardees, who fail to secure regular position after completion of five years in the respective schemes. The fellows will be called 'SERB Research Scientists'. The scheme provides them an opportunity to continue their research activities for another two years and during the interim also to explore for regular positions.

2.6.3 SCIENTIFIC SOCIAL RESPONSIBILITY (SSR)

The need of bridging scientific knowledge and social responsibility cannot be underestimated. An issue-based learning in science and technology w.r.t society and its scientific implications has always been the need of the hour. An attempt has been recently initiated in SERB to develop the "Scientific Social Responsibility"

programme, wherein the scientist across all ages/ spectrum from various institution/laboratories/ organizations would be involved to participate for the noble cause. A policy framework has been instituted to integrate and align the social responsibility activities within the gambit of SERB's influence and impact.

2.6.4 OVERSEAS VISITING DOCTORAL FELLOWSHIP

The fellowship was approved during the year for its implementation at a later date. It was announced by Dr. Harsh Vardhan, Hon'ble Minister for Science and Technology. It will support students registered for a Ph.D. Programme at an Indian institution to train for a specified duration (maximum one year) at a reputed overseas

institution. To and fro air fare, a fellowship amount of US\$2000 p.m. and a contingency grant is provided for under the scheme. The fellowship also has a provision for the faculty adviser of the student as well as the overseas collaborator to visit each other's labs.

2.7 VITAL STATISTICS

2.7.1 WORK LOAD TRENDS AND COST

It is evident from the work load trends and cost analysis given in Table 1, that the numbers of proposals being processed by the SERB have been steadily increasing and so is the associated

work load. The number of proposals being received has increased steadily over a period. As can also be seen from the statistics, the funding is becoming more and more competitive.

Table 1. Project proposals and workload trend captured during last 5 years in all the schemes

Measure	2013-14	2014-15	2015-16	2016-17	2017-18	% change in last one year
PROPOSALS						
Received	11557	11630	13769	24353	25699	05.52 (+)
Supported	3435	4589	4237	5616	4565	18.71 (-)
WORKLOAD						
Officers handling the scheme	03	08	21	21	21	Nil
FINANCIALS						
Total cost of new sanctioned projects (in Cr)	589.67	509.04	689.48	1125.16	885.47	21.30 (-)
Amount Released (Cr)	554.91	554.93	648.24	788.48	907.37	15.07 (+)
Number of releases	7158	8550	8632	9859	10633	7.85 (+)

2.7.2 PROPOSALS SUPPORTED DURING LAST FIVE YEARS

Figure 10 & 11 depict the substantial increase in funding levels and number of projects supported in the two major schemes of SERB, namely CRG and YSS (ECRA & NPDP).

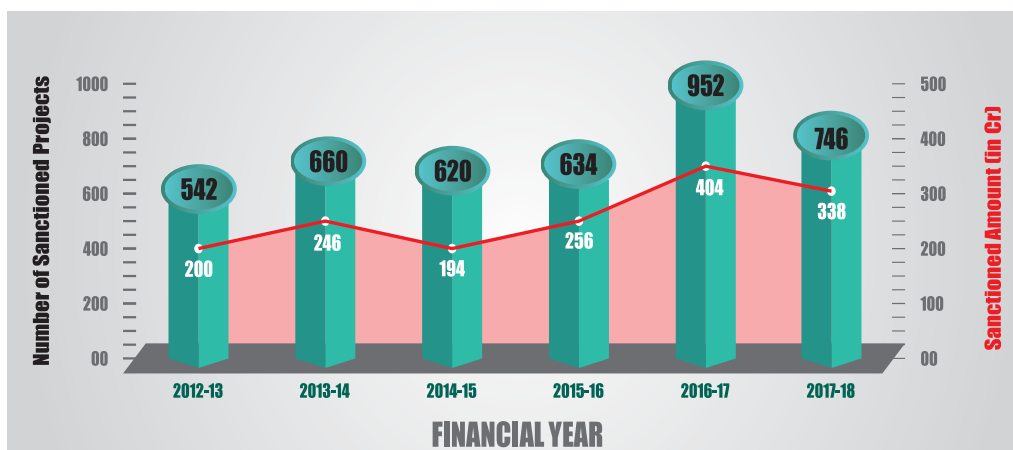


Figure 10 : Funding status under CRG scheme during last few years.

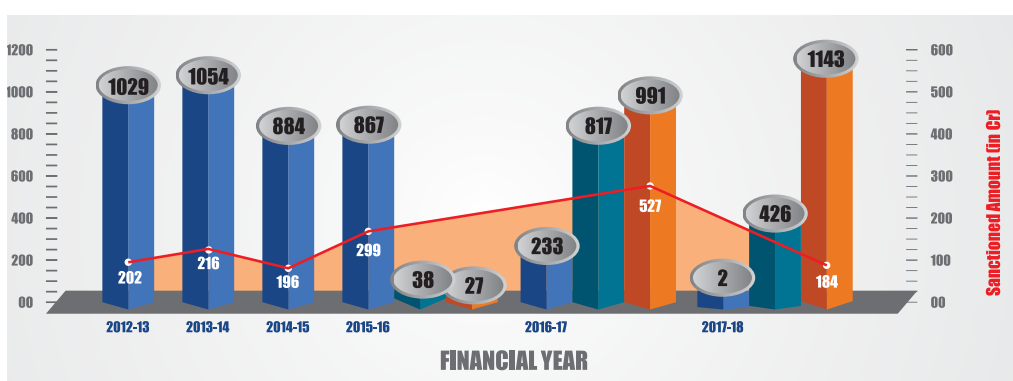


Figure 11 : Funding status under YSS (ECRA & NPDP) scheme during last few years.

2.7.3 TOTAL EXPENDITURE DISTRIBUTED FOR THE YEAR 2017-18

The pie chart shows total expenditure during the year 2017-18 under different schemes and administration (Figure 12). As is seen from the diagram, more than two-third of the funds being

disbursed by SERB are for three major schemes CRG, ECRA and NPDP (as well as erstwhile YSS). The establishment expenditure forms a miniscule part of the overall spending.

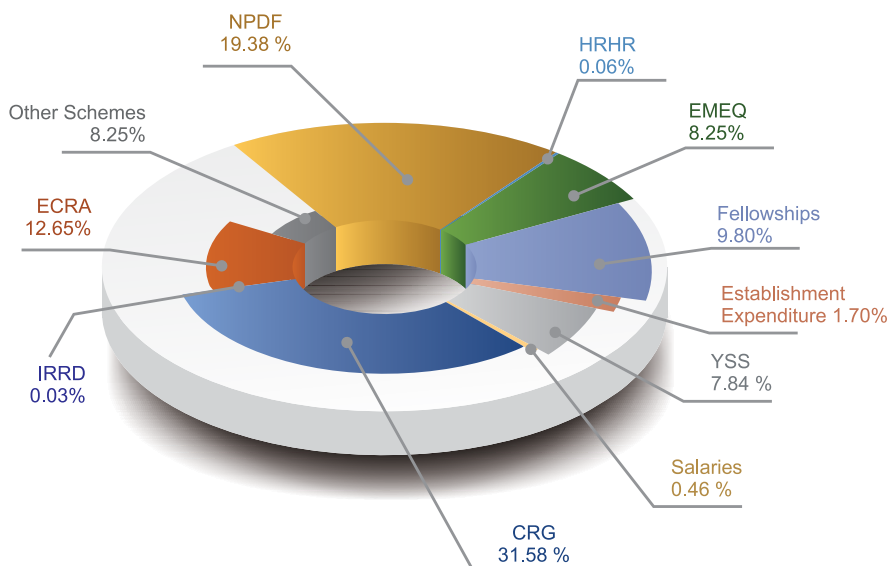


Figure 12 : The expenditure during Financial Year 2017-18.

2.7.4 PROPOSAL SANCTIONED RATE DURING THE YEAR 2017-18

Figure 13, 14 and 15 depict share of various disciplines in three major schemes of SERB namely, CRG, ECRA and NPDF during the financial year. As is evident, Life Sciences takes major

share among CRG and NPDF, followed by the Chemical Sciences. However in ECRA scheme, the major share during the year was taken away by Engineering Sciences followed by Life Sciences.

New Proposals: CRG (2017-18)

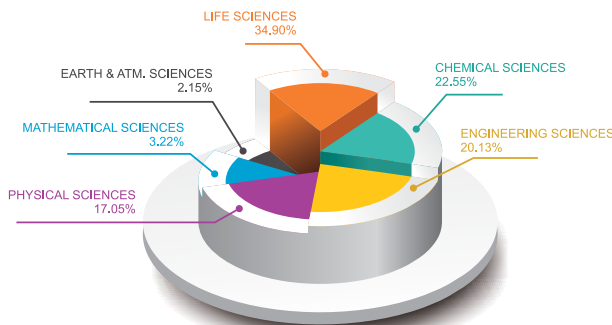


Figure 13 : Funding status under CRG scheme for the financial year 2017-18.

TOTAL (2017-18)	
Received	5162
Supported	746
Sanctioned Rate (%)	14

New Proposals: ECRA (2017-18)

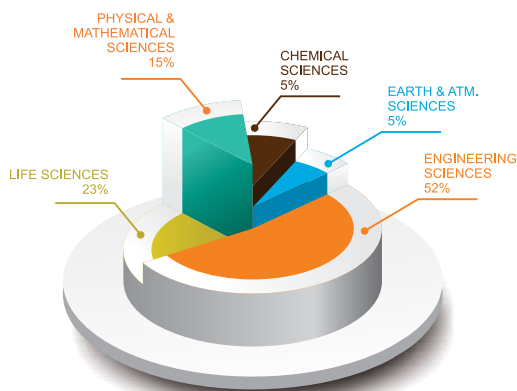


Figure 14 : Funding status under ECRA scheme for the financial year 2017-18.

TOTAL (2017-18)	
Received	2106
Supported	426
Sanctioned Rate (%)	20

New Proposals: NPDF (2017-18)

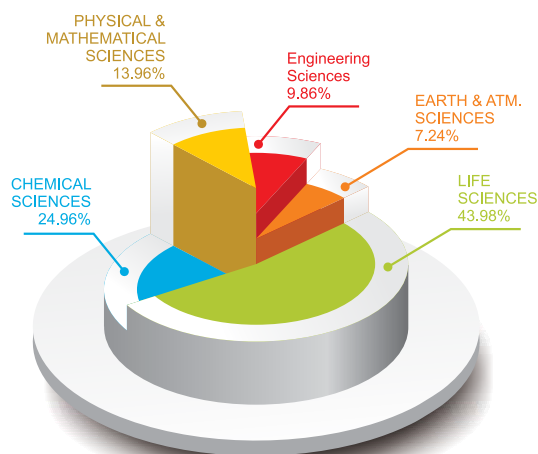


Figure 15 : Funding status under NPDF scheme for the financial year 2017-18.

TOTAL (2017-18)	
Received	3106
Supported	1143
Sanctioned Rate (%)	37

2.7.5. GRANT CATEGORIES

The details of sanctioned proposals during the year under various categories along with window opening mechanism (during last few years) for

both online and offline programmes is given in Table 2 and Table 3 respectively.

Table 2. Online Programmes

Category	Window opening (In general)	Sanctioned Projects (2017-18)
CRG	Twice in a year	746
HRHR	Throughout the year	01
IRRD	Throughout the year	03
NPDF	Twice in a year	1143
ECRA	Twice in a year	426
EMEQ	Once in year	229
Seminar/ Symposia	Throughout the year	593
Travel support	Throughout the year	1222
Prime Minister's Fellowship	Throughout the year	19

Table 3. Offline Programmes

Category	Window opening (In general)	Sanctioned Projects (2017-18)
IRHPA	Throughout the year	01
Awards and Fellowships		
SERB Year of Science Chair Professorship	Based on call	03
SERB Distinguished Fellowship	Based on call	03
J C Bose National Fellowship	Throughout the year	35
Ramanujan Fellowship	Throughout the year	49
National Collaborations and International Linkages		
Graduate Research Opportunities Worldwide (GROW)	Based on call	01
Partnerships for International Research and Education (PIRE)	Based on call	01
SN Bose Scholars Programme	Based on call	50
SERB Overseas Postdoctoral Fellowship	Once in a year	37
SERB Overseas Doctoral Fellowship	Based on call	14
Newton – Bhabha International Fellowship	Based on call	14
Ayurveda Biology Programme	Throughout the year	02

2.7.6 GENDER WISE DISTRIBUTION OF MAJOR SCHEME

Table 4. Male Female participation ratio during 2017-18

S.No	Schemes	Male	Female	Total
1	CRG	530	216	746
2	NPDF	850	293	1143
3	ECRA	265	161	426
4	EMEQ	193	36	229
	Total	1838	706	2544

The Gender wise distribution of some of the major schemes during the year under review, suggests almost 2.5:1 male – female ratio in the CRG and 2.9:1 in NPDF; whereas 1.6:1 in ECRA and 5.3:1 in EMEQ. As a whole, the male-

female ratio has improved to 2.5:1 for all major programmes. In comparison to few years ago, much greater participation of women scientists is being observed in the major schemes of SERB.

2.8 CONNECTIVITY

If one has to draw a comprehensive picture of what SERB does to connect with tens of thousands of stakeholders each year; it can be as depicted from the average numbers of grants / fellowships / programmes that were supported during last few years (Figure 16).



Figure 16 : SERB connectivity at a glance on annual basis (Averages).

2.9 CHALLENGES

Since its inception, SERB has been striving to live up to the nation's expectations as a national R&D funding agency of the country. The organisation was conceived with an aim to be at par with the global standards. This goal is being achieved through policy interventions, processes and mechanisms gear to ensure expeditious decision making. However, there are challenges in this journey, which SERB has been steadfastly trying to overcome. Some of the challenges are :-

- a. Ever increasing number of proposals as well as increasing number of schemes, programmes, fellowships and partnerships vis-à-vis the fewer manpower resources in SERB.
- b. Funding decisions becoming ever difficult due to enhanced competitiveness and cumulative liability on account of ongoing projects vis-a-vis availability of budgeted funds.
- c. Timely and quality peer review process by independent reviewer.
- d. Adopting and ensuring the conflict of interest policy on all its stake holders.
- e. Timely decisions and disbursement of funds on account of many of the above factors.

3 Supporting Core Research & Innovation

Development of new technologies and consequent innovation is rooted in basic research efforts undertaken on long term basis. Realising this critical need of core research in pushing the scientific envelop and making the country an S&T player of global level, the pillar “Support for Core Research and Innovation (SCRI)” has been developed to extend support to universities, academic institutions, research laboratories and other R&D organizations to carry out basic research in frontier areas of science and engineering. The bricks of this pillar are CRG, IRHPA, HRHR & IRRD which have been described for the respective disciplines/sub-disciplines in succeeding paragraphs. For the sake of brevity, research highlights for only one project from each domain has been included in this report as a representative from large number of individual projects supported by SERB during the year.

3.1 CORE RESEARCH GRANT (CRG)

Objective

Core Research Grant (CRG) in recent times, provides research support to individual scientists to undertake cutting edge research.

Features

This is the flagship scheme of the board accounting for almost one-third of SERB's budget.

The scheme is for those who are holding a regular academic/research position in a recognized academic institution or national laboratory or in any other recognized R & D institution in India.

INSPIRE Faculty, Ramanujan and Ramalingaswamy Fellows are also eligible to apply.

Grant covers equipment, manpower, consumables, travel & contingency.

Normal duration of projects is three years.

Website links
<http://serbonline.in/SERB/emr?HomePage=New>
<http://www.serb.gov.in/emr.php>

3.1.1 CHEMICAL SCIENCES

3.1.1.1 Organic Chemistry

During the financial year 2017-18, a total of 281 proposals were received and 64 were supported in different sub disciplines (Figure 17).

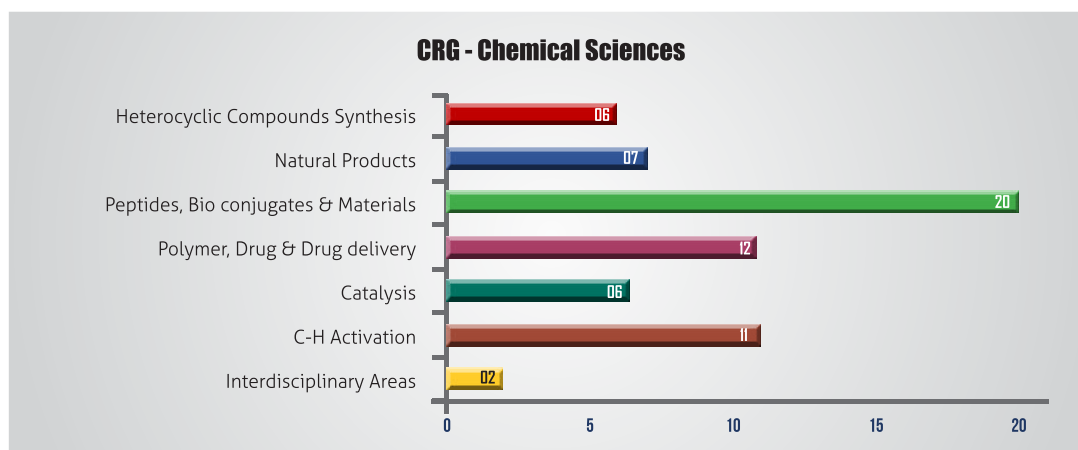


Figure 17 : Projects supported in different sub disciplines of Organic Chemistry.

Research Highlights

Environment-Responsive Fluorescent Peptide Nucleic Acid Conjugates: Design, Synthesis, and Applications in Nucleic Acid Diagnosis:

Biophysical tools that can provide a comprehensive understanding of the structure-function relationship of RNA both in real time and at atomic level always have a profound impact in advancing our knowledge of RNA functions in biology. This work describes a multifunctional nucleoside probe made of an environment-sensitive fluorescent label and an anomalous X-ray diffraction label (5-selenophene uracil), which enables the direct correlation of RNA structure and antibiotic binding in real time and in 3-dimensions. The nucleoside probe, when site-specifically incorporated into the bacterial ribosomal decoding site RNA, fluorescently signals the antibiotic binding, and provides X-ray diffraction information in determining the crystal structure without distorting the native RNA structure (Figure

18). Could support discovery platforms to identify new antibiotics against resistant bacterial strains.

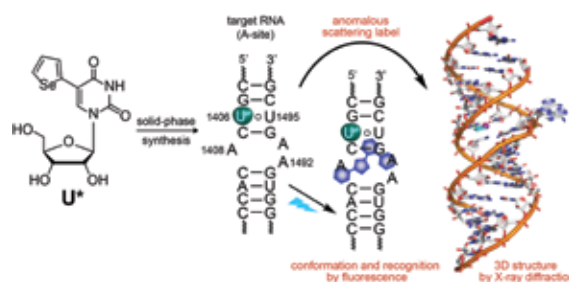


Figure 18 : Simultaneous biophysical investigation of bacterial ribosomal decoding site RNA-antibiotic interaction by fluorescence and X-ray crystallography using a conformation-sensitive “dual-app” nucleoside probe. Reference:-Nuthanakanti, A.; Boerneke, M. A.; Hermann T., Srivatsan S. G. *Angew. Chem. Int. Ed.* 2017, 56, 2640–2644 *Mater. Interfaces*, 2016, 8 (5), 3182–3192

3.1.1.2 Inorganic and Physical Chemistry

During the year, a total of 390 proposals were received in inorganic & physical chemistry and

104 were supported for funding in different sub disciplines (Figure 19).

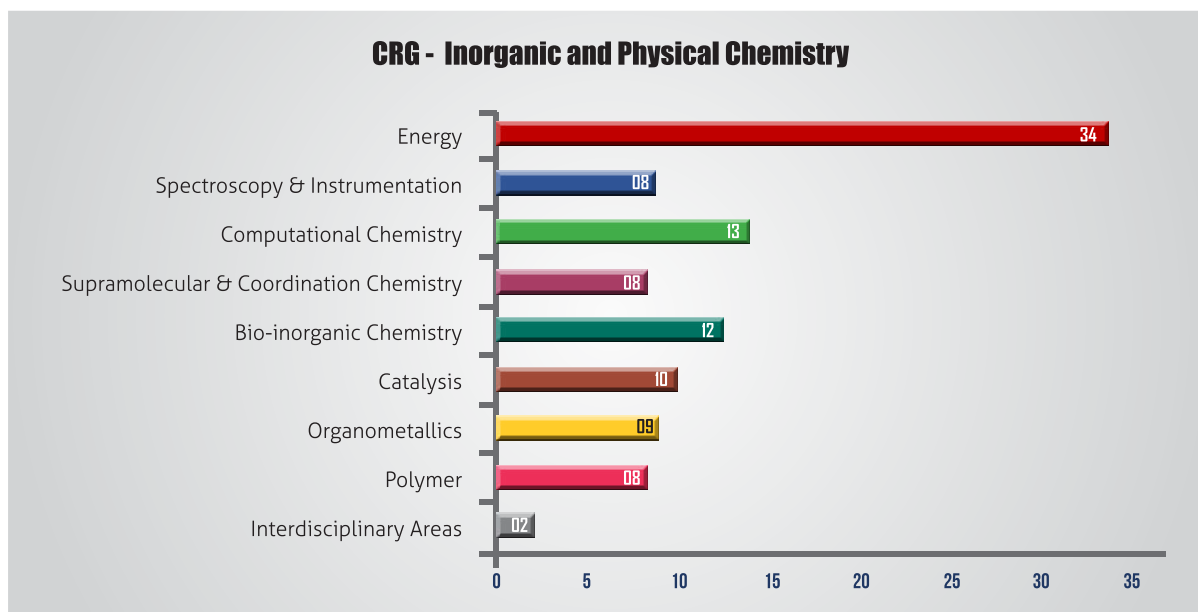


Figure 19 : Projects supported in Inorganic and Physical Chemistry.

Research Highlights

Perovskite Oxide Nanoparticle Catalyzed Overall Water Splitting Driven by Perovskite Solar Cells:

An innovative approach for transforming ubiquitous substrates such as commonly available cellulose paper and cotton fabric into inexpensive, flexible and highly catalytic current collectors for overall water splitting have been reported. A solution processed “soak-and-coat” method of electroless plating was used to render the substrates conducting by conformably

depositing metallic NiO nanoparticles which retains open macroporous framework. Proof-of-concept paper-electrodes for electrochemical water splitting were realized by modifying Ni-paper (Ni-P) with two model electrocatalysts, viz. NiFe oxyhydroxide and Ni₄Mo through simple electrodeposition route to form the NiFe/Ni-P anode and Ni₄Mo/Ni-P cathode of alkaline ‘paper-electrolyzer’. This study shows extraordinary oxygen and hydrogen evolution

reaction performances of NiFe/Ni-P and NiMo/Ni-P electrodes with favourable kinetics, robust stability in excess of 200h and flexibility. This 'paper-electrolyzer' splits water with an impressive efficiency of ~98% corresponding to a cell voltage of merely 1.51 V at 10 mA/cm², amongst the lowest reported values for alkaline

water splitting. This work has the potential to pave a new path for designing multi-functional flexible electrodes from commonly available substrates for other low-cost energy conversion and storage devices, such as a decently performing zinc-air battery fabricated in this case (Figure 20).

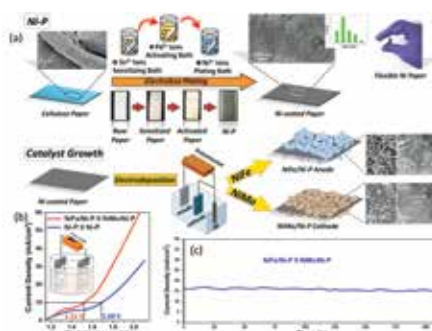


Figure 20 : (a) Schematic illustration, digital and electron microscopy images depicting the fabrication process of flexible electrodes. (b) Linear sweep voltammograms for overall water splitting. (c) Long term durability test.

3.1.2 EARTH AND ATMOSPHERIC SCIENCES

During the year, a total of 126 proposals were received in earth and atmospheric sciences and 16 were supported in different sub disciplines (Figure 21).

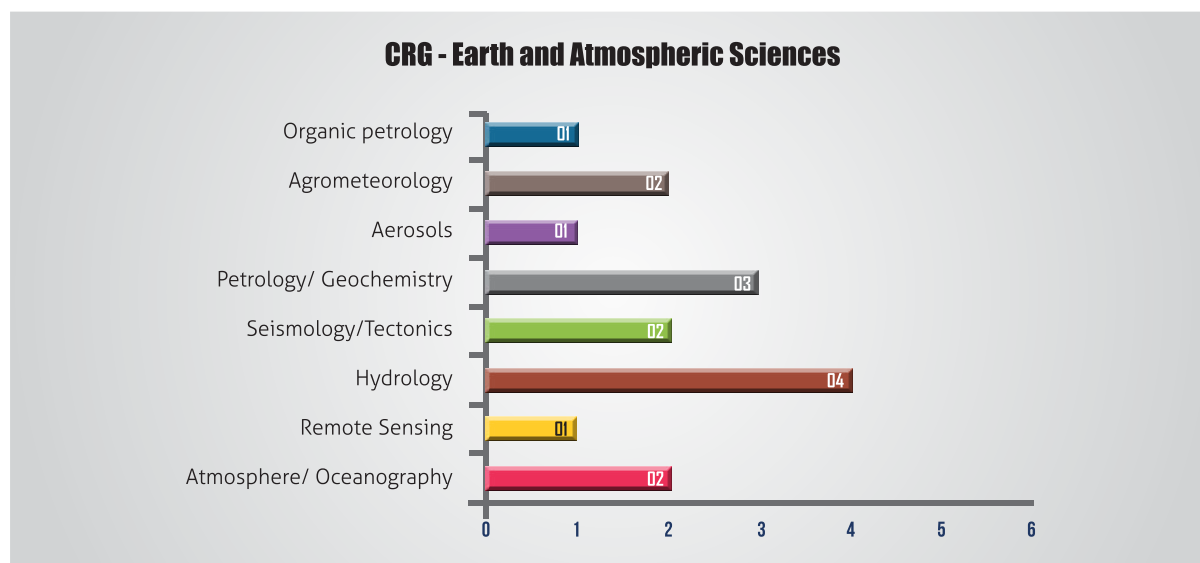


Figure 21 : Projects supported in Earth & Atmospheric Sciences.

Research Highlights

Wave and Instabilities and their role in Energetics in Geospace: Project connect nonlinearities and the turbulence associated with Alfvén Kinetic Alfvén Wave (KAW), the fast magnetosonic wave in the magnetopause. It has been observed that appearance of localized structures of KAW, may be accountable for the heating and acceleration of plasma. The presence of density fluctuations affects the formation of localized structures. Respective turbulent scaling for the different amplitude of background fluctuations has also

been studied (Figure 22). The relevance of the numerical results has been discussed with the THEMIS observations near the magnetopause. Results reveal that due to the nonlinear interplay between these waves, nature of the formation of localized structures is complex and intense in nature in quasi steady state. The steepening in the turbulent spectrum is also observed and results are found to be consistent with spacecraft observation.

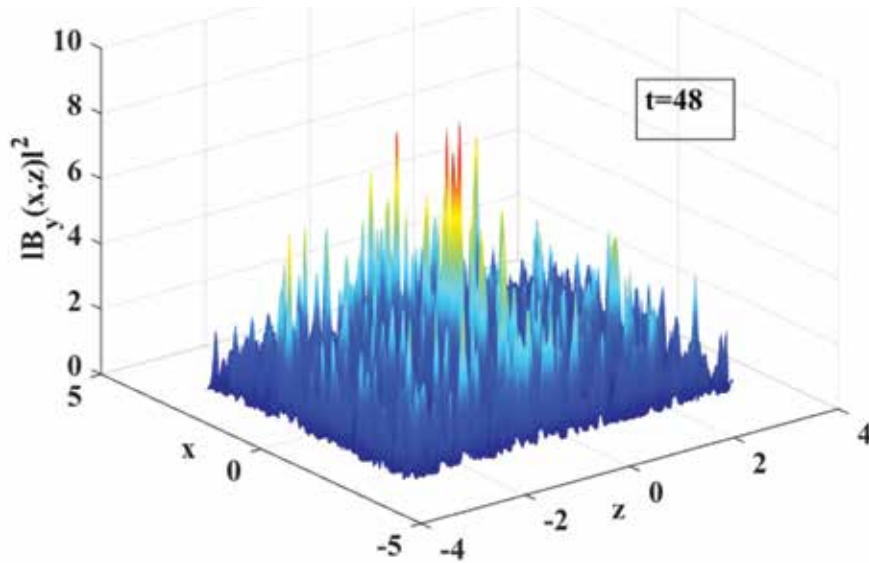


Figure 22 : The magnetic field intensity profile of KAW for magnetopause at $t = 48$, (Reference: Journal of Geophysical Research: Space Physics, 120(2), 1238-1247)

3.1.3. ENGINEERING SCIENCES

3.1.3.1 Civil and Mechanical Engineering

A total of 618 proposals were received and 33 proposals were supported in different subdisciplines (Figure 23).

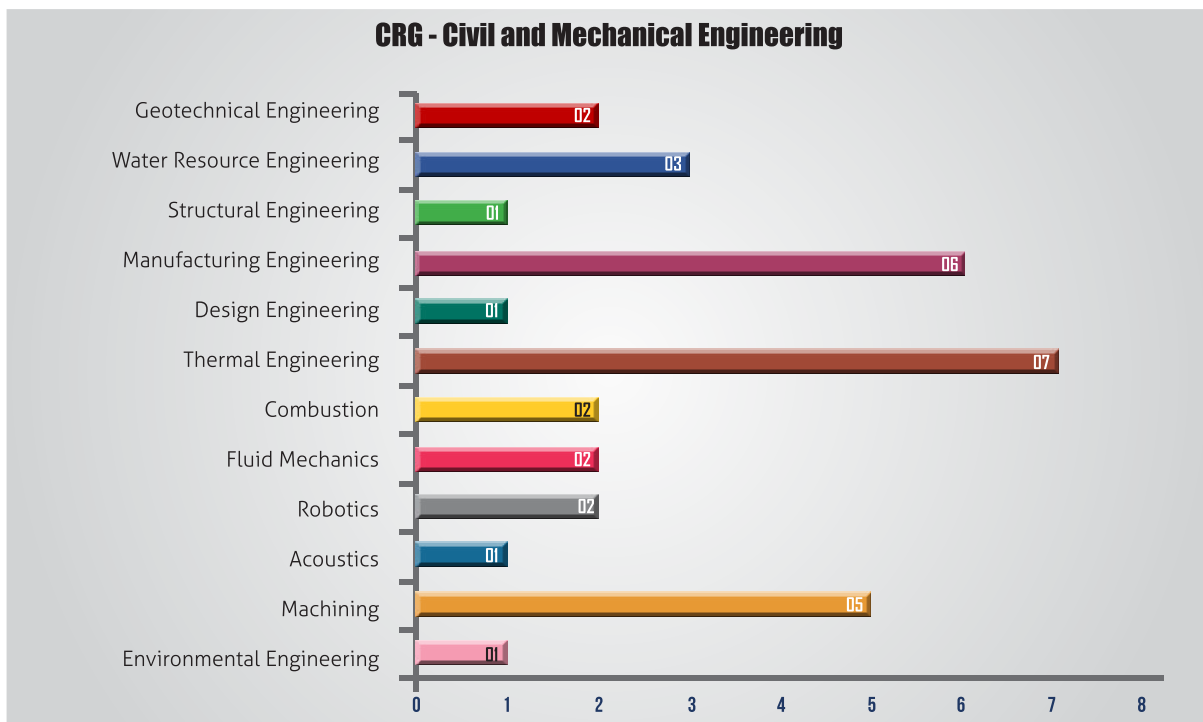


Figure 23 : Projects supported in Civil and Mechanical Engineering.

Research Highlights

Design and Development of a high speed atomic force microscope system with integrated cantilever-based chemical sensing system: A High Speed Atomic Force Microscope System with Integrated Cantilever-based Chemical Sensing System has been designed and developed at IISc

Bangalore. This is achieved by proposing a new design for the Atomic Force Microscopy (AFM) probe for high speed of operation, a new design for the actuation system, and new strategy to measure the in-plane motion of the AFM probe. (Figure 24).

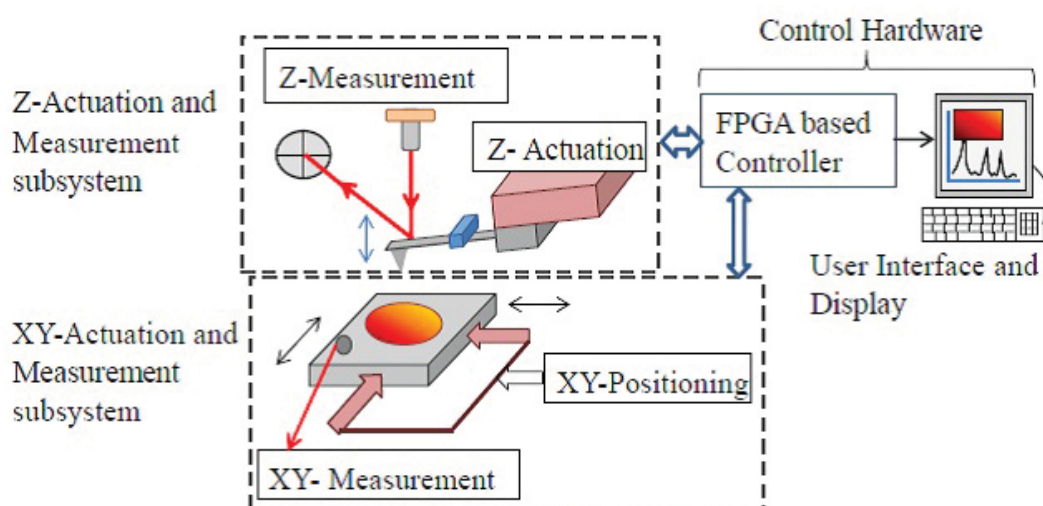


Figure 24 : Functional schematic of the in-house developed dynamic mode AFM system

3.1.3.2 Materials, Mining and Minerals Engineering

A total of 135 proposals were received and 33 were supported in different sub disciplines (Figure 25).

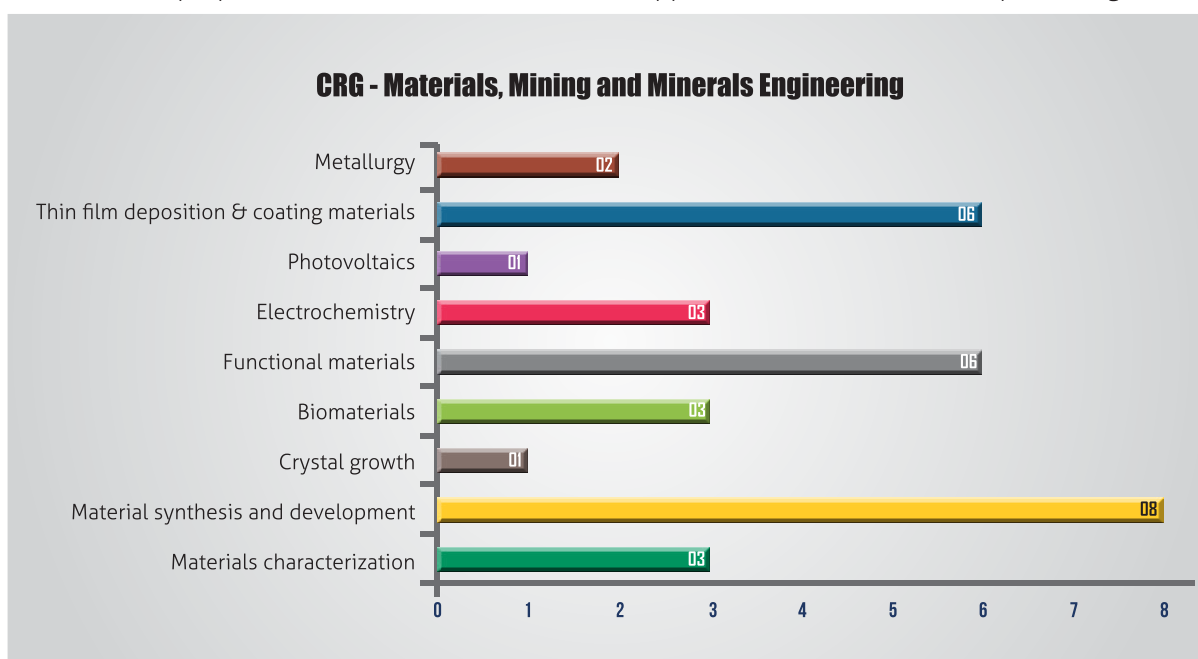


Figure 25 : Projects supported in Materials, Mining and Minerals Engineering.

Research Highlights

Metallic Tumor Marker for Breast Cancer: Design, Development and Clinical Implications: Low cost Metallic Tumor Marker Clip with MR compatible material like titanium for Breast Cancer patients has been designed and developed with collaborative efforts of IIT Delhi and AIIMS New Delhi. Such patients can be evaluated with MRI during the treatment by localizing the site of cancer through the developed technology and treated accordingly. Till date, 23 of these clips have been used. The clips were deployed using ultrasound, after instilling

local anaesthesia (Figure 26) with no major intra or post procedure complications. All patients tolerated the procedure well. No technical difficulty or failure was encountered during the use of flip-needle assembly. No displacement or migration seen on immediate post procedure mammogram or follow up ultrasound. The further follow of post chemotherapy mammogram, MRI, breast conservative surgery, reproducibility of procedure and imaging protocol are being undertaken by the research teams.

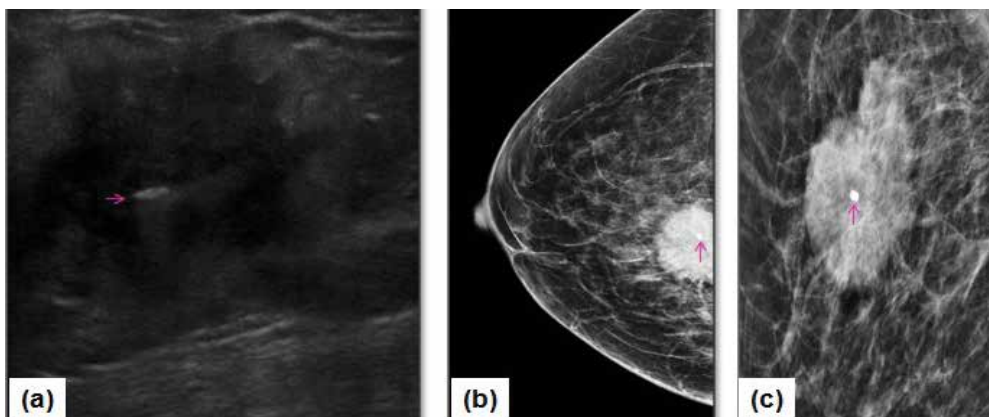


Figure 26 : Chip used in breast cancer patients

3.1.3.3 Electrical, Electronics and Computer Engineering

A total of 819 proposals were received and 48 were supported in different sub-disciplines (Figure 27).

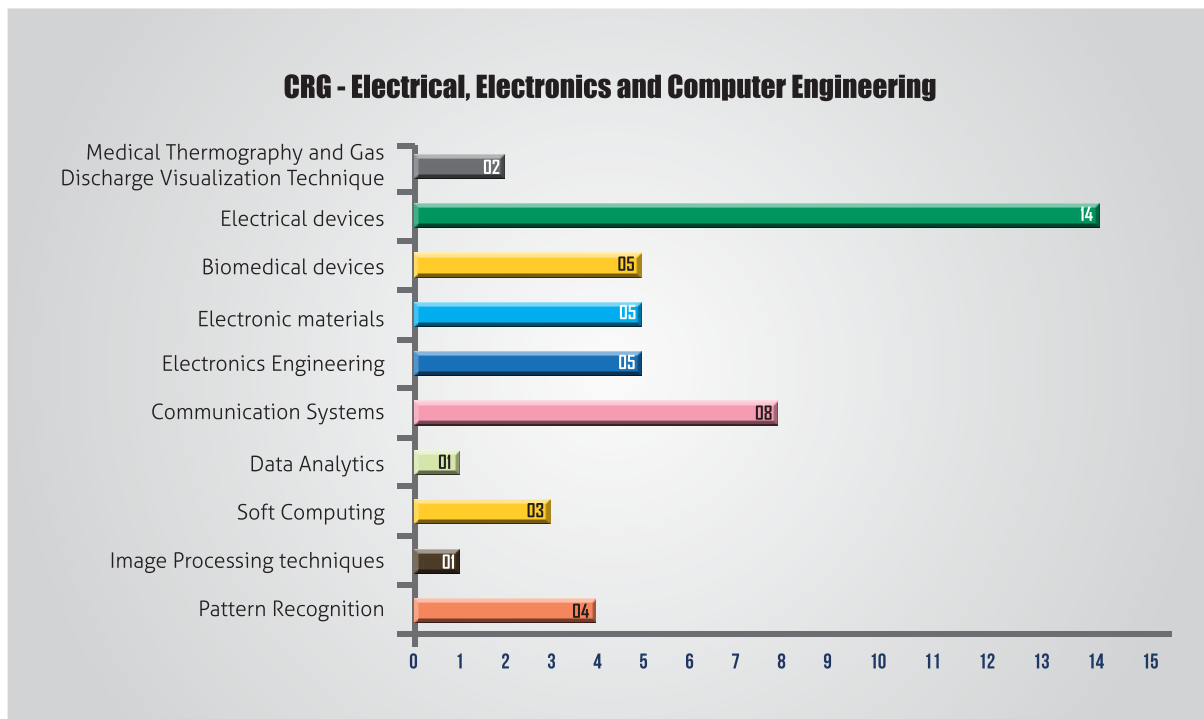


Figure 27 : Projects supported in Electrical, Electronics and Computer Engineering.

Research Highlights

Investigation of Emerging Non-Volatile Memory Technology for Storage and Computing Applications: Emerging non-charge based resistive memory technology (RRAM) has been investigated in this project. In relevance to the objectives, the state of art dedicated RRAM test-bench has been setup and custom test routines have been built in test bench to characterize small packaged DUT structures. The state of art dedicated FPGA based memory chip test bench has also been developed. Prototype HfOx RRAM devices and Prototype BYO RRAM devices were fabricated and characterized using above described setup (Figure 28). High level RRAM

application models were built in Matlab for computing application study and simulations and by using the models developed, 7 new computing (non-storage) hybrid RRAM-CMOS applications were successfully conceptualized and demonstrated. Conceptual demonstration of novel CMOS-RRAM pixel circuit with variable conversion gain was carried out (Figure 29 a) and patented. This circuit exploited resistive and capacitive properties of RRAM device, to vary pixel conversion gain for dim and bright-light situations. Using D2D variability in RRAM devices, ELM design was implemented (Figure 29 b).

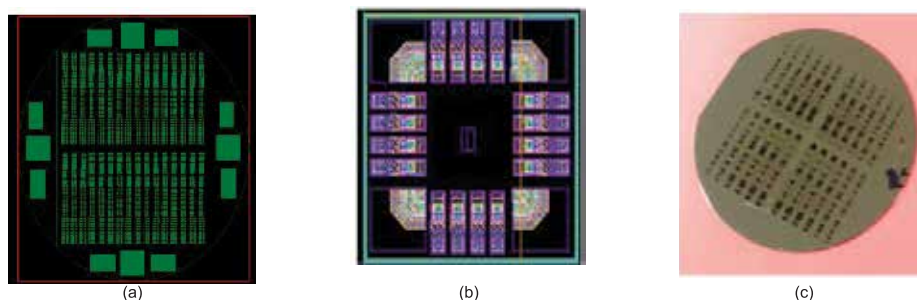


Figure 28 : Mask design developed for the 1st run of RRAM device fabrication and wafer of fabricated devices.

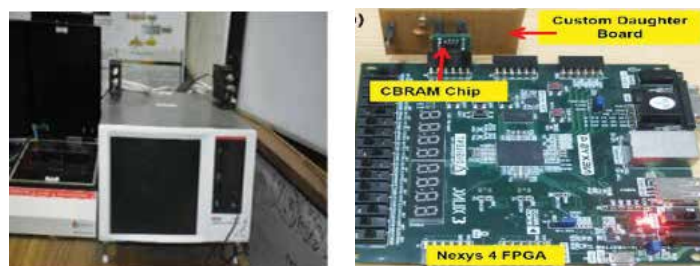


Figure 29 : (a) Dedicated NVM Characterization test-bench and customized FPGA based test platform.

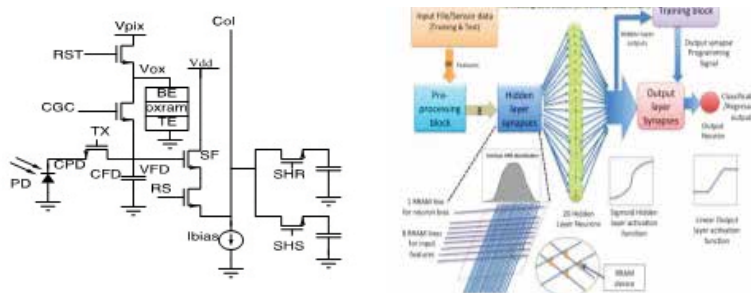


Figure 29 : (b).Circuits of 2 novel CMOS-RRAM applications proposed (a) Pixel and (b) ELM.

Innovations of the project includes integrated test routine for benchmarking multiple kinds of NVM devices, development of first-of-a-kind hybrid CMOS-RRAM Pixel circuit and exploiting RRAM capacitive and resistive properties in imaging

applications. The work from this project resulted in 24 publications, 15 invited talks (including 2 tutorials + 2 panels), 2 books chapters, 1 Springer book (~7000 downloads), 2 patent applications (1 Indian + 1 PCT) and 3 Indian copyright.

3.1.3.4 Chemical and Environmental Engineering

A total of 160 proposals were received and 30 proposals have been supported in different subdisciplines (Figure 30).

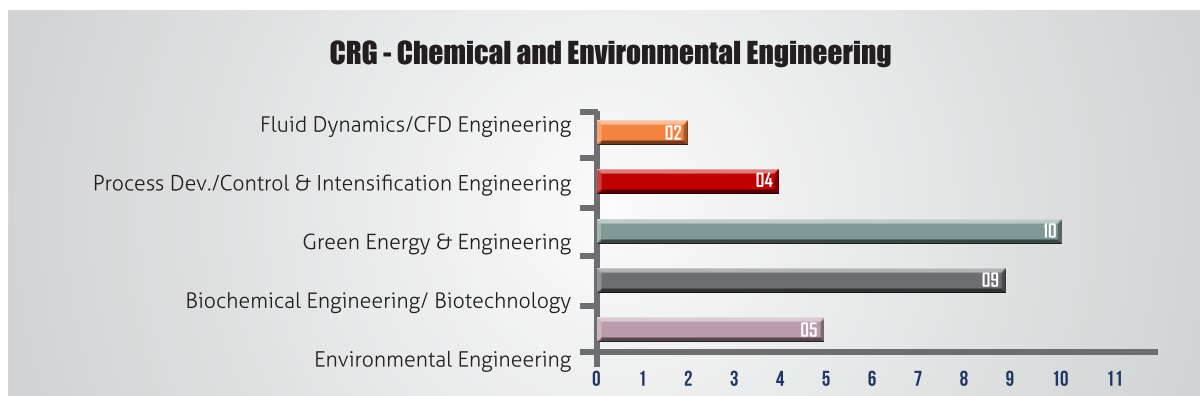


Figure 30 : Projects supported in Chemical and Environmental Engineering.

Research Highlights

Experimental and numerical investigation of suspension flow in microfluidic bifurcation channels: The effect of bifurcation angle, channel width, bulk particle concentration and flow rate on fluid and particle partitioning through micro

particle image velocimetry (μ -PIV) and particle tracking (PTV) experiments as well as numerical simulations has been examined. The aim had been to arrive at parameters that control particle migration in bifurcation channels (Figure 31).

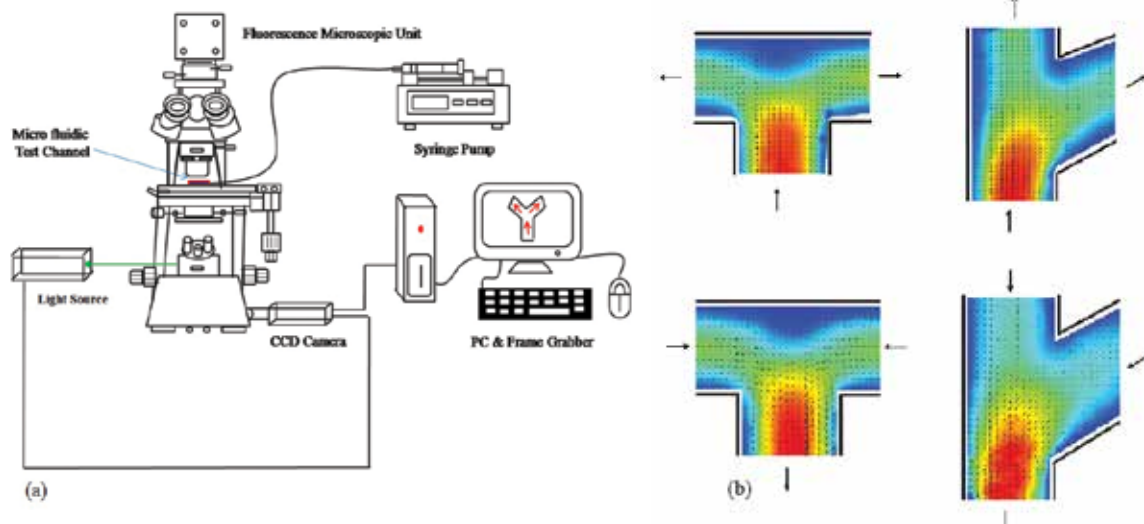


Figure 31 : (a) Schematic of micro-PIV experimental set up (b) Experimental velocity field in symmetric and asymmetric bifurcating channels in converging and diverging flows.

Numerical simulations of particle migration in symmetric 2D Y-shaped bifurcation channels showed peak-valley-peak pattern in velocity profile near the bifurcation (Figure 32). For oblique bifurcation channel it was observed that the angle of bifurcation effects the relative flow and particle partitioning in the daughter

branches. Numerical simulations were carried out in 3D Y-shaped bifurcation channel and it was observed that wall shear stress near the bifurcation is highest for channel with 90 degrees (Figure 32). Front view of velocity counter, cross sectional view, side branch and wall shear map have been depicted in Figure 33.

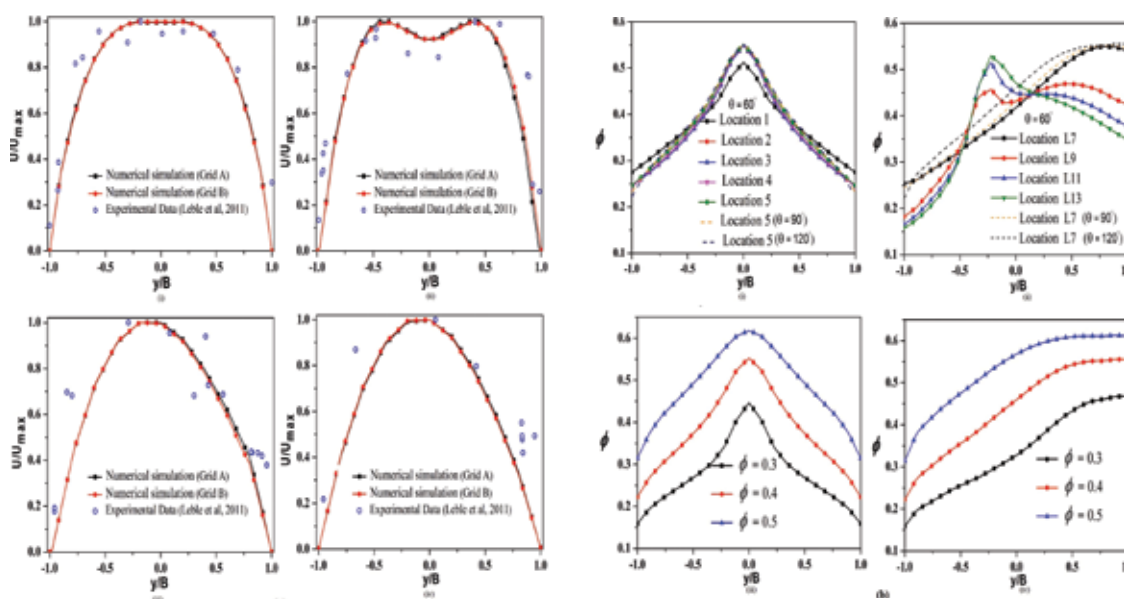


Figure 32 : (a) Velocity profile near the bifurcation of Y-shaped channel (b) Particle concentration profile of 2D Y-shaped channel obtained from numerical simulations (Reference: Particulate Science and Technology. 34, 83 (2016))

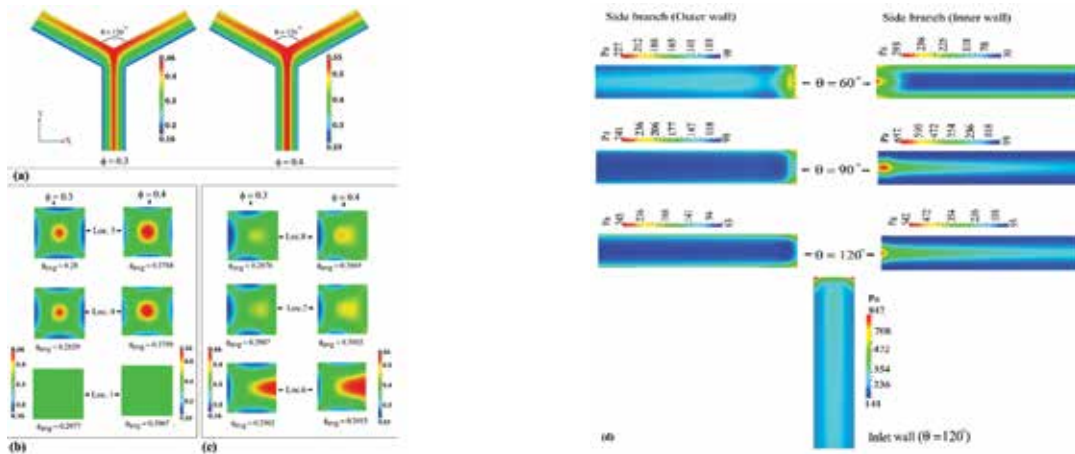


Figure 33 : (a) Front view of velocity contour (b) Cross-sectional view in the inlet, (c) side branch and (d) wall shear stress map in 3D Y-shaped channel from simulations (Reference: International Journal of Multiphase Flow, 76, 1 (2015))

3.1.4. LIFE SCIENCES

3.1.4.1. Animal Sciences

A total of 284 proposals were received and 29 were supported in different sub disciplines (Figure 34).

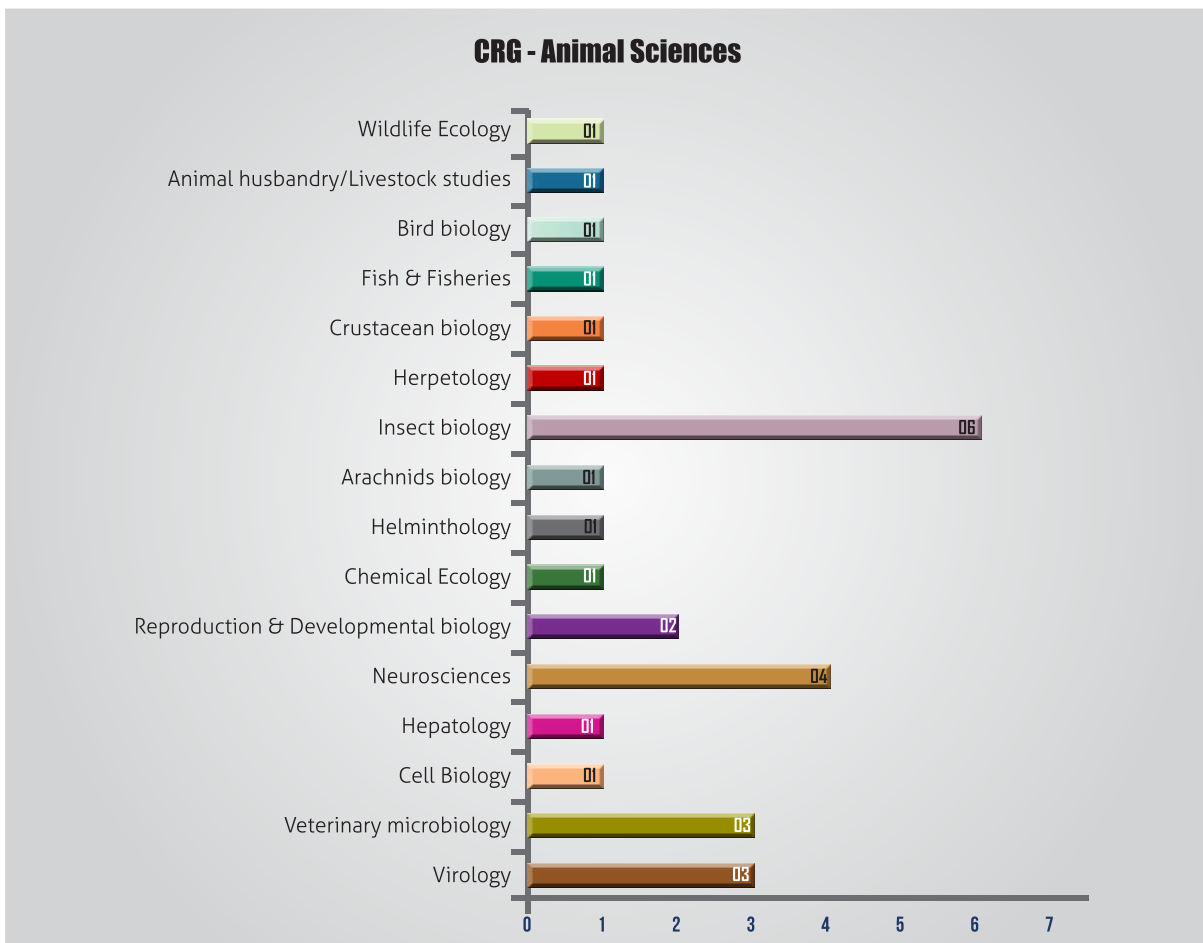


Figure 34 : Projects supported in Animal Sciences.

Research Highlights

Insect Biology: Insects are the most important group of parasitoids which keep the various pest

populations of agricultural and horticultural crops under check in natural conditions. As natural enemies

of many pest populations, the diversified fauna of encyrtid insects are to be taken into consideration for better understanding at specific, generic as well as higher classification level so that these may be

utilized successfully in various biological control measures. The types and determined material have been deposited in the insect depositories (Figure 35).

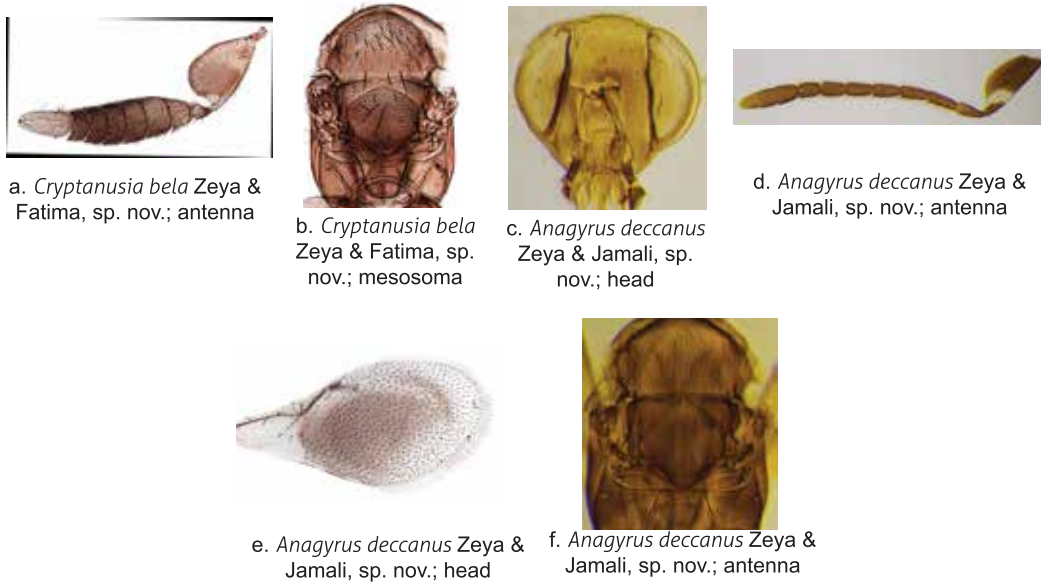
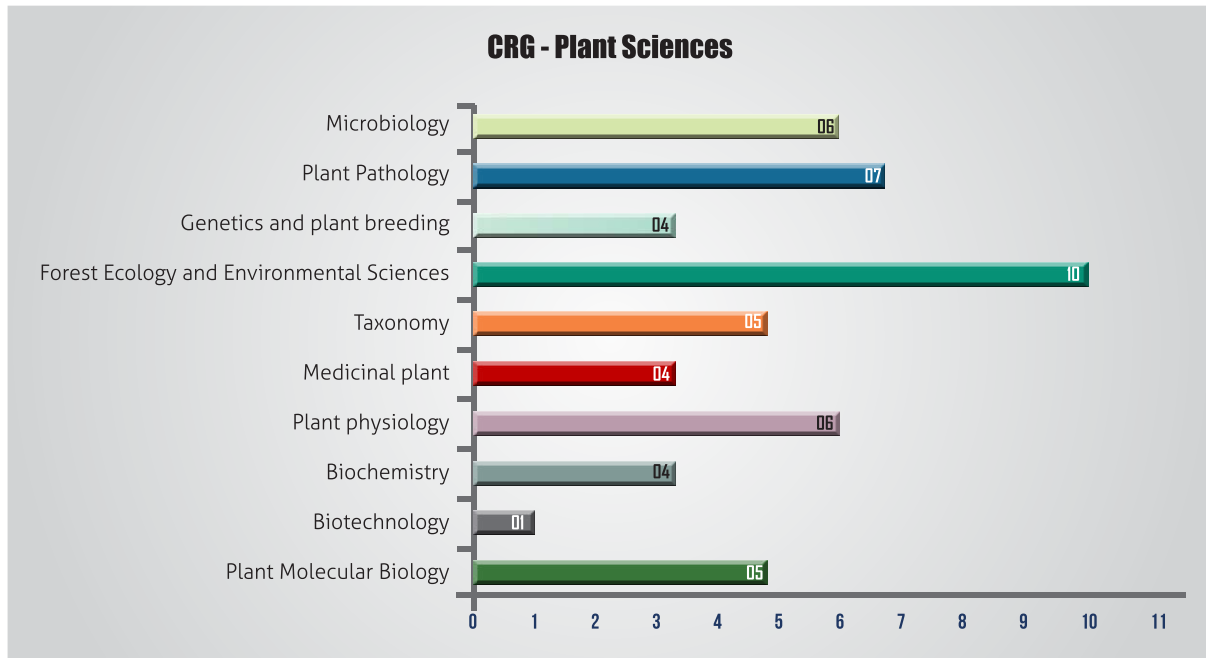


Figure 35 : Parts of insect in the experiment

3.1.4.2 Plant Sciences

A total of 420 proposals were received and 52 were supported in different sub disciplines (Figure 36).



Figures 36 : Projects supported in Plant Sciences.

Research Highlights

Bioprocess development for production of debittered kinnow juice for preparing low alcoholic naturally carbonated beverage: Bioprocess

developed for production of debittered kinnow juice using yeast and debittering enzymes has been standardised. The yeast strain isolated from whey

beverage *Clavispora lusitaniae* KF633446 was used. The yeast strains were identified on the basis of morphological characteristics as cream coloured, smooth colony and circular in shape (Figure 37), biochemical and 18S rDNA sequence analysis. It has the ability to produce such debittering enzymes when grown in presence of enzyme inducer.

This yeast has been exploited for upscaling of low alcoholic naturally carbonated beverages from citrus fruit and is gaining popularity due to increased consumer palatability. Technology has been developed for production of Low Alcoholic Naturally Carbonated beverage from citrus fruits (kinnow, lemon, grapefruit, Big lime, sweet lime). In this technology, fresh harvested fruit is washed with KMS solution, juice is extracted, diluted (20-30%) and Brix are set to 140 B with sugar solution. Afterwards, the yeast culture is added @0.5% for batch scale fermentation. The beverage production is optimized to prepare within 36 hours through microbial fermentation process. The process is carried aseptically to avoid contamination. After 36 hours, the beverage is suspended into bottle and refrigerated for cold maturation.



Figure 37 : (Colony Morphology) of yeast *Clavispora lusitaniae* KF6334463

Technologies Optimized includes, Low Alcoholic Naturally Carbonated beverage from citrus fruits, Production and partial purification of debittering enzymes produced by yeast, debittering of kinnow juice using purified debittering enzymes, production of wine and vinegar from kinnow beverage and juice restoring and Pectin extraction from citrus peel waste.

3.1.4.3 Health Sciences

A total of 900 proposals were received and 126 were supported in different sub disciplines (Figure 38).

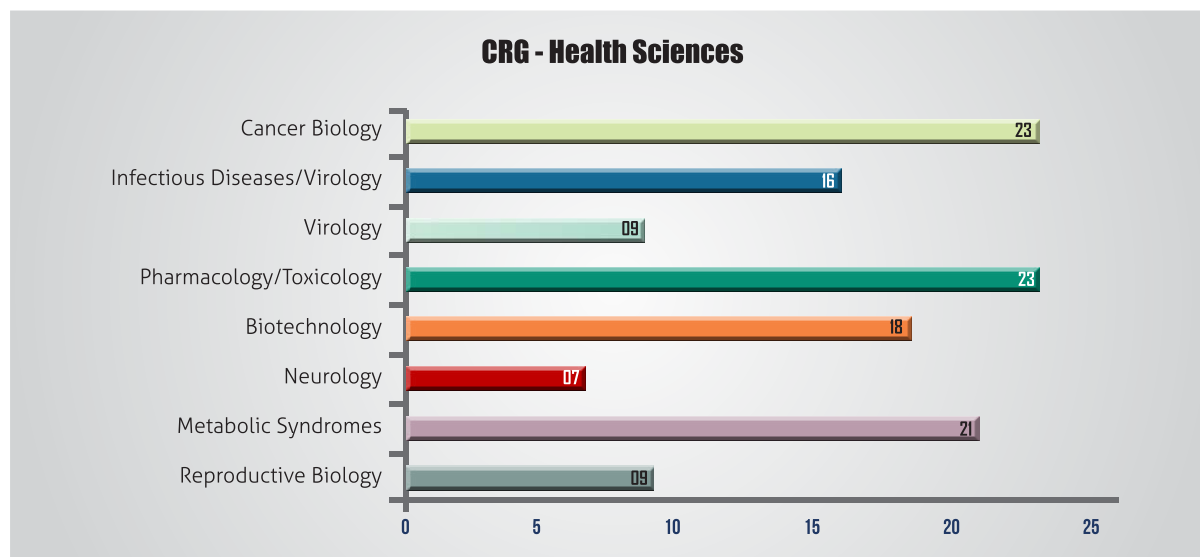


Figure 38 : Projects supported in Health Sciences.

Research Highlights

Modulation of intracellular trafficking in macrophages by *Leishmania*: Visceral Leishmaniasis (VL) also known as kala azar, is

one of the major public concerns in large parts of north-east India, south-eastern Nepal and western Bangladesh. This parasite is thought to reside

and replicate in a phagolysosomal compartment in macrophages. But, how *Leishmania* survives in such detrimental compartment in macrophages is not known. In this study the investigator used differentiated human macrophages as a relevant model to unravel the molecular mechanism how *Leishmania(L) donovani* is modulating endo-lysosomal pathway and as well as its prolonged survival as a parasite in the host.

It has been observed that *L. donovani*, parasites block the processing of the lysosomal enzymes in the early endosomal compartment by overexpressing Rab5a which helps the parasite to survive in human macrophages upon infection. Further, parasite also recruit Lamp1 and inactive pro-cathepsinD on parasitophorous

vacuole which leads to conclusion that it resides in phagolysosomal compartment. The expression of Rab5a, an early endosomal protein downregulates the expression of miR-494 in infected human macrophages as a consequence of gp-63 dependent degradation of c-Jun.

It is now understood that *L. donovani* evades the successful degradation pathway by recruiting immature and inactive form of lysosomal enzymes in human macrophages upon infection. The results provide a clue that there is a possibility of modulating endo-lysosomal pathway in parasite infected cells either by over expressing miR-494 or small molecules to divert trafficking of *Leishmania* in the lysosome as a future intervention (Figure 39).

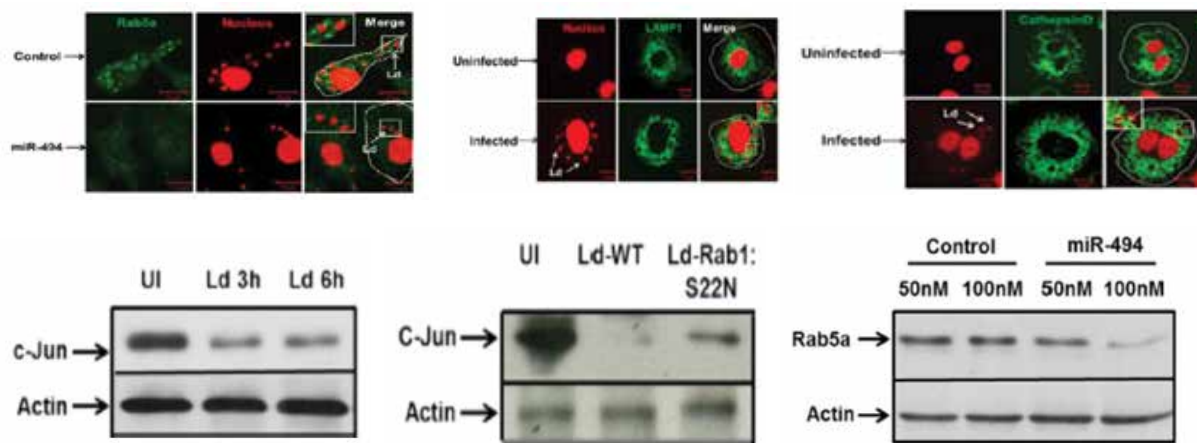


Figure 39 : *L. donovani* recruits immature forms of lysosomal proteins on their parasitophorous vacuoles & donovani infection downregulates the expression of miR-494 by degrading c-Jun in macrophages.

3.1.4.4 Biochemistry, Biophysics, Molecular Biology and Microbiology

A total of 464 proposals were received and 52 were supported in different sub disciplines (Figure 40).

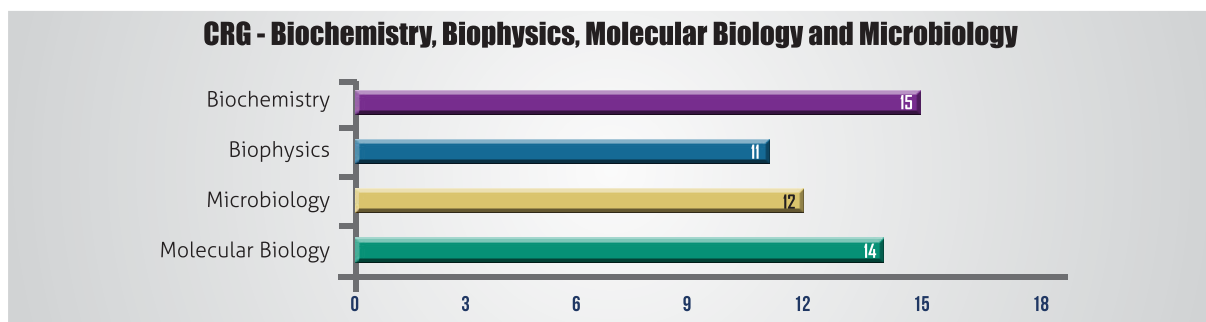


Figure 40 : Projects supported in Biochemistry, Biophysics, Molecular Biology and Microbiology.

Research Highlights

Pathological consequences of epigenetic deregulation on the breast cancer transcriptome:

The cancer cells thrive on glucose by converting it to lactate at the end of glycolysis. The phenomenon is known as aerobic glycolysis

or Warburg effect and promotes the growth of the cancer cells. The alternative spliced isoform Pyruvate kinase M2 (PKM2) contributes to the Warburg effect by promoting aerobic glycolysis whereas PKM1 isoform promotes oxidative

phosphorylation. The PKM gene contains two mutually exclusive exons, exon 9 and 10 which are alternatively included in the final transcript to give rise to PKM1 and PKM2 isoform respectively. It has been reported that the intragenic DNA methylation-mediated binding of BORIS (Brother of regulator of imprinted sites) at the alternative exon of Pyruvate Kinase (PKM) is associated with cancer-specific splicing that promotes Warburg effect and breast cancer progression. Interestingly, inhibition of DNA methylation or BORIS depletion or CRISPR/Cas9-mediated deletion of BORIS binding site leads to splicing

switch from cancer-specific PKM2 to normal PKM1 isoform. This results in the reversal of Warburg effect and inhibition of breast cancer cell growth, which may serve as a useful approach to inhibit the growth of breast cancer cells. Importantly, in addition to PKM splicing, BORIS also regulates alternative splicing of several genes in a DNA methylation-dependent manner. These findings highlight the role of intragenic DNA methylation and DNA binding protein, BORIS in cancer-specific splicing and its role in tumorigenesis (Figure 41 & Figure. 42).

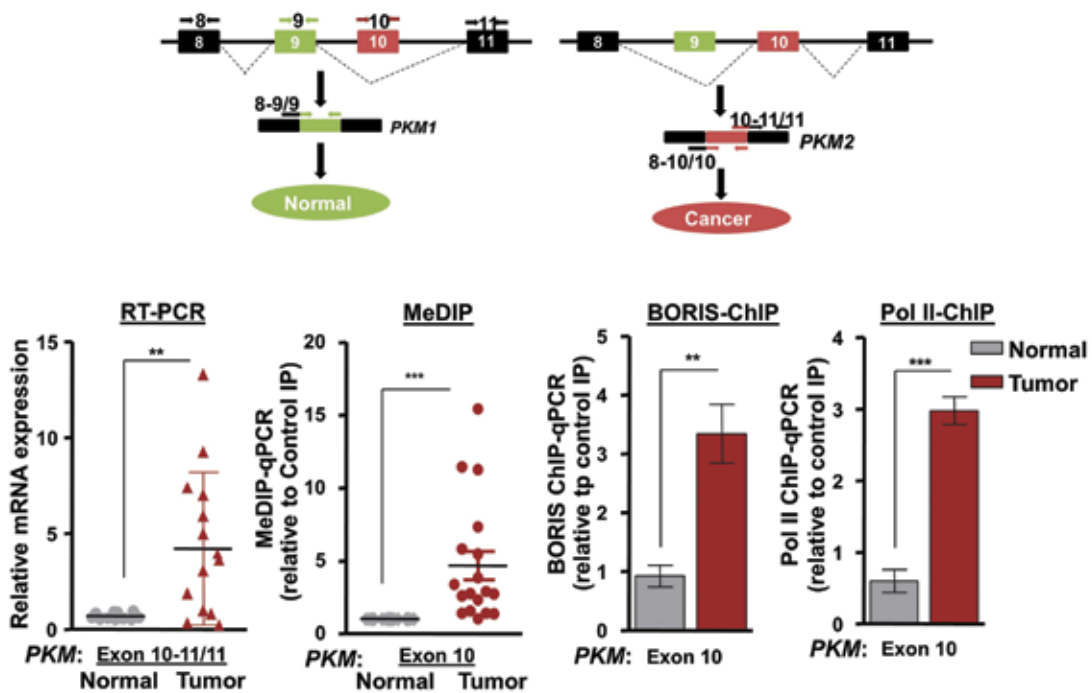


Figure 41 : Elevated DNA methylation at exon 10 of PKM gene correlates with increased PKM2 isoform expression in breast cancer.

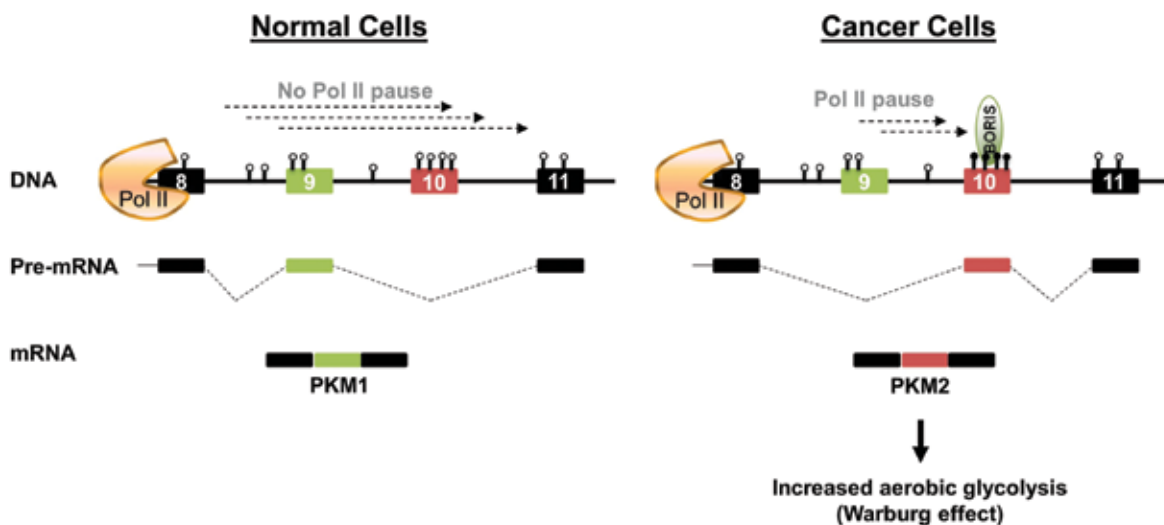


Figure 42 : Model for BORIS-mediated regulation of PKM alternative splicing.

3.1.5 PHYSICAL & MATHEMATICAL SCIENCES

3.1.5.1 Physical Sciences

A total of 451 proposals were received, and 127 were supported in different subdisciplines (Figure 43).

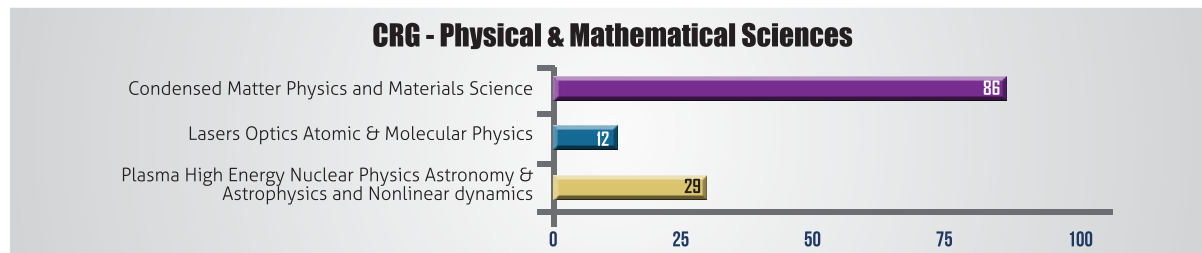


Figure 43 : Projects supported in Physical Sciences.

Research Highlights

Study of molecular dynamics in low-energy electron collisions with jet-cooled molecules

Dissociative electron attachment to CO molecule using the well-established velocity slice imaging technique was studied. The symmetries of the TNI states involved in both the channels producing O⁻ ions are observed. In contrast to a recent report, additional forward lobes in the angular distribution data were observed and there is no need to invoke coherent interference between different states as introduced previously. Recent R-matrix calculations and momentum imaging study reported by other researcher is well corroborated by the generated data. Electron beam induced ion-pair dissociation dynamics of O₂ was also investigated. The Ion-Pair Dissociation (IPD) of molecular oxygen due to 21-35 eV energy electron collision has been studied using time sliced velocity map imaging technique. The

threshold of the process and the kinetic energy and angular distribution of the fragment negative ions were measured. The IPD was found to be occurring due to pre-dissociation of a Rydberg state via ion-pair state for lower incident electron energies as well as from direct excitation to the ion-pair states for higher primary beam energy. The location and symmetry of the excited states has been determined from the kinetic energy and angular distribution data respectively. A new spectrometer based on time-of-flight method for the absolute cross section measurements for the DEA and PD process using relative flow technique (RFT) was also established. From the kinetic energy distribution, the two resonances are observed to have the same threshold energy, describing that the two processes, giving rise to the two resonant peaks, have the same dissociation limit.

3.1.5.2 Mathematical Sciences

A total of 114 proposals were received, and 24 were supported in different sub disciplines (Figure 44).

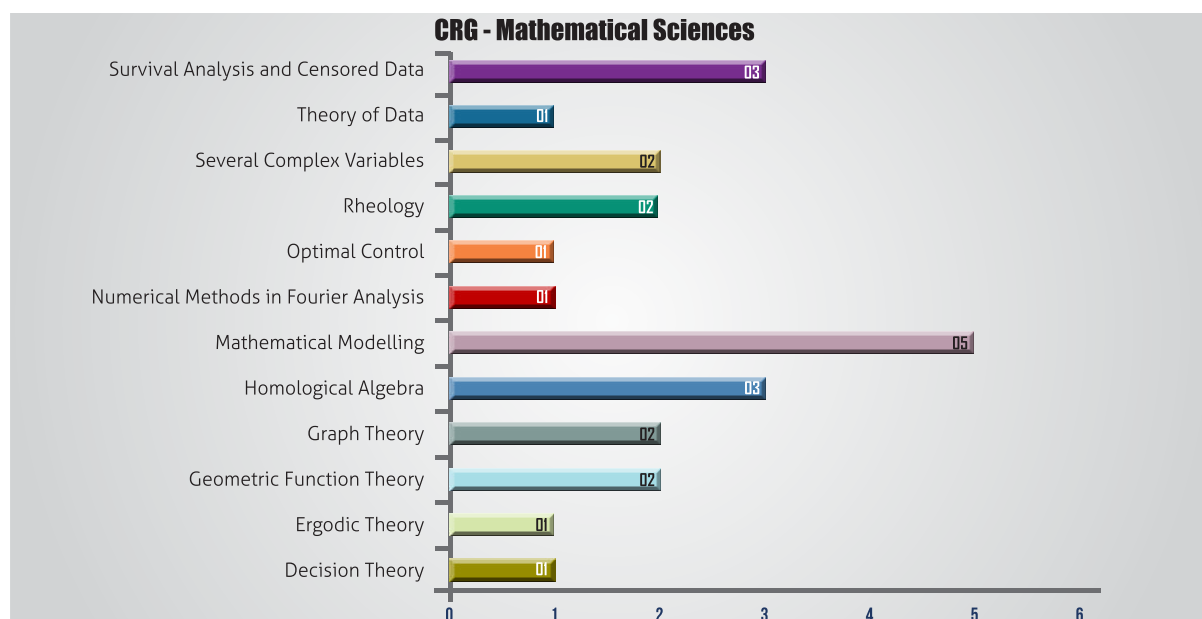


Figure 44 : Projects supported in Mathematical Sciences.

Research Highlights

Energy and Laplacian energy of graphs: The work investigates the spectra and Laplacian spectra of graphs and investigates the energy and Laplacian energy of various families of graph. The study also investigates the relation between energy and Laplacian energy in different classes of graphs. A homogenous signed graph with each edge positive becomes a generalization of graphs. The coefficient theorem in signed graphs has been obtained which gives the information about the coefficients of the characteristic polynomial. Coulsons integral formula has been formed to determine the energy of a signed

graph with unknown eigenvalues. Using the concept of matchings in graph, the even and odd coefficients of the characteristic polynomial of a unicyclic signed graph is shown to be alternating in sign. The study also investigates the signed graphs which have minimal energy. Energy of graphs have found to be significant application in Chemistry and may extend the applications in Computer sciences also. The techniques applied also finds applications in the study of several other problems related to spectra and energy of signed graphs.

3.1.6 MATHEMATICAL RESEARCH IMPACT-CENTRIC SUPPORT (MATRICS)

Objective

To provide fixed limited grant support to active researchers with good credentials in Mathematical Sciences. The aim is to encourage mathematicians to undertake research in this field which has observed dwindling rate during last few years on account of various factors, including mathematical sciences being distinct in nature from other basic sciences, it having orientation for theoretical research.

Features

The applicant should be an active researcher in the field of Mathematical Sciences and allied areas.

The applicant should hold a Ph.D. degree and must be working on regular basis in academic institutions/national labs or any other recognized R&D institutions.

The applicant should have at least three years of service remaining before superannuation as on the date of submission of the proposal.

Research grant of Rs. 2.00 lakh p.a. for a period of three years

Website links
<http://www.serb.gov.in/matrix.php>

The main attribute of this scheme would be submission of a simple 1-2 page proposal. The fund provided, would cater to the specific needs

of Mathematical Sciences research. A total of 2347 proposals were received and committee recommended 188 proposals during the year.

3.2 HIGH RISK HIGH REWARD (HRHR)

A total of 181 proposals were received and one proposal under the discipline of Physical Sciences was approved in the recently initiated scheme.

Objective

To support proposals that are conceptually new and risky, and if successful, expected to have a paradigm shifting influence on the S&T. This may be in terms of formulating new hypothesis, or scientific breakthroughs which aid in emergence of new technologies.

Features

The scheme signifies the beginning of highly competitive quality and impactful R&D in the country: Currently majority of R&D funding in the developed world is of this nature.

The applicant(s) must secure a regular academic/research position in a recognized institution.

The funding is provided normally for a period of three years. In exceptional cases, the duration can be up to 5 years as assessed by the expert committee.

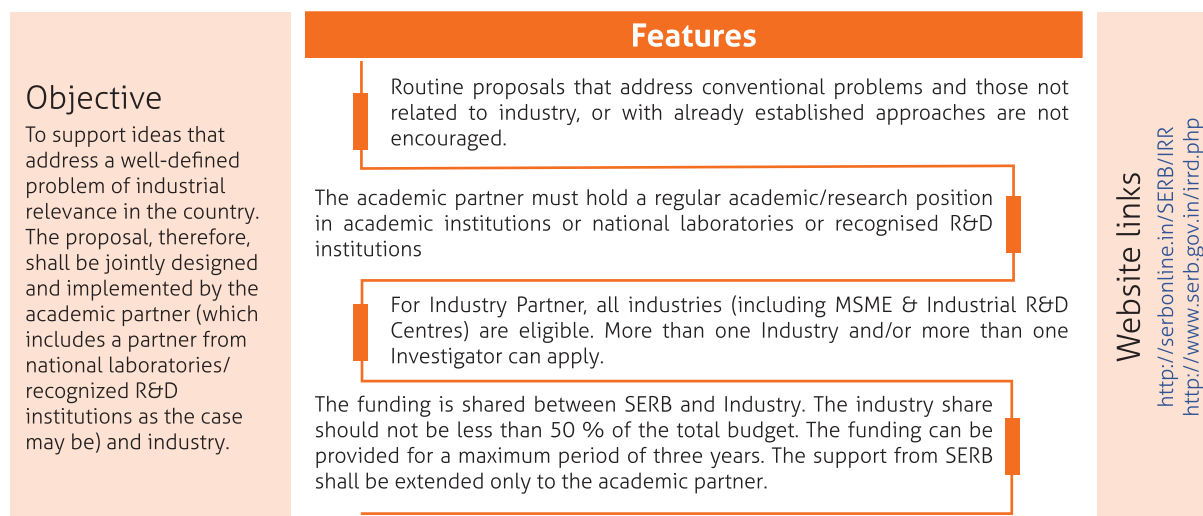
Website links
<http://serbonline.in/SERB/HRR>
<http://www.serb.gov.in/hrhr.php>

Summary of the Project supported under HRHR is given below:

Title of the project	Name of the PI	Affiliation of the PI
Sustained Energy Generator based on Auto-catalytic Interactions	Dr. Prahlada Rama Rao	Swami Vivekananda Yoga Anusandhana Samsthana Bangalore, Karnataka- 560018
<p>Salient Features : The objective of the study was setting up the lab and experiments for the generation of excess heat through the reaction between the metal hydride and palladium and systematic study of the experiment/reaction to understand the by products of the reaction and transmutations, if any, as well as efforts to improve the efficiency of heat generation. Involve Industry for mass production version. The final milestone is to upgrade to small scale engineered version for application and involved industry for mass production version.</p> <p>Expected benefits, if project is successful are (a) Clean, Compact, Scalable, Portable & Sustained energy at low cost Standalone power source at remote & inaccessible locations (b) Energy security & freedom from imports.</p> <p>If the concept of cold fusion or LENR (Low Energy Nuclear Reaction) works with more efficiency, a gram of fuel powder can generate continuous energy for weeks if not months once it is triggered. This will help the country making it free from importing oil, coal and Uranium, which is main source of energy as of now. Reaching remote areas in term of energy will become possible. One need not depend upon seasonal energy sources like wind, solar etc. This energy source would be eco-friendly as no pollutants will be released. The energy source would be scalable and portable. In nutshell, this will serve as a low cost energy, where and when needed.</p>		

3.3 INDUSTRY RELEVANT R&D (IRRD)

A total of 36 proposals were received and three proposals were funded during the financial year.



Summary of the supported Projects under IRRD is given below:

Title of the project	Name of the PI	Affiliation of the PI
Design and development of embedded vision-based system for yoga therapy	Dr. Selvakumar Karuppusamy	Senior Assistant Professor, Instrumentation and Control, P.S.G College of Technology, Peelamedu Coimbatore, Coimbatore, Tamil Nadu-641004
<p>Salient Features : The main objective of the proposal is to develop a low cost embedded vision system called 'AASAN' to analyses and assist the asana practitioner as well as trainers along with the involvement of industry -Yantravision Software Pvt Ltd, Bangalore. The study will involve collection of the videos of yoga practitioners in training centers and annotate the human body parts with the help of an expert. After the video acquisition, processing and analysis will be done using laptop or smart phone for real-time audio feedback. Computer vision based algorithms will be developed for asana posture skeleton extraction and pose verification. Different visualization techniques</p>		

will be developed using the extracted joint angles which will lead to the development of a software module for animation based visualization of asana posture. This feature can help the users to analyze and correct their movements according to the audio visual feedback.

The developed device can be used in hospitals where asanas are recently being used as a physical rehabilitation tool for optimal physical functioning, to certify the yoga instructors, careful and uniform assessment of their performance for each posture and as a personal gadget for voice guide, performance evaluation and real-time feedback for the trainees.

Title of the project	Name of the PI	Affiliation of the PI
Design and Development of Energy Efficient Permanent Magnet Assisted Reluctance Motor Drives for Pump Application	Dr. V Kamaraj	Professor and Head, Electrical and Electronics Engineering, SSN College of Engineering, Sri Sivasubramaniya Nadar College of Engineering Rajiv Gandhi Salai (Omr), Kalavakkam, Kanchipuram, Tamil Nadu-603110

Salient Features :

The main objective of the proposal is to improve the performance of the Permanent Magnet Assisted Reluctance motor by obtaining high average torque, reduced torque ripple with considerable total losses and hence increased efficiency, by selection and analysis using suitable parameters. The industry involved in the project is Euro Process Automatik, Chennai. The results of the study and the design output of this project will help the designers in industries to apply this drive for commercial applications.

The proposed configuration aims at development of Reluctance Motor topology with improved efficiency, high power density, minimum torque ripple and acoustic noise. Such a drive would be a viable alternate to the existing drive set up. For academic purpose, this sort of analysis and experimental setup would enhance the research interest among the academic community to explore possibilities of energy efficient drives.

Title of the project	Name of the PI	Affiliation of the PI
Development of Resin Formulation and Hybrid Materials for 3D printing	Asha S K	Principal Scientist, Polymer Science and Engineering, National Chemical Laboratory, Dr. Homi Bhabha Road, Pashan, Pune, Pune, Maharashtra-411008

Salient Features :

The project aims to develop flexible resin materials and resin formulation with improved mechanical properties and also to develop hybrid materials for 3D printing. The industry involved is a Pune based company – FORM3D Solutions, Pvt Ltd. The expected deliverables of the project are development of resin formulation that can be used as UV curable resin in 3D printing application, to print jewelry designs with very fine details in even 30 micron layer thickness and fused deposition modelling as one of the widely used 3D printing processes.

3.4 INTENSIFICATION OF RESEARCH IN HIGH PRIORITY AREA (IRHPA)

One new proposal was funded during the financial year under Life Sciences scheme. Besides, all the ongoing mega projects under the scheme were continued to be supported.

Objective

To support proposals in high priority areas where multidisciplinary / multi institutional expertise may be required and which will put our nation in international science map in that particular discipline.

Features

Identification, formulation and implementation of national R&D Programmes through involvement of scientists from different agencies & institutions is encouraged.

The amount of grant is slightly higher than regular projects, since in order to set up core groups or units/facilities under this scheme, existing infrastructural facilities of the institutions needs to be strengthened.

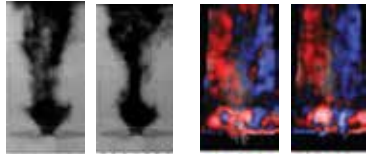


The duration of these type of project is 5 years.

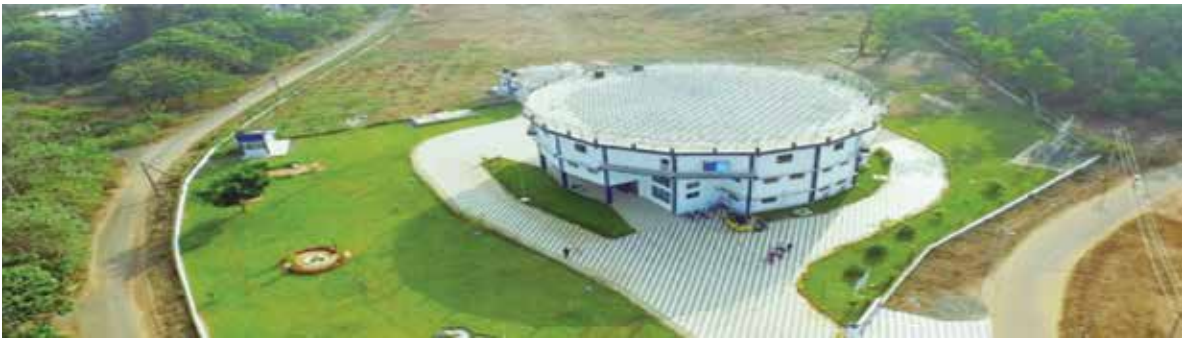
A Core Group/Unit is set up for a period of five years so that it can serve as focal point for a national programme. The parent institute is asked to take over the unit after five years.

Website links

<http://serbonline.in/SERB/irhpa>
<http://www.serb.gov.in/irhpa.php>

Summary of few of the major IRHPA Projects is given below:

Title of the project	Name of the PI	Affiliation of the PI
Combined Centres for Combustion Research	Prof. T. Sundararajan; Prof. S. Chakravarty; Prof. R.V. Ravikishna & Dr. Charlie Oommen	IIT, Madras & IISc., Bangalore
<p>Salient Features : The twin challenges of alternative energy and environmental protection afflicting a modern emerging economy like India is based on effective utilization of combustion as a means of thermo-chemical energy conversion. Realising this SERB is supporting the establishment of the National Centre for Combustion Research & Development (NCCRD) at IIT, Madras and IISc, Bangalore. The research interests are in three major application sectors-automotive, thermal power and aerospace propulsion; besides fire research and microgravity combustion to a minor extent Experimental setups and rigs of global standards have been done, along with the infrastructure developments for NCCRD that has been inaugurated in 13th October 2017 at IIT Madras. At IISc, the NCCRD has been hosted in the Inter-disciplinary centre for Energy Research earlier. Over a dozen companies and governmental organization (both Indian and foreign) are engaged in industrial research with NCCRD. Ninety Ph.D students are using the NCCRD facilities and more than 100 masters students and project associated are also engaged in the centres. Twenty journal papers and 2 conference papers have been published during the financial year (Figure 45,46 & 47).</p>		
<div style="display: flex; justify-content: space-around;"> <div data-bbox="204 835 571 987">  <p>Figure 45 : Two Simultaneous PIV and Chemiluminescence frames during precursor event</p> </div> <div data-bbox="600 853 1070 987">  <p>Figure 46: (a) Spray Chamber Facility with Laser Diagnostics, (b &c) Open calorimeter</p> </div> <div data-bbox="1094 842 1385 987">  <p>Figure 47: Flame ($\phi=0.6$) in LDI-4C burner at upstream velocity of (left) 5m/s and (right) 2 m/s.</p> </div> </div>		

Title of the project	Name of the PI	Affiliation of the PI
Studies on the tropospheric feature and stratosphere coupling processes over the Monsoon region using stratosphere tropospheric (ST) Radar at Cochin.	Prof. K. Mohankumar	Director, Advanced Centre for Atmospheric Radar Research
<p>Salient Features : The Cochin University of Science and Technology (CUSAT) has installed the most sophisticated and indigenously developed Stratosphere-Troposphere (ST) radar that is successfully functioning and being operated at 205 MHz frequency. The facility was inaugurated by union Hon'ble Minister, Dr. Harsh Vardhan in July 2017. Besides being the first radar in the World operating at this frequency, it is also the first wind profiler radar in the near equatorial site set up primarily to study the characteristics of Indian summer monsoon right at its Gateway in the region at Cochin. This radar provides a cost effective and high precision technology data of atmosphere starting from 315m and well up to 20 km in all weather conditions. Besides looking into the dynamics of Indian Monsoon and other aspects of Tropical Meteorology, the capacity in the field has been developed through two user workshops in recent times. A number of papers have also emerged (Figure 48).</p>		
<div style="text-align: center;">  <p>Figure 48 : Aerial view of 205 MHz ST Radar Facility at CUSAT</p> </div>		

Title of the project	Name of the PI	Affiliation of the PI
National Centre For Catalysis Research (NCCR)	Prof. P. Selvam	Indian Institute of Technology Madras

Salient Features :

The National Centre for Catalysis Research (NCCR) was established by the Department of Science and Technology at IIT, Madras with a mandate to i) build human resource and knowledge, ii) establish advanced R&D facilities, iii) initiate research Programmes in frontier areas and iv) cultivate a vibrant partnership between academy and industry. A bench scale process for the trans-esterification of vegetable oils with alcohols into bio-diesel has been developed at NCCR. Further, a process for catalytic conversion/deoxygenation of vegetable oils (including non-edible jatropha oil into diesel hydrocarbons (green diesel) using a novel zeolite based Ni-Mo-catalyst was also developed. Ruthenium based multi-metallic catalysts for condensation of bio-ethanol with >80% selectivity towards butanol and higher alcohols was also synthesized. Many industrial processes have been developed at NCCR, along with many patents and publications over a period of time since its inception NCCR has fulfilled the mandate and earned recognition at national and international forums of science for sustained contributions towards education research and training in the area of Catalysis (Figure 49).



Figure 49 : National Centres for Catalysis Research.

Title of the project	Name of the PI	Affiliation of the PI
Development of Li-ion batteries for Electric Vehicle applications (Completed during the year)	Dr. R. Gopalan	Scientist-G, Department of Centre for Automotive Energy Materials, ARCI, Hyderabad

Salient Features :

The two main objectives of the project are - to set up the pilot plant facility and establish the technology for fabrication of Li-ion battery (LIB) using standard electrode materials, and to develop indigenous technology for producing the standard/new electrode materials and integrate them in the pilot plant facility to fabricate cells/batteries.

The large scale LiFePO_4 and $\text{Li}_4\text{Ti}_5\text{O}_{12}$ materials were synthesized and characterized. Both dehumidified rooms and the LIB processing equipments have been installed and commissioned (Figure 50). 15 Ah SS-LIB cells and assembly of 48V, 15Ah (720 Wh) battery pack was fabricated and demonstration of e-cycle was carried out (Figure 51). Indigenous electrode materials (cathode and anode) was developed by large scale process and scale-up of carbon coating technology up to 1.5 Kg was achieved. LTO electrode of 30 m length was fabricated using indigenous LTO materials by Li-ion pilot plant unit (Figure 52). The work carried out in this project has yielded 4 patents (Filed) and 18 papers published in peer reviewed journals and 13 Technical personnel have also been trained in this project.




Figure 50 : Dehumidified room's external internal views.

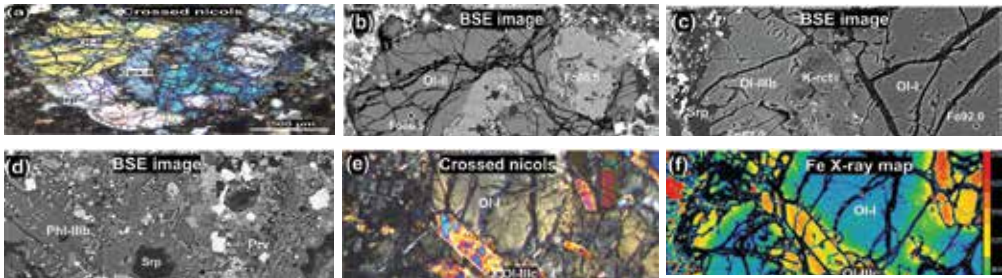


Figure 51: a) 15 Ah SS Cell b) Formation cycle c) 48V, 15Ah (720 Wh) battery pack d) e-cycle with battery pack.



Figure 52 : Images of (a) 2.5 kg of slurry contains LTO, binder and carbon black and (b-d) coating, drying and roll of large scale synthesized LTO electrode fabricated by Li-ion pilot plant unit.

Title of the project	Name of the PI	Affiliation of the PI
A Novel feasibility study of new born screening for treatable disorders and epidemiologic data generation for inborn metabolic errors in Delhi state.	Prof. B.K. Thelma	Department of Genetics, University of Delhi
<p>Salient Features : The project demonstrated feasibility of new born screening for inborn errors of metabolisms (IEMs) and generate the first ever epidemiological data in our country involving more than 2.00 Lakhs new born babies across the Delhi state under Public Private Partnership mode (PPP). The project demonstrated the possibility of providing genetic analysis and prenatal diagnosis where needed, this project also made a notable example of contemporary P4 medicine (Predictive, Preventive, Personalized and Participatory). IEC workshops were conducted under auspices of the National Neonatology forum, Indian Academy of Paediatrics and Indian Medical Association, Federation of Obstetrics and Gynaecology. Six continued medical education series on IEMs were deliberated before the Ministries at Delhi, Chhattisgarh and Orissa (Figure 53).</p>		
 <p style="text-align: center;">Figure 53 : New Born Screening for Treatable Inborn Metabolic Errors in Delhi State</p>		

Title of the project	Name of the PI	Affiliation of the PI
Petrology of kimberlites from southern India and garnets from kimberlite concentrates: Implications on sub-continental lithospheric mantle. (Electron Probe Micro-Analyser National Facility cum Main Project)	Prof. Suresh Chandra Patel	Indian Institute of Technology (IIT) Bombay
<p>Salient Features : The Wajrakarur Kimberlite Field in southern India contains 48 intrusions which are distributed in six clusters. Higher oxygen fugacity appears to have prevailed in TK1 as indicated by higher content of ferric iron in spinel, perovskite and phlogopite in the rock. Close spatial association and likely near contemporaneous emplacement of Mesoproterozoic kimberlites, lamproites, lamprophyres and UML in southern India can possibly be explained by a unifying model which involves the interaction of an asthenosphere-derived melt with variably metasomatized source regions in the SCLM. In the above basin, a rift-related origin for these rocks is being thought as the possibility in the study. Three distinct populations of olivine, phlogopite and clinopyroxene have been recognised based on their microtextural and compositional characteristics. A number of publications have engaged from the study (Figure 54).</p>		
 <p>Figure 54 : Photomicrographs, back scattered electron images and X-ray of P4 lamproite samples showing three generations (I, II and III) of olivine (Ol) and clinopyroxene (Cpx). Forsterite (Fo) content in olivine is shown at representative spots. (a) Olivine-clinopyroxene nodule in crossed nicols showing different olivine grains marked by distinct interference colours. Serpentine (Srp) replaces olivine. (b) BSE image of the same nodule as (a) showing spongy areas marked by black arrows in the marginal part of clinopyroxene grain. (c) K-richrichterite (K-rct) and clinopyroxene-II occurring at the interface of olivine-I core and olivine-IIIb overgrowth rim. (d) Poikilitic laths of phlogopite-IIIb in the groundmass containing inclusions of perovskite (Prv), spinel (Spl) and clinopyroxene-IIIb. (e) Photomicrograph of a part of an olivine-I macrocryst; crystals with bright interference colours are neoblasts with different optical orientations than the host olivine. (f) Fe X-ray map of the same area as (e) showing Fe-rich alteration zones of olivine-IIIc adjacent to intragranular fractures.</p>		

Title of the project	Name of the PI	Affiliation of the PI
Petrogenesis and Rare Earth Element potential of Kamthai and Amba Dongar carbonatites	Prof. Biswajit Mishra	Department of Geology & Geophysics, IIT, Kharagpur

Salient Features :

The Amba Dongar carbonatite-alkaline complex is a sub-volcanic diatreme consisting of a sövite ring dike with an inner rim of carbonatite breccia and surrounded by a K-rich fenite zone. While the dominant magmatic phases in the carbonatite are calcite, albite, aegirine augite, the accessory minerals include pyrochlore and apatite as euhedral zoned crystals (Figure 55).

The carbonatite-hosted REE mineralization at Amba Dongar and Kamthai exemplify variant of post-magmatic hydrothermal REE deposits, wherein the REE budget was exclusively confined to primary magmatic minerals such as pyrochlore and apatite, and the mineralization was a consequence of pervasive fluid-assisted REE mobilization from these phases

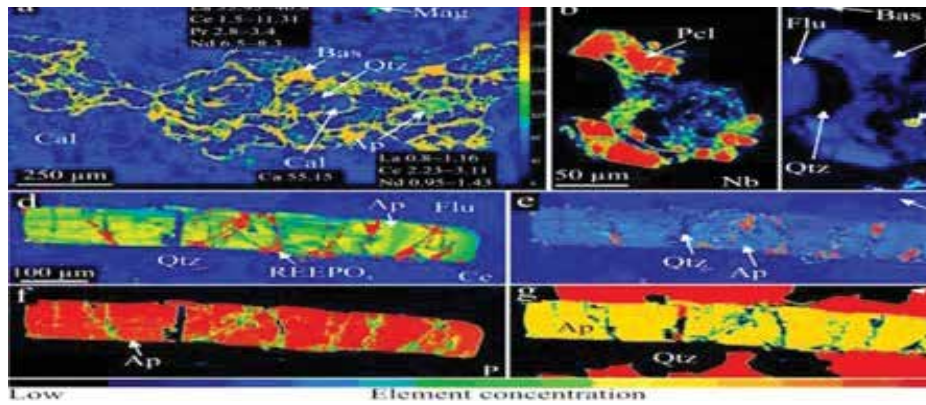


Figure 55 : FCC EPMA-BSE image of Kamthai carbonatite (a); X-ray element images of Nb (b), Ce (c) of pyrochlore (Pcl); and Ce (d), La (e), P (f) and Ca (g) of apatite (Ap) within fluorite from Amba Dongar carbonatite. Note replacement of apatite/calcite by bastnäsite (a) and formation of florencite along micro-cracks in pyrochlore (b, c) and apatite (d through f). Element concentrations in (a) are given in oxide wt. %. Mineral abbreviations: bastnäsite (Bas), magnetite (Mag), fluorite (Flu), florencite (Fln).

Title of the project	Name of the PI	Affiliation of the PI
Setting up of a National Facility on Electron Probe Micro Analyser at BHU, Varanasi	Dr. N.V. Chalapathi Rao	Banaras Hindu University

Salient Features :

The CAMECA SXFive EPMA at the Department of Geology, Banaras Hindu University was inaugurated on 11th April, 2016 and became fully functional ever since. Apart from the PIs of the project, twenty-five users from various Faculties/institutions/Universities/Colleges within the Banaras Hindu University and across the country are utilising this facility (Figure 56).

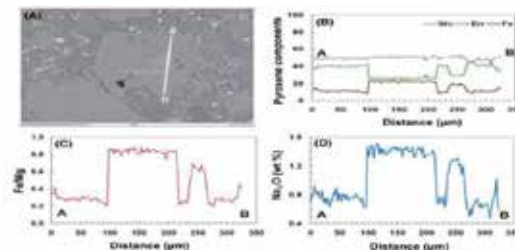


Figure 56 : (A) BSE image of a zoned pyroxene with AB as the line along which compositional profiling has been done. (B) Pyroxene components along AB lines showing an increase in Fe and decrease in Mg content from rim to core, whereas the Ca component remains unchanged. (D) Na₂O (wt%) along AB profile showing their enrichment.

Title of the project	Name of the PI	Affiliation of the PI
Setting up of a National Facility on Low Temperature-Chronology (Fission Track Dating) at Kurukshetra University, Kurukshetra.	Prof. Ramesh Chander Patel	Department of Geophysics, Kurukshetra University

Salient Features :

From early Cretaceous to present, the evolution and exhumation of the Shillong plateau occurred in three broken blocks i.e. northern part of the North Shillong Detachment (NSD), region between NSD and Oldham fault and region to south of Oldham fault. The northern block is exhuming slowly since 180-200Ma whereas the southernmost one is exhuming rapidly since 8-15 Ma. Despite precipitation gradient in the NE-Himalaya due to rise of the Shillong plateau, the gradients in rock uplift dictated by fault kinematics control the exhumation pattern of the NE-Himalayas (Figure 57).

New cycle of in-sequence thrusting during Plio-Pleistocene in the Kumaon region, NW-Himalaya is observed. After completing one cycle of in-sequence thrusting from the MCT to Main Frontal Thrust (MFT) between Miocene and Plio-Pleistocene, second cycle of in-sequence thrusting initiated at Plio-Pleistocene along the Vaikrita Thrust (VT) and Bering Thrust (BT) which is described as out of sequence thrusting and now it is gradually shifting towards south between the MCT zone and MFT. The zone between the MCT and MFT is, therefore a potential zone of occurrence of major earthquakes and recent in-sequence thrusting pattern needs to be considered during Himalayan seismic hazard studies.

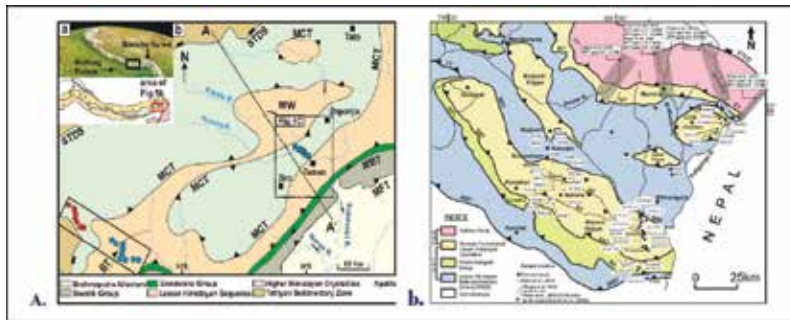


Figure 57 : (a) Geological map of Eastern Himalaya with locations of collected samples (map compiled from Singh and Jain (2007), Yin et al. (2010) (b) Geological map of the Kumaon-Garhwal region, NW-Himalaya - collected samples (Valdiya, 1980)

Title of the project	Name of the PI	Affiliation of the PI
Fundamentals of electrocoalescence and design aspects of electro-coalescers	Prof. Rochish Thaokar	Department of Chemical Engineering, Indian Institute of Technology Bombay, Mumbai

Salient Features :

Crude oils received in oil refineries have considerable salt as a result of their exploration from the oil wells. This salt needs to be removed before the crude oil is processed in a refinery for petroleum products, since otherwise it can cause corrosion of the refinery equipments. Towards this water droplets are mixed with the crude to transfer the salt in the crude oils to the water droplets. The water droplets are then removed using electric fields in a process called electrocoalescence. Electrocoalescers are therefore essential to all refineries and are the first important unit in any refinery. The project aims to understand electrocoalescence and develop design principles for new electrocoalescers for new opportunity crudes, which are cheaper but difficult to electrocoalesce (Figure 58).

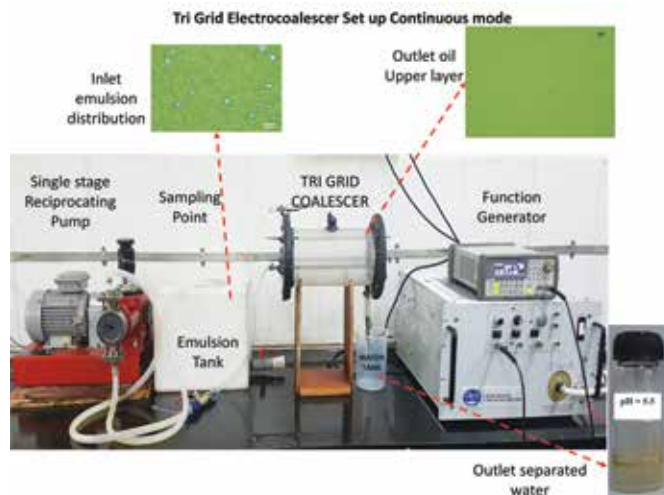



Figure 58 : Tri Grid Electrocoalescer Set up Continuous mode

Title of the project	Name of the PI	Affiliation of the PI
Setting up of ST Radar System at ARIES Nainital, Uttarakhand.	Director, ARIES	Aryabhata Research Institute of Observational Science (ARIES), Nainital, Uttarakhand.
<p>Salient Features : Another Stratosphere Troposphere Radar has been installed at ARIES, Nainital at a relatively lower frequency. During 2016-17, after successful installation of the clutter fence around the antenna array, the radar has been operated for nearly 500 hours with its seven clusters and captured wind data up to a height ~13 Km Observed wind pattern from the system is consistent with the general wind patterns over this region. The radar is being made fully operational by next few months (Figure 59).</p>		
		
<p>Figure 59 : ASTRAD antenna array on the roof-top of the ASTRAD building with recently installed clutter fence along the periphery of the antenna array.</p>		



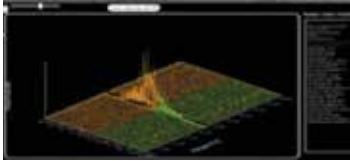
Title of the project	Name of the PI	Affiliation of the PI
Setting up of ST Radar System at University of Calcutta, West Bengal.	Prof. Ashik Paul	Institute of Radio Physics and Electronics, University of Calcutta.
<p>Salient Features : A Stratosphere-Troposphere (ST) radar at 53MHz is being implemented by Calcutta University at Ionosphere Field Station, Haringhata of the University. This will be a unique facility at this frequency in the entire eastern and north-eastern part of India. The 19-element Pilot Radar is presently operational at Haringhata. Efforts are being made to validate the wind profiles with radiosonde observations in collaborations with North Eastern Space Applications Centre (NESAC). Some initial observations from the lower atmosphere as well as backscatter from ionosphere have been recorded. A paper based on these initial results has been accepted for oral presentation at the 15th International Symposium on Equatorial Aeronomy (ISEA-15) to be held at Physical Research Laboratory (PRL) in October. Two Project Engineers, one Research Scientist and one JRF are presently working in the project. QT/AT tests for Transmitter Receiver Modules (TRMs) and Antenna are presently being conducted at AMPL, Hyderabad by the CUSAT team. Necessary training for system maintenance and data analyses is being conducted at National Atmospheric Research Laboratory (NARL), Gadanki (Figure 60).</p>		
		
ST Radar Pilot Subarray	Radar Controller	Lower Atmospheric Profile

Figure 60 : ST Radar System at University of Calcutta, West Bengal.

Title of the project	Name of the PI	Affiliation of the PI
Interdisciplinary forays into human-environment interactions: an integrative research initiative in energy, ecology and nonlinear modelling	Director, NIAS Dr. Hippu Salk Kristle Nathan Prof. Sindhu Radhakrishna, Prof. Janaki Balakrishnan,	National Institute of Advanced Studies, Bangalore

Salient Features :

This perhaps is the being first multidisciplinary proposal where studies on various issues on energy, human-animal conflicts and modelling of environment assessment near coal mining areas. The study area proposed is Ramagundam area, Karim Nagar District of Telengana state. Major objective is to conceptualize self-sustaining ecosystem, develop suitable regulatory mechanism for pre- and post-mining land usage and ecological impact of coal mining. Initially available data for PM 10 and PM 2.5 will be collected from coal mining areas and be analysed. The studies will also be carried out on farm mitigation techniques as well as temporal and spatial demographic behaviour between human and primates. These two aspects of "Energy utilisation" and "Human Animal Concepts" will be handled for better understanding of the process as well as look into the predictability.

Title of the project	Name of the PI	Affiliation of the PI
Facility for protein X-ray crystal structure determination and protein design-PHASE-II	Prof. B. Gopal	Molecular Biophysics Unit, Indian Institute of Science, Bengaluru

Salient Features :

The X-Ray facility was established by a DST-Thrust Area Programme grant in 1983. It has subsequently been supported by grants from the DST / SERB IRHPA scheme. The facility has served as a node for structural biology research in India; indeed a substantial number of macromolecular crystallography researchers in India have been associated with this facility at different points in their career. The mandate of this facility is to determine the structures of biological macromolecules and macromolecular assemblies of significant biological and pharmaceutical interest. The diffraction data collection, liquid handling and solution scattering equipment at the facility form the core research infrastructure for six faculty and over fifty students and post-doctoral fellows. This facility is accessed by groups from other academic institutions in Bangalore as well as other parts of India (Figure 61). The thrust of the research programme in the recent past has been in the structure-function studies of integral membrane proteins involved in neurotransmitter transport and antimicrobial resistance. In order to image membrane protein crystals in lipid-rich systems, a high throughput UV imaging system (UVEX-P) was procured recently. This has considerably strengthened resources for membrane protein research. Among ongoing Programmes, substantial progress was achieved in the recent past on heat shock proteins, HSP90, and small heat shock proteins (sHSPs) (Figure 62).

Ongoing projects that extensively utilize the facility aim to capitalize on high resolution structural information for the design of chemical modulators/ inhibitors for selected *Mycobacterium tuberculosis* proteins. The facility at IISc thus caters to the broad mandate of advancing fundamental research on biologically important macromolecules while also facilitating early stage, preclinical translation research efforts.

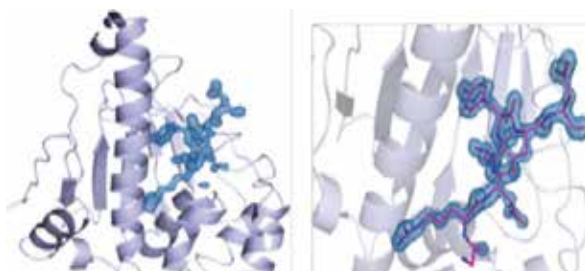


Figure 61 : State of the art facilities for structural biology. The Rigaku FRE+ superbright X-ray generator with copper (Cu) and a chromium (Cr) anode was installed in Phase I of the current IRPHA project (left).

Figure 62 : HSP90 is a target for cancer drugs. Crystal structure of the N-terminal domain of HSP90 of *Dictyostelium discoideum* has been determined presenting the first structural view of a peptide bound at the active site. (Sci Reports 2015 5:17015).

4 Fostering Young Researchers

It is extremely important to provide opportunities to young researchers to enable them to focus on research projects based on their original ideas. The pillar "Fostering Young Researchers (FYR)" provides support to young scientists having adequate background and training for pursuing exciting and innovative research in frontier areas. The pillar also supports training of Ph.D. students outside the country, thereby adding heft to research capabilities and outcomes at Indian universities.

4.1 YOUNG SCIENTIST SCHEME (YSS)

The Start-up Grant is an important element in the career of a young scientist. In recent times, the YSS (erstwhile) has been restructured into two parts – National Post-Doctoral Fellowship (N-PDF) and the Early Career Research Award (ECRA). The N-PDF aims to provide opportunities for young PhDs to avail post-doctoral research

fellowships in academic institutions and research laboratories of the country. The ECRA provides start up research grants to young researchers. The erstwhile YSS continue to be in existence w.r.t its already ongoing approved projects in all the five basic disciplines.

4.2 EARLY CAREER RESEARCH AWARD (ECRA)

Objective

To provide supplementary and concentrated support to the young and emerging Indian researchers in the area of Science, Engineering and Medicine who are in their early career for pursuing exciting and innovative research.

Features

- One of the most vital research opportunities for young professionals. It refers to the first assignment in the beginning of their career.
- A regular academician/researcher in a recognized academic institution/ or national laboratory or any other recognized R&D institutions can apply.
- This grant is one-time award with up to Rs.50.00 Lakhs (Excluding Overheads) for duration of three years.

Website links

<http://serbonline.in/SERB/ecr?HomePage=Newhttp://www.serb.gov.in/ecr.php>

4.2.1. CHEMICAL SCIENCES

A total of 295 proposals have been received under different sub disciplines of Chemical Sciences and 22 proposals were supported (Figure 63).

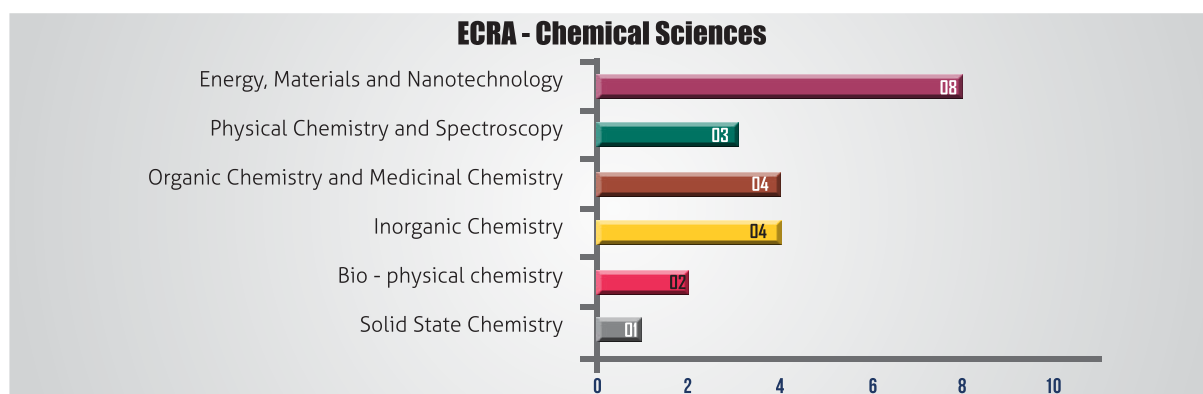


Figure 63 : Projects supported in Chemical Sciences.

4.2.2 EARTH AND ATMOSPHERIC SCIENCES

A total of 65 proposals have been received under different sub disciplines of Earth & Atmospheric Sciences and 21 have been supported (Figure 64).

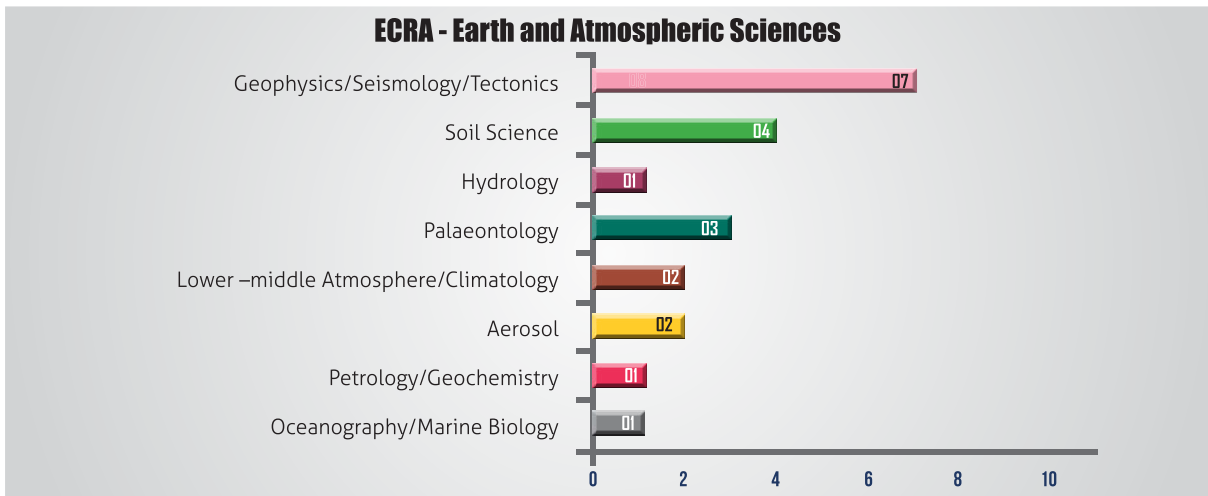


Figure 64 : Projects supported in Earth and Atmospheric sciences.

4.2.3 ENGINEERING SCIENCES

A total of 727 proposals have been received under different sub disciplines of Engineering Science and 221 were supported (Figure 65).

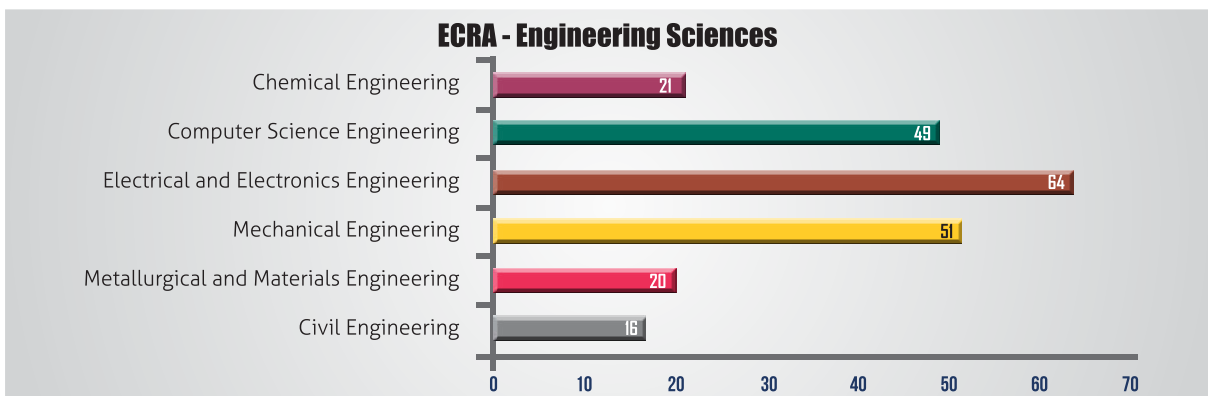


Figure 65 : Projects supported in Engineering Sciences.

4.2.4 LIFE SCIENCES

A total of 759 proposals have been received under different sub disciplines of Life Science and 99 have been supported (Figure 66).

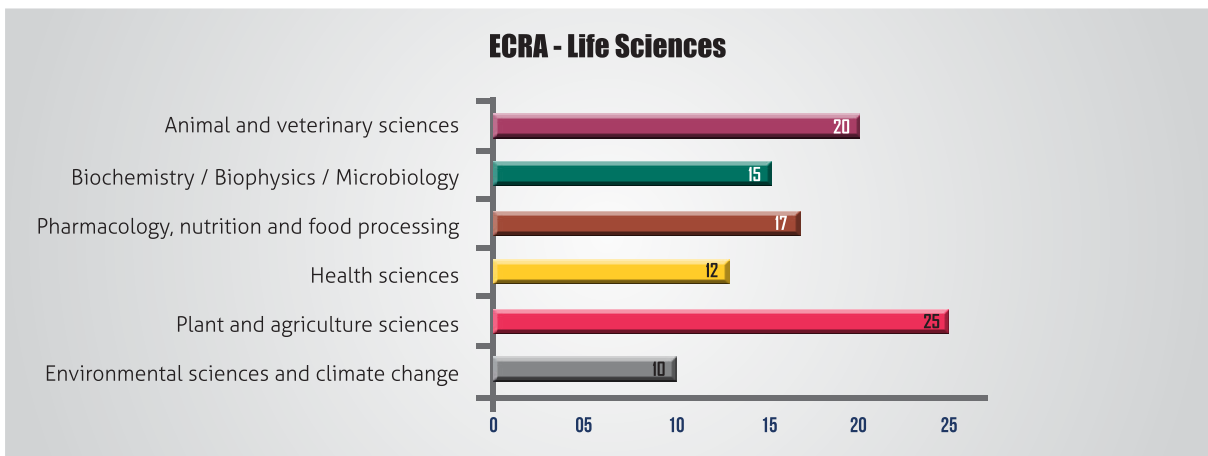


Figure 66 : Projects supported in Life Sciences.

4.2.4 PHYSICAL AND MATHEMATICAL SCIENCES

A total of 261 proposals have been received under different sub disciplines of Physical and Mathematical Sciences and 63 have been supported (Figure 67).

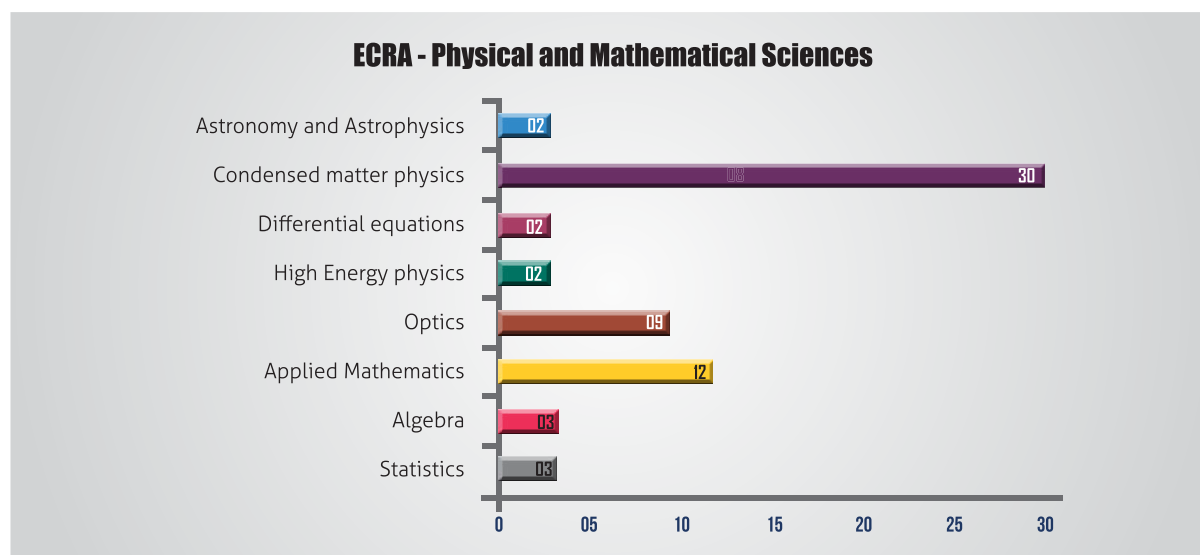


Figure 67 : Projects supported in Physical and Mathematical Sciences.

4.3 NATIONAL POSTDOCTORAL FELLOWSHIP (NPDF)

Objective

This Fellowship aims to identify motivated young Indian researchers and provide them support for doing research in scientific field.

Features

Fellows availing NPDF are required to work under a mentor so that the training provided to them act as a platform to develop them as an independent researcher.

NPDFs are open to the applicants who have obtained Ph.D/ MD/MS degree in Science, Engineering and Medicine.

The fellowship is a temporary assignment and provide a sum of Rs. 35,000 to 55,000 per month for the period of 2 years with overhead amount of Rs. 1,00,000 per annum to each awardee. Can be availed only once during career.

Website links

<http://serbonline.in/SERB/npdf?HomePage=Newhttp://www.serb.gov.in/npdf.php>

4.3.1 CHEMICAL SCIENCES

A total of 671 proposals have been received under different sub disciplines of Chemical Sciences and 286 have been supported (Figure 68).

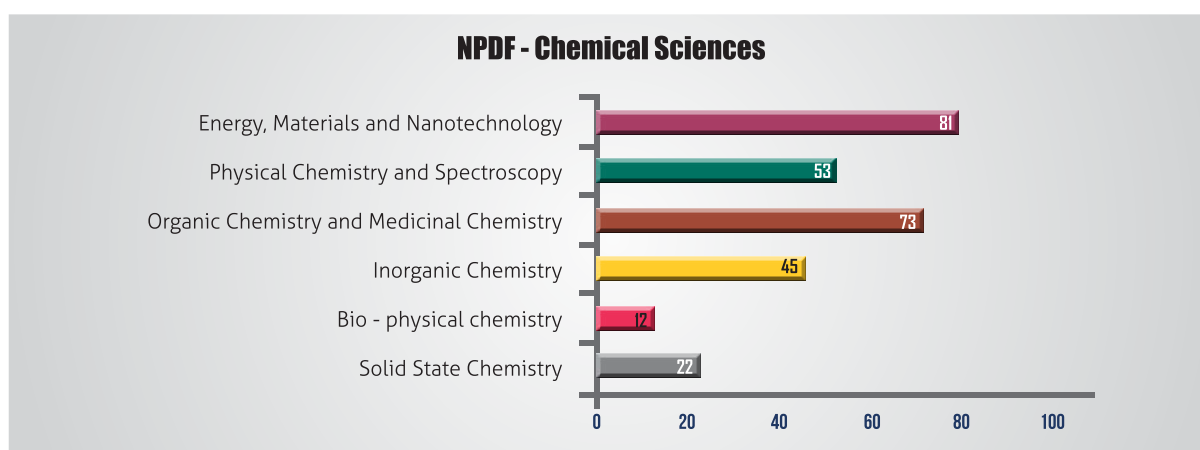


Figure 68 : Projects supported in Chemical Sciences.

4.3.2 EARTH & ATMOSPHERIC SCIENCES

A total of 169 proposals have been received under different sub disciplines of Earth & Atmospheric Sciences and 83 have been supported (Figure 69).

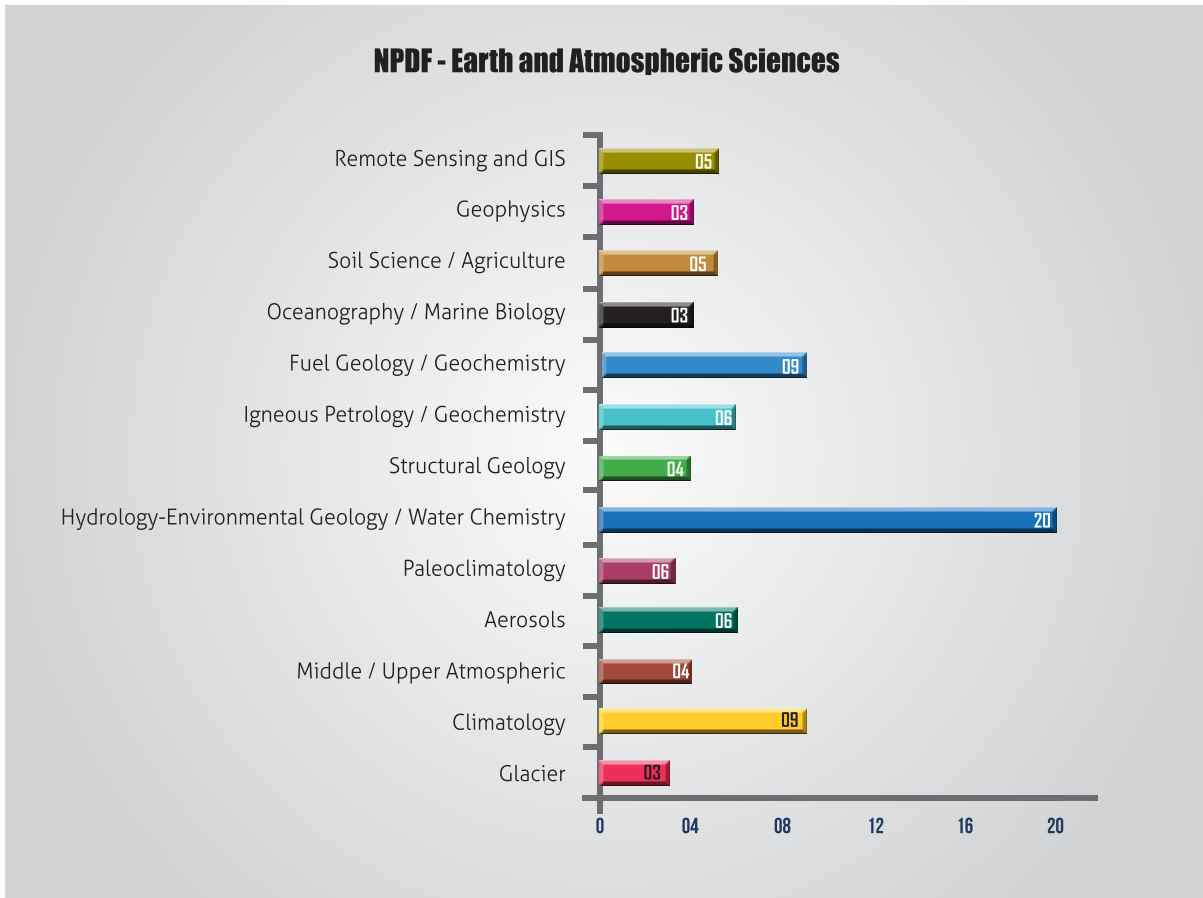


Figure 69 : Projects supported in Earth and Atmospheric Sciences

4.3.3 ENGINEERING SCIENCES

A total of 310 proposals have been received under different sub disciplines of Engineering Sciences and 110 have been supported (Figure 70).

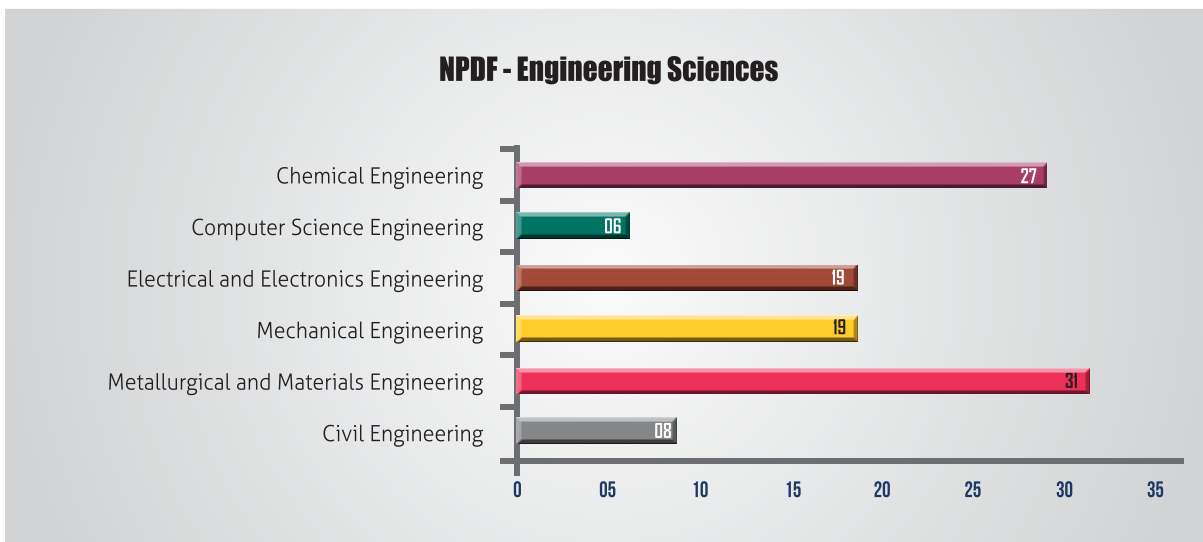


Figure 70 : Projects supported in Engineering Sciences

4.3.4 LIFE SCIENCES

A total of 1558 proposals have been received under different sub disciplines of Life sciences and 504 have been supported (Figure 71).

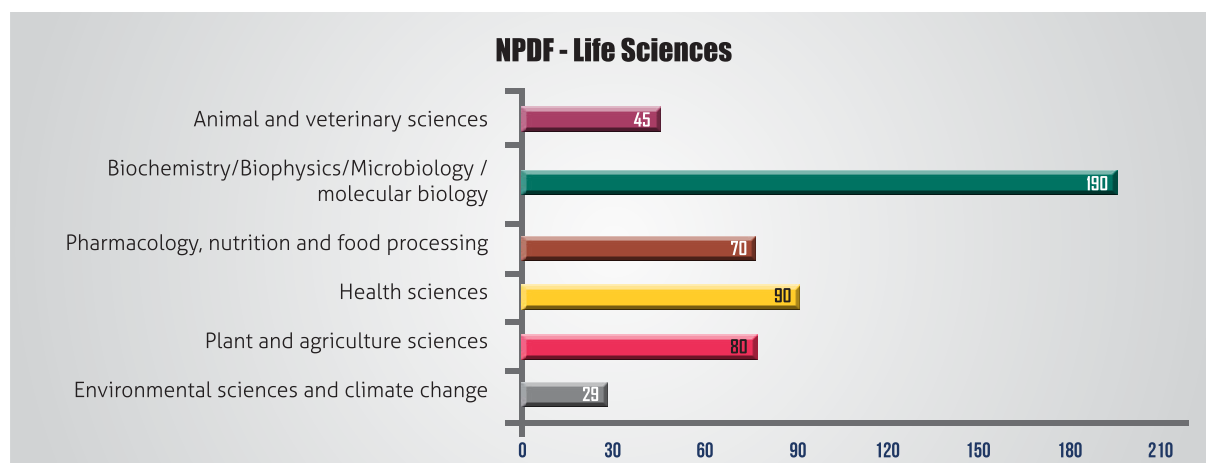


Figure 71 : Projects supported in Life Sciences.

4.3.5 PHYSICAL AND MATHEMATICAL SCIENCES

A total of 398 proposals have been received under different sub disciplines of Physical and Mathematical Sciences and 160 have been supported (Figure 72).

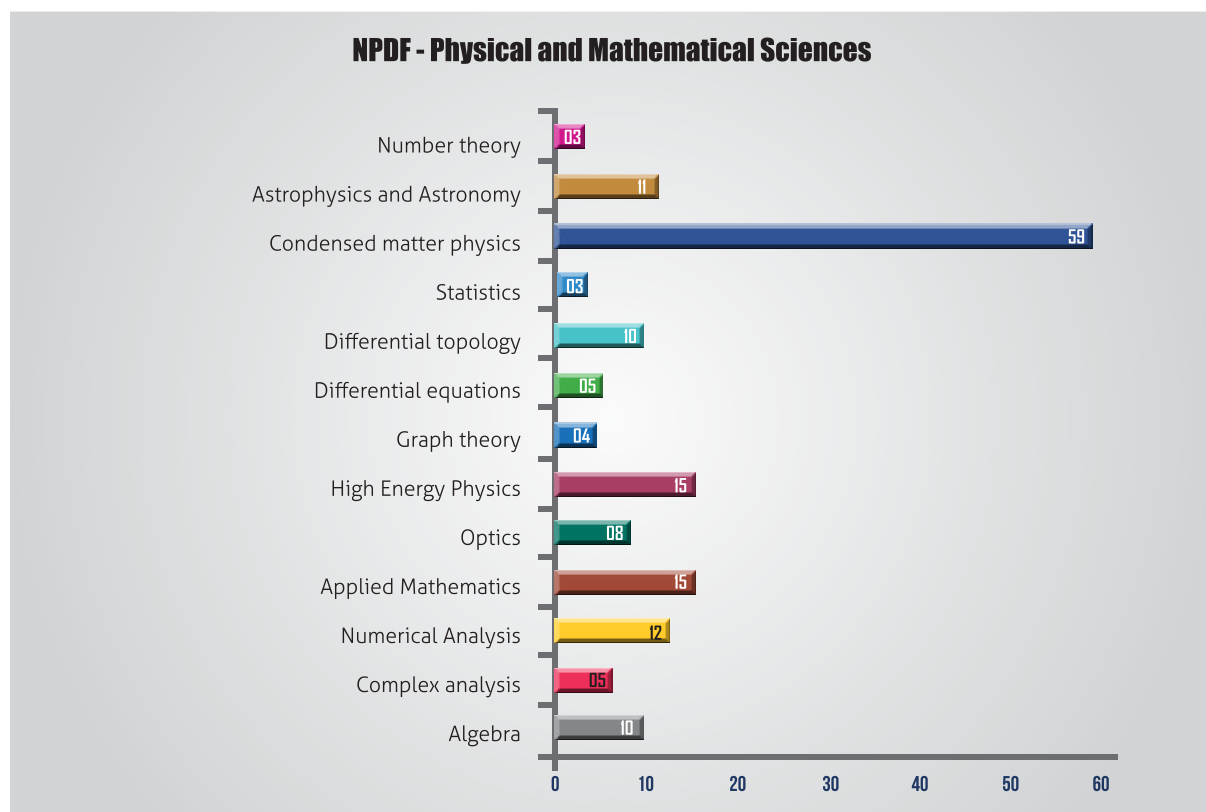


Figure 72 : Projects supported in Physical and Mathematical Sciences.

4.4 SIGNIFICANT RESEARCH HIGHLIGHTS FROM YSS/ECRA/NPDF PROJECTS

A large number of young researchers are awarded NPDF and ECRA every year; and so was the case this year. These awards constitutes a major proportion of SERB's budget; and are real motivators to the bidding scientists, to come out with substantial research outcomes. However, for the purpose of

brevity, only one research highlights from each discipline of YSS/ECRA/NPDF have been included in the document here.

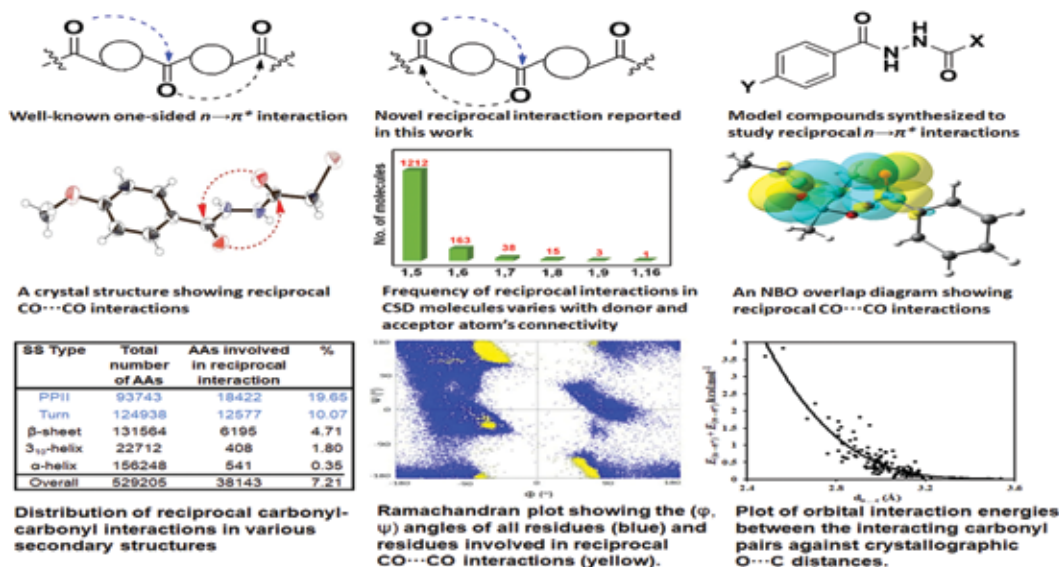
4.4.1 CHEMICAL SCIENCES

Understanding various aspects of Noncovalent Interaction: Carbonyl-carbonyl ($\text{CO}\cdots\text{CO}$) $n\rightarrow\pi^*$ interaction is an emerging noncovalent interaction found in many important small and macromolecules. The emergence of interaction as a stabilizing force in \rightarrow -helices, polyproline II (PPII) helices and collagen triple helices has created a lot of excitement in this area. The scientific community now considers it as an important noncovalent interaction that warrants incorporation in the computational force fields. All known $\text{CO}\cdots\text{CO}$ $n\rightarrow\pi^*$ interactions are one-sided in nature, wherein one carbonyl group donates and the other one accepts. The objective of this project was to look for the possibility of "reciprocal" $\text{CO}\cdots\text{CO}$ interactions in small molecules and proteins where the two carbonyl groups will be involved in back and forth electron donation between them.

First, model compounds were designed and synthesized; X-ray crystallographic and theoretical studies were subsequently carried out to show that reciprocal $\text{CO}\cdots\text{CO}$ interactions are widely present in small molecules and proteins. The prevalence of reciprocal interactions in PPII

helices and turn regions of proteins suggests a possible role for these interactions in protein folding. Further, the presence of these interactions in distorted \rightarrow -helices and twisted \rightarrow -sheets suggests that these interactions could stabilize SS that deviate from their regular geometries. The reciprocal $\text{CO}\cdots\text{CO}$ interactions present at the interface of two different types of SS could also help in stabilizing the strained amino acid residues that are present at these interfaces.

The discovery of reciprocal interactions opens up many possibilities. In future, it would be interesting to investigate the ability of amino acid pairs having high propensity to get involved in reciprocal $\text{CO}\cdots\text{CO}$ interactions to stabilize PPII helices and \rightarrow -turns. It would also be interesting to investigate if some non-peptidic fragments (obtained from the CSD) having strong reciprocal interactions could act as used to stabilize PPII conformation or to design peptide- \rightarrow -turns. Finally, these interactions could be a novel force to impart conformation constraints in small molecules, a property required for high potency of bioactive compounds and drugs.



Understanding Reciprocal carbonyl-carbonyl interactions in small molecules and proteins [Reference: Nature Communications,

Figure 73 : Understanding Reciprocal carbonyl-carbonyl interactions in small molecules and proteins

Reference: Nature Communications, Volume 8, Article number: 78, 2017

Crucial role of torsional angle to determine the magnetic exchange was then explored. Broken Symmetry-DFT calculation of "complex 2" was carried out and revealed the expected

ferromagnetic exchange between two Cu(II) ions with J value of $+1.4 \text{ cm}^{-1}$. Variable temperature magnetic susceptibility measurements reveal that there is indeed ferromagnetic exchange

with the J value of $+1.32 \text{ cm}^{-1}$. The dc magnetic susceptibility measurements show drastic changes of magnetic properties from

paramagnetic nature of "complex 1" to weak ferromagnetic exchange of "complex 2".

4.4.2 EARTH AND ATMOSPHERIC SCIENCES

Modelling the impact of constructing cascade dams on the evolution of the downstream:

The overall flood conveyance of the channel to downstream of dams may decrease leading to increase in flood risk.

A more attenuated hydrograph at the upstream boundary is likely to be responsible for the formation of an overall gentle relief in the channel in the post-dam state, as compared to

the pre-dam one. The theoretically expected rise in the river energy due to the lack of sediment load in the post-dam scenario was counteracted by the reduced magnitude of the peak discharge during this period vis-a-vis the pre-dam state. The major population centres downstream of the Teesta Stage Dam III and IV are not under significant risk in the event of an earthquake induced dam-break of the upstream dams (Figure 74).

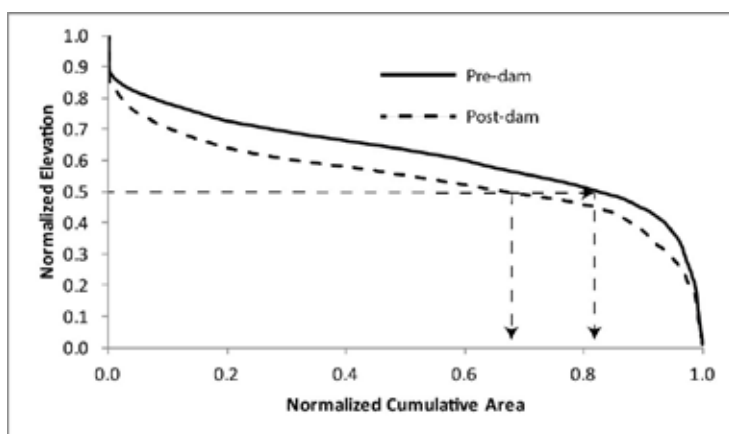


Figure 74 : Normalized hypsometric curves of the predicted pre- and post-dam states of the channel bed topography

4.4.3 ENGINEERING SCIENCES

Synthesizing single atom thick inorganic nanosheets isomorphous to graphene by developing chemical exfoliation strategies for layered boron-based materials. Findings of the study will motivate scientists to explore the rich potential offered by borides. The project was carried out through following three stages:-

(a) Exfoliation of a layered metal diboride (MgB_2) by ultrasonication: Demonstrated the feasibility of exfoliating MgB_2 using the simple tool of ultrasonication in an aqueous phase. This ability to synthesize chemically modified MgB_2 nanosheets will significantly add to the current state of knowledge on boron based quasi 2-D nanostructures. It will be exciting to explore the electronic, mechanical and thermal properties of these Mg-deficient hydroxyl functionalized boron-based nanosheets. The ultrasonication can result in exfoliating layered materials with interlayer binding forces stronger than the van der Waals forces. This ability to exfoliate MgB_2

to yield nanosheets with a chemically modified lattice and properties distinct from the parent material presented a fundamentally new perspective on the science of MgB_2 (Figure 75).

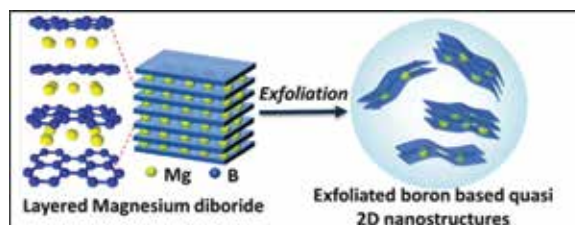


Figure 75 : Exfoliation of layered metal borides (for example, magnesium diboride) into few layer thick nanosheets (quasi 2D nanostructures).

(b) Exfoliation of layered MgB_2 and AlB_2 by developing a chelation based chemical recipe: As chelation assisted exfoliation can not only be extended to members of the metal boride family, as described for the case of AlB_2 , but also other layered ionic solids such as metal oxides,

metal carbides, and silicides having interlayer metal atoms that might be susceptible to chelation. This prospect is supplemented by an entire arsenal of chemical ligands that not only enable chelation but also assist in stabilization. The porous, lamellar nature of the lyophilized nanosheets and the presence of B-H surface functionalities are expected to have important implications in evaluating the candidature of these nanomaterials for hydrogen storage, considering that boron compounds, especially borohydrides, are high potential materials for hydrogen storage (Figure 76).

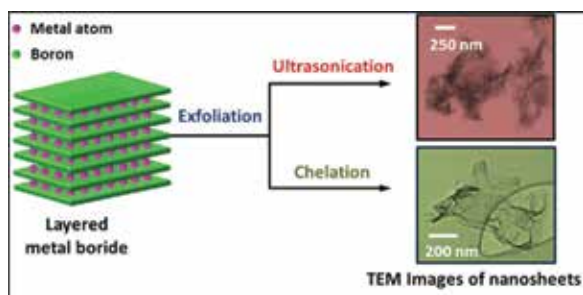


Figure 76 : Layered metal borides can be exfoliated into few-layer-thick boron based nanosheets by (i) ultra-sonication (ii) chelation

(c) Chemical exfoliation of layered magnesium diboride to yield functionalized nanosheets and nanoaccordions for potential flame-retardant applications: This work presents maiden efforts on the synthesis of accordion-like nanostructures from any layered metal boride. This also forms the first study demonstrating that nanoscale metal borides have the potential to be used as excellent flame-retardant fillers in a flammable polymer matrix. The ability to exfoliate MgB_2 to yield nanoaccordions and

nanosheets paves the way to explore if other layered metal borides, (such as TiB_2 , TaB_2 , HfB_2 ; around 20 metal borides analogous to MgB_2 are known), can also yield such nanostructures. Furthermore, it would be promising to see if the nanoscale metal borides can capitalize the excellent physicochemical properties offered by this family of layered materials. (Figure 77).

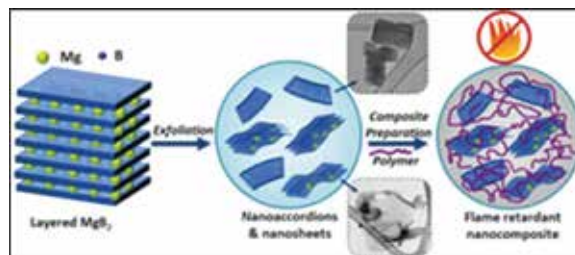


Figure 77 : Layered MgB_2 exposed to prolonged and rigorous chemical treatment

4.4.4 LIFE SCIENCES

Characterization of Arsenic Bioaccumulation by an Arsenic Tolerant Rhizospheric Fungus *Piriformospora indica* and its Utilization for Amelioration of Arsenic Mediated Toxicity:

This study has been conducted to identify the location and amount of arsenic bioaccumulation in rice plant. It has been observed during the study that *P. indica* is able to tolerate both sodium arsenate and sodium arsenite up to 1mM, adsorbed on cell wall and accumulate in vacuoles up to 28.8% and 20% at 0.1 and 2 mM (Figure 78 & 79). This study also suggested that *P. indica* protects rice plant from arsenic toxicity, regulates anti-oxidative enzyme and reduces the arsenic load in rice plant.

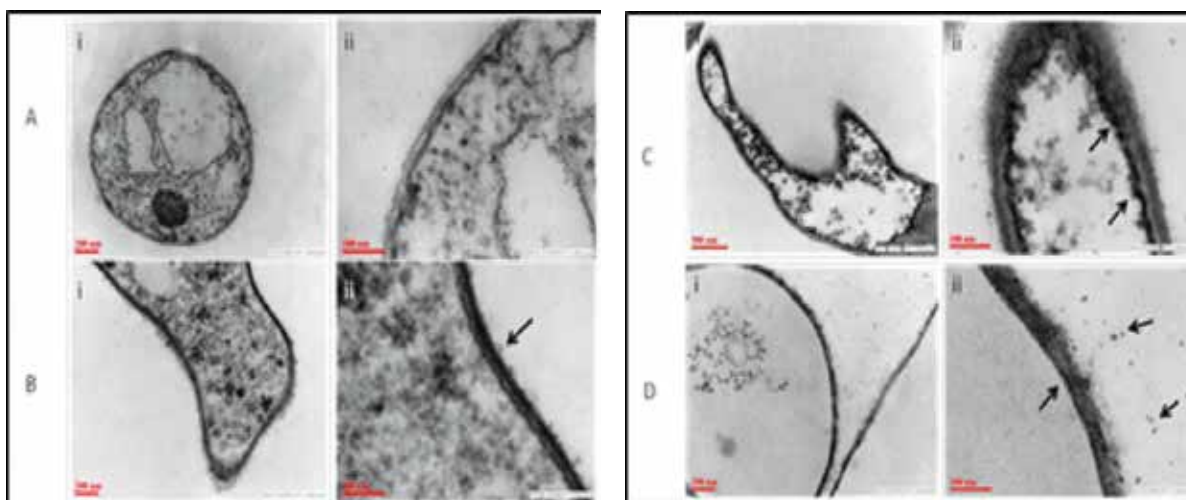


Figure 78 : Transmission electron micrograph of fungus *P. indica* showing arsenic adsorption, accumulation and precipitation. A, untreated fungus; B, accumulation of arsenic on cell wall of fungus (marked with arrows) treated with sodium arsenate (As V); C, accumulation of arsenic on in vacuole of fungus (marked with arrows) treated with sodium arsenate (As V); D, synthesis of insoluble precipitates of arsenic (marked with arrows) on cell wall of fungus treated with sodium arsenite

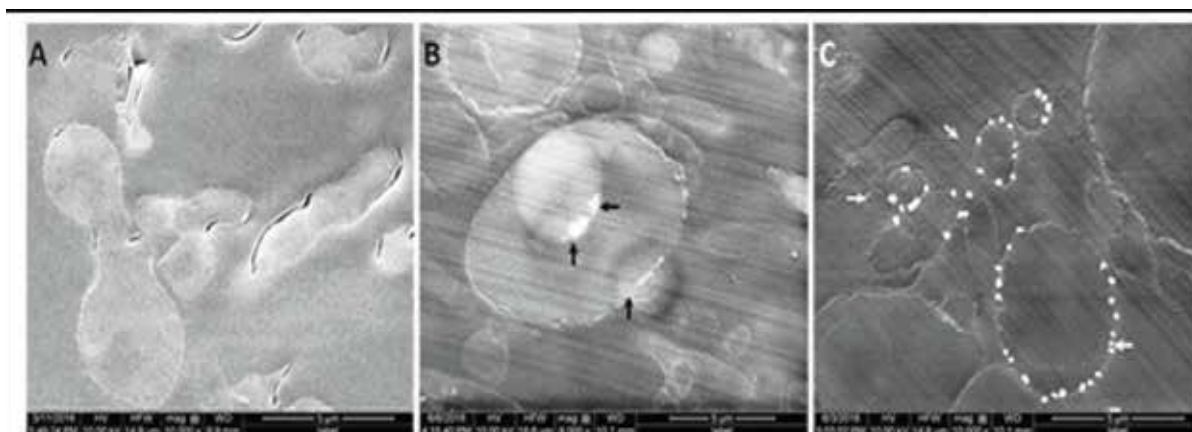


Figure 79 : SEM of fungus *P. indica* showing adsorption, accumulation and precipitation. A, untreated fungus; B, Accumulation of arsenic in vacuoles and on cell wall of fungus (marked with black arrows) arsenic (100 μM As); C, Synthesis of insoluble precipitates (marked with white arrows) (500 μM As).

4.4.5 PHYSICAL AND MATHEMATICAL SCIENCES

Multi Petawatt Laser plasma Interactions: A new frontier in Physics: Generating proton or ion beams with limited energy spread is always a challenging task. The project investigates the recent developments in the field of ultrafast isochoric heating of multi-layered solid targets with hot electrons. It has been demonstrated for the first time, mono-energetic heavy Au ion accelerated with all the charge states of Au accelerated, to the same velocity using nano structured targets. Especially, engineered multi-layer targets have been developed to

achieve uniform volumetric heating which can last for several picoseconds, enhancing the coupling between hot electrons and ions by collisional shock waves in order to achieve keV ion temperatures at solid density. (Figure 80). The mono-energetic heavy ion production of multiple charge states offers a new possibility for ion injectors and compact accelerators and applications such as laboratory astrophysics, shock related studies, and isochoric heating of matter, exploiting the unique characteristic of laser accelerated ion beam.

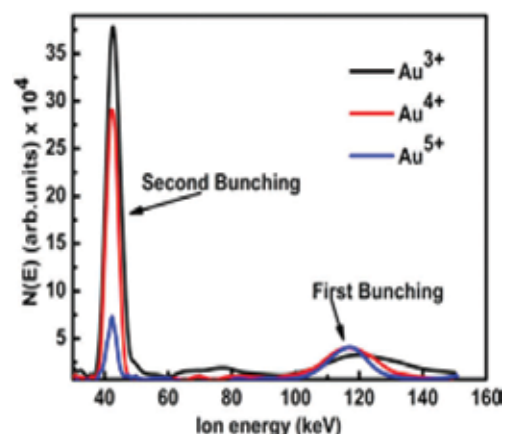
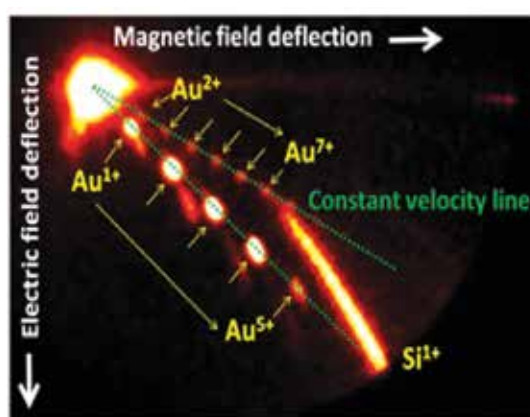


Figure 80 : a) Multiple Au ion bunches from Au-C nanocomposite thin film on Si substrate: Ion emission spectra recorded with TPIS from Au-C nano-composite thin film showing multiple mono energetic ion bunches having peak at different energy. b) Calculated ion energy spectrum of Au ion species

The study reports that for the first time, highly repeatable, mono-energetic, multi-species bunched gold ion acceleration from moderately intense laser produced plasmas employing targets containing Au nanoparticles co-sputtered with carbon on Al and Si substrate. The research is mainly motivated by the challenge

of understanding the underlying physics and potential applications such as hadron therapy in oncological applications, injector to conventional particle accelerators, proton driven fast ignition, short lived isotope production for Positron Emission Tomography, particle radiography etc.

4.5 SERB OVERSEAS POSTDOCTORAL FELLOWSHIP

Objective

The fellowship aims to build national capacity in frontier areas of Science and Engineering, which are of interest to India.

Features

This fellowship duration is of one year and is extendable up to one more year, subject to good performance.

Amount of fellowship is US\$ 3000 per month and a contingency/preparatory allowance of Rs. 60,000/- is also provided to each fellow.

The applicant should have completed Ph.D not earlier than the preceding two years from recognized institutions in India.

Website links
<http://www.serb.gov.in/opf.php>

During the year under review, 45 postdoctoral students were selected for US specific Institutions

and another 37 researchers for undertaking research in 11 countries.

4.6 TEACHER ASSOCIATESHIP FOR RESEARCH EXCELLENCE (TARE)

TARE being the new programme conceived and approved by the board during the previous financial year. It was officially launched by the Honourable Minister for Science and Technology

and first call for proposals was made on 1st February to 31st March 2017. A total of 1381 proposal are received during the call and are under processing for further evaluation.

Objective

To provide an opportunity to those academicians cum researcher(s) working in State Universities / Colleges and in private Academic Institutions who wants to learn new vistas of S&T by carrying out their research work in an established public funded institution such as IITs, IISc, IISERS, National Institutions (NITs, CSIR, ICAR, ICMR labs and other central institutions) and Central Universities, located preferably nearer to the institution where the faculty member is working.

Features

The applicant(s) must have a regular academic / research position in a State Universities / Colleges and in private Academic Institutions.

Research fellowship of Rs. 60,000/- per year (in addition to the researcher's own salary) will be provided subject to completion of minimum 90 days research work per year in the host institution. Research grant of Rs. 5 lakhs per annum (50% each to host and parent institution) and overheads (as per SERB norms) will be provided.

Website links
<http://serbonline.in/SERB/Tare>

5 BUILDING RESEARCH NETWORKS

The networking, exchange and linkages are essential for the pursuit of science, and can be achieved through various partnerships between institutions, departments and ministries. Due to involvement of multiple processes and agencies, collaborative activities are inherently complex. Recognizing this, SERB has been making constant efforts to build peer networks through its pillar "Building Research Networks (BRN)".

5.1 NATIONAL COLLABORATIONS

5.1.1 PRIME MINISTER'S FELLOWSHIP PROGRAMME FOR DOCTORAL RESEARCH

Objective	Features	Website links
<p>This fellowship is aimed at encouraging young, talented, enthusiastic and result-oriented Ph.D scholars to take up industry-relevant research. The government and corporate sector have jointly developed the concept of Prime Minister's Fellowship to attract talent for doctoral research, nurture leadership qualities in scholars, provide exposure to international best practices & innovations and encourage industrial research in academic institutions.</p>	<ul style="list-style-type: none"> The programme provides mentoring through industry and academic expert through the mechanism of annual review meetings. The applicant should have a valid industry partner who should be ready to support the research project financially as well as provide guidance and mentorship. Fifty percent fellowship each comes from the government and the partner Industry. It has the provision to award up to 100 new scholarships every year, of up to Rs 8.7 lakh per annum per candidate for 4 years. 	<p>http://www.serb.gov.in/pmfdi.php http://www.primeministerfellowshipsscheme.in/ http://www.serbficci-iiirada.in/</p>

The scheme has received enormous response over a period of time. This year itself, more than 700 aspirants gave proposals out of which, a total of 19 proposals were supported during the year.

Name of partnership	Name of organization/ agency	No. of fellows
Prime Minister's Fellowship Scheme for Doctoral Research	SERB	86 ongoing fellows
	CII & FICCI	

5.1.2 RESEARCH & DEVELOPMENT SCHEME IN FOOD PROCESSING

Objective	Features	Website links
<p>The scheme is aimed at creation of processing and preservation capacities as well as modernisation / expansion of existing food processing units.</p>	<ul style="list-style-type: none"> The R&D outcomes should benefit Food Processing Industry in terms of product and process development, improved preservation, packaging, storage and distribution technologies, value addition, standardization of additives, coloring agents, preservatives, pesticide residues, etc. with focus on enhancement of production, quality, consumer safety, public health and trade. The setting up of new units and modernization/ expansion of existing units are covered under the scheme. 	<p>http://www.serb.gov.in/pdi.php http://www.mofpi.nic.in/</p>

This scheme is jointly supported by Ministry of Food Processing Industry (MoFPI) and SERB, DST.

Name of Partnership	Name of organization/ agency	No. of projects
R&D Scheme in Food Processing	SERB	19 ongoing projects
	MoFPI	

5.1.3 CELL TOWER AND MOBILE RADIATION PROGRAMME

<p>Objective</p> <p>The Programme is aimed at Studying the possible impact of EMF radiation exposure from mobile towers and handsets, especially on Humans life, Living Organism, Flora & Fauna & Environment, and to take up related R&D initiatives for next generation technologies in order to develop environmentally benign solutions for wireless and mobile communication.</p>	<p>Features</p>	<p>Website links</p> <p>http://www.serb.gov.in/ctr.php</p>
	<p>To focus on hazard risk aspects of radiation taking into account population density; To carry out health risk quantification on human and other ecosystems.</p> <p>To derive country specific norms and R&D solutions for mitigating the hazard potentials and health risks through innovations.</p>	

It is a joint initiative with Department of Telecommunication (DoT), Ministry of Communications in campaign mode to study the possible impact of EMF radiation exposure from mobile towers and handsets on Flora & Fauna.

Name of Partnership	Name of organization/ agency	No. of projects
Cell Tower and Mobile Radiation	SERB	19 ongoing studies
	DoT	

5.1.4 IMPACTING RESEARCH INNOVATION AND TECHNOLOGY (IMPRINT) PROGRAMME

<p>Objective</p> <p>To channelize the research in premier institutions in areas that can have largest social and economic good for the Country.</p>	<p>Features</p>	<p>Website links</p> <p>http://www.serb.gov.in/ir/it.php</p>
	<p>IMPRINT is piloted by MHRD and steered by Indian Institute of Technology and Indian Institute of Sciences.</p> <p>A first-of-its-kind pan-IIT and IISc joint initiative to lay down a research roadmap to address major engineering and technology challenges in ten selected domains relevant to our country's needs.</p> <p>Intended to bring forth collaborative funding for the research projects that would end up creating products and patents.</p>	

A unique national initiative called IMPacting Research, INnovation and Technology (IMPRINT) has been launched by the Ministry of Human Resource Development (MHRD), Government of India (GoI) to address all major engineering challenges relevant to India through an inclusive and sustainable mode of translational research steered by the top engineering institutions in the country. The President and Prime Minister inaugurated IMPRINT from Rashtrapati Bhavan on November 5, 2015. Ten technology domains have been identified under IMPRINT that could substantially impact the quality, safety and security of life both in urban and rural areas, namely: (1) Healthcare, (2) Energy, (3) Sustainable Habitat, (4) Nano Technology Hardware, (5) Water

Resources and River Systems, (6) Advanced Materials, (7) Information and Communication Technology, (8) Manufacturing, (9) Security and Defence, (10) Environmental Science and Climate Change.

SERB/DST, in partnership with MHRD on equal cost sharing supports projects mainly in the area of Advanced Materials and Nanomaterials. The scheme targeted the Faculties / Scientists of IITs, IISERs, NITs, JNU and IISc. About 2600 proposals were received and 259 selected for funding under this programme. Out of these, DST has supported 17 projects (50% of the total cost). Second release of these projects has been made in this financial year.

Seeing the wide spread enthusiasm, and also to simplify and streamline the process, MHRD decided to forge ahead with the next version of IMPRINT, that is IMPRINT-2 with a revised strategy. The SERB will implement IMPRINT-2 under the

guidance of the Apex Committee co-chaired by Secretary, DST and Secretary, MHRD. An announcement was made for inviting preliminary proposals on March 23, 2018 under IMPRINT-2.

5.1.5 UCHHATAR AVISHKAR YOJANA (UAY)

It's a national partnership programme with Ministry of Human Resource Development (MHRD) and Industry. In view to promote innovation of a higher order that directly impacts the need of the industry and thereby improving the competitive edge of Indian Manufacturing, the UAY has been launched by the MHRD. Under

UAY scheme, the industry-sponsored, outcome-oriented research projects are being funded by the Government. At present, SERB is contributing partial funding to 30 projects under UAY and it is likely that SERB's support will be extended to some more projects in future.

5.1.6 ABDUL KALAM TECHNOLOGY INNOVATION NATIONAL FELLOWSHIP (AKTIN)

SERB has launched the Abdul Kalam Technology Innovation National Fellowship to recognize, encourage and support translational research by Indian Nationals. Indian National Academy of Engineering (INAE) will co-ordinate and award AKTIN Fellowships in association with SERB-DST. All areas of engineering, innovation and technology will be covered by this fellowship.

The duration of the fellowship will be initially for three years. The nominations can be sent by the Heads of the Institutions/ Organizations, Presidents/ Fellows of National Science/ Engineering Academies, SS Bhatnagar Awardees and JC Bose awardees and the same will be accepted throughout the year. Maximum of 10 Fellowships will be awarded per year.

Features	
Objective To award outstanding engineers to recognize, encourage and support translational research to achieve excellence in engineering, innovation and technology development.	The scheme is applicable to Indian nationals working in India in various capacities of engineering profession in public funded institutions. The applicants should be working in India and possess adequate professional qualification and hold at least a bachelor's degree.
	This applicant should have a minimum of five (5) years of service left in the parent organization as on the date of the award. They should not be holding any other fellowship and in the event of selection, they will have to opt for only one of the fellowships.
	The fellowship amount is Rs. 25,000 per month, in addition to regular perks of these researchers in their parent organization. Research grant is Rs.15.00 lakh per annum, which can be utilized for engineering research and innovation activity including hiring of manpower, consumables, national and international travel for research purposes, chemicals, equipment, etc. An Overhead of Rs.1.00 lakh per annum is provided to the host institute.
	The fellow is eligible for regular research grants through the extramural and other research schemes of various S&T agencies of the Government of India.
Website links www.serb.gov.in/kalam.php	

5.2 INTERNATIONAL LINKAGES

5.2.1 VISITING ADVANCED JOINT RESEARCH (VAJRA) FACULTY SCHEME

VAJRA Faculty Scheme is instituted to bring a strong international connect to the R&D

ecosystem of India. The scheme offers adjunct / visiting faculty positions to overseas scientist

/ faculty / R&D professional including Non-resident Indians (NRI) and Overseas Citizen of India (OCI) to undertake high quality collaborative research in public-funded academic and research

institutions of India. VAJRA Faculty will engage in collaborative research in cutting edge areas of science and technology with one or more Indian Collaborators.

<p>Objective</p> <p>VAJRA aims to bring overseas scientists and academicians to India to work as adjunct/visiting faculty in public funded academic and research institutions.</p>	Features	<p>Website links</p> <p>www.serb.gov.in/vajra.php</p>
	<p>The scheme is open to overseas scientist / faculty / R&D professional including NRI and OCI.</p>	
	<p>The overseas scientist/faculty should be an active researcher working in a leading academic / research / industrial organization with proven track record of research and development.</p>	
	<p>Indian Collaborator(s) should be a regular faculty/researcher in public-funded institutions.</p>	
	<p>The residency period in India would be for a minimum of 1 month and a maximum of 3 months.</p>	
	<p>VAJRA Faculty will be provided US\$ 15000 in the first month of engagement and US\$ 10000 p.m. in subsequent two months.</p>	
	<p>While no separate support is provided for travel, accommodation, medical / personal insurance etc. the host institute may consider providing additional support.</p>	

5.2.2 GRADUATE RESEARCH OPPORTUNITIES WORLDWIDE (GROW)

<p>Objective</p> <p>To facilitate mutually beneficial research collaborations for GROW fellows and host researchers in India that will enhance science and engineering research & training by engaging complementary expertise and specialized skills, facilities and resources It aims to pave way for the next generation scientists and technologists from the United States to interact with their Indian peers.</p>	Features	<p>Website links</p> <p>http://www.serb.gov.in/grow.php</p>
	<p>It is divided into two tracks: GROW and GROW with US Agency for International Development (USAID). The standard GROW track offers research opportunities in the partner countries: Australia, Austria, Brazil, Chile, Denmark, Finland, France, India, Ireland, Japan, Korea, the Netherlands, Norway, Singapore, Sweden, and Switzerland. Through a partnership between NSF and the USAID, the GROW with USAID track provides opportunities to NSF Graduate Fellows to conduct research in developing countries, which includes Brazil, Colombia, India, Indonesia, Philippines, Senegal, and South Africa.</p>	
	<p>The research fellows must be enrolled at U.S. institutions, making satisfactory progress towards their degrees, and have fulfilled all Graduate Research Fellowship Programme (GRFP) reporting requirements. The competition is open to MS- and PhD-seeking Fellows.</p>	
	<p>It offers funding for international stays for 3-12 months, with the duration varying by country and partner organization.</p>	

It is a partnership between SERB and the NSF, U.S.A. to provide NSF Graduate Research Fellows with opportunities to enhance their professional development through research collaborations at top-caliber science and engineering research sites in India. GROW Awardees have been placed

at leading institutions across India. The binational Indo-U.S. Science and Technology Forum (IUSSTF) is administering the Programme in India. One fellow from University of Notre Dame had undertaken research visit under GROW in National Centre for Biological Sciences, Bengaluru.

Name of Partnership	Name of organization/ agency	No. of projects
GROW	SERB	One ongoing project
	NSF	

5.2.3 INDO-US GRAND CHALLENGE

Objective

Indo-US Grand Challenge Programme is aimed to develop durable, reliable and affordable blood pressure measuring technologies for either passive or active monitoring of hypertension.

Features

Two broad approaches are (i) High end systems that can measure and record the blood pressure of a large population quickly, integrated into a routine activity (ii) Minimal interaction devices meant for individual usage in home environment having low cost, consistent with personal use.

The guiding criteria for acceptability is reliability, simplicity and affordability. This implies that such systems may involve complex sophisticated technology at the back end, but the front user end should be as simple as possible.

It also means that while the cost of some of such systems may be significantly high in absolute terms, as in the case of high throughput devices, the overall cost per unit measurement should still be very low.

The project work is conducted by a consortium having knowledge and experience to undertake high-quality collaborative research programmes. These consortia consists of entities or individuals from academia, national laboratories, non-governmental institutions, industry and others as applicable.

Website links

<http://www.serb.gov.in/iusa.php>
<http://www.iusstf.org/story/53-60-Indo-US-Grand-Challenge.html>

The SERB has partnered with the National Institute of Biomedical Imaging and Bioengineering (NIBIB, NIH), USA. The purpose of the initiative is to encourage collaborative research within and between both the countries to propose new approaches to the measurement of Blood Pressure that are unobtrusive or passive, low cost and which can automatically provide frequent data recording and reporting to healthcare workers as well as feedback to the patients. The innovation resulting from the SERB, NIBIB and NIH, USA are intended to focus on the clinical needs of not only the underserved population of USA and India but are also expected to be more broadly applicable to the general population globally.

The SERB part of the Programme is handled by IUSSTF, New Delhi.

So far, 5 patents and more than 20 publications have emanated from these projects. As an overall outcome of the programme, the SERB-NIBIB initiative has succeeded in creating a group of scientists and engineers sensitized in this niche area. Moreover, new knowledge and several promising leads have been generated. The teams supported under this programme received funding at the critical proof-of-concept stage. Additionally, several of the mid-to-long-term leads generated through this programme may be poised to find interesting applications in areas other than blood pressure measurement.

Name of Partnership	Name of organization/ agency	No. of students supported
Indo-U.S. Grand Challenge	SERB, DST	10 ongoing projects
	NIBIB, NIH, USA	

5.2.4 SERB NEWTON - BHABHA INTERNATIONAL FELLOWSHIPS

SERB has entered into an understanding with NSF to partner the programme. The programme is administered through the binational IUSSTF. In PIRE scheme, the Indian applicant(s) have to apply through their US collaborator(s) by way of a complete and composite application, including the portion of Indian partner(s), directly to NSF.

The funding under the PIRE grants is provided under the budget heads applicable for regular DST / SERB grants, namely, manpower, equipment, consumables, travel, contingency and institute overheads. The extent of head-wise allocation as well as any special requirement is considered on case-to-case basis.

<p>Objective</p> <p>This programme is aimed at encouraging and supporting increased research capacity in the area of research and innovation in the field of Science, Technology, Engineering and Mathematics (STEM).</p>	<p>Features</p>	<p>Website links</p> <p>http://www.serb.gov.in/snbi.php</p>
	<p>The applicant should hold Ph.D Degree in STEM and working with regular positions in institutions based in India.</p> <p>The award is up to two consecutive years in length, spent in the UK undertaking research at a host university or research institute.</p> <p>The awards will provide a stipend, research expenses and one-off relocation expenses and will provide up to £99,000 for two years.</p> <p>The fellowship have been instituted through a MoU between SERB and the Royal Society, UK.</p>	

A MoU has been signed between The Royal Society and SERB. Covering fields of Science, Technology, Engineering and Mathematics (STEM).

Name of Partnership	Name of organization/ agency	No. of students supported
SERB Newton Bhabha International Fellowships	SERB	14
	The Royal Society, UK	

5.2.5 SERB OVERSEAS DOCTORAL FELLOWSHIP

<p>Objective</p> <p>To build national capacity in frontier areas of Science and Engineering, by giving an opportunity to Indian students to undertake /complete doctoral work in certain overseas institutions where agreement have been signed.</p>	<p>Features</p>	<p>Website links</p> <p>http://www.serb.gov.in/ocdf.php</p>
	<p>The duration of the fellowship is for 4 years and its amount is US\$2000 p.m. in addition to preparatory allowance and to and fro fare.</p> <p>The overseas institution where agreement have been signed are Cambridge University, UK. Stanford University, USA. Carnegie Mellon University, USA. University of Southern California, USA. University of California, Irvine, USA. Rice University, USA, the State University of New York, University at Buffalo, USA. University of British Columbia, Canada.</p>	

The Board has entered into an agreement with several leading universities in the world for the Indian students to do doctoral programmes abroad. The Board will provide fellowship amount of \$2000 pm for duration of 4 years, to and fro air fare and preparatory allowance

Name of Partnership	Name of organization/agency	No. of projects
SERB Overseas Doctoral Fellowship	SERB	14 students have availed the benefit of this fellowship.
	IUSSTF	

5.2.6 PARTNERSHIPS FOR INTERNATIONAL RESEARCH AND EDUCATION (PIRE)

<p>Objective</p> <p>PIRE is meant to support high quality projects which are in need of international collaborations and whose requirement could not be fulfilled without external involvement.</p>	<p>Features</p>	<p>Website links</p> <p>http://www.serb.gov.in/pire.php https://www.nsf.gov/funding/pgm_summ.jsp?prims_id=505038</p>
	<p>All areas of science and engineering are eligible for support under the programme.</p> <p>Grants of size up to INR 5 Crore could be provided over a period of 5 years.</p>	

PIRE is a highly prestigious international collaborative Programme of National Science Foundation (NSF) aimed to leverage the monetary resources of funding agencies as well as intellectual capabilities of research groups all over the world in

front line areas of research and education. India has joined the PIRE Programme through a bilateral agreement between SERB and NSF. The PIRE project being implemented at Indian Institute of Astrophysics, Bengaluru is progressing well.

Name of Partnership	Name of organization/ agency	No. of projects
PIRE	SERB	One sanction supporting six students
	NSF, USA	

5.2.7 S.N. BOSE SCHOLARS PROGRAMME

Objective	Features	Website links
<p>It is a dynamic student commute programme developed in partnership, for exposing Indian students to the world class R&D environment through research internship.</p>	<p>It is for Indian and U.S. students (enrolled in Bachelors and Masters programs in Atmospheric and Earth Sciences; Chemical Sciences; Engineering Sciences; Mathematical and Computational Sciences; Physical Sciences) to undertake a research internship.</p> <p>The duration of the internship is 10-12 weeks beginning each summer for 50 Indian students and 30 U.S. students to intern at partner universities in the U.S and recognized Indian educational institutions.</p> <p>A stipend of US\$ 2000/- for Indian student in US and Rs. 50,000 for US student in India are paid by SERB through IUSSTF.</p>	<p>http://www.serb.gov.in/snbasp.php http://serbonline.in/SERB/snbose?HomePage=New</p>

Name of Partnership	Name of organization/ agency	No. of projects
SN Bose Scholars Programme	SERB IUSSTF and WINStep Forward, USA	50 students have received the Internship during the year

5.3. INTERNATIONAL LINKAGES AND NATIONAL COLLABORATIONS AT A GLANCE

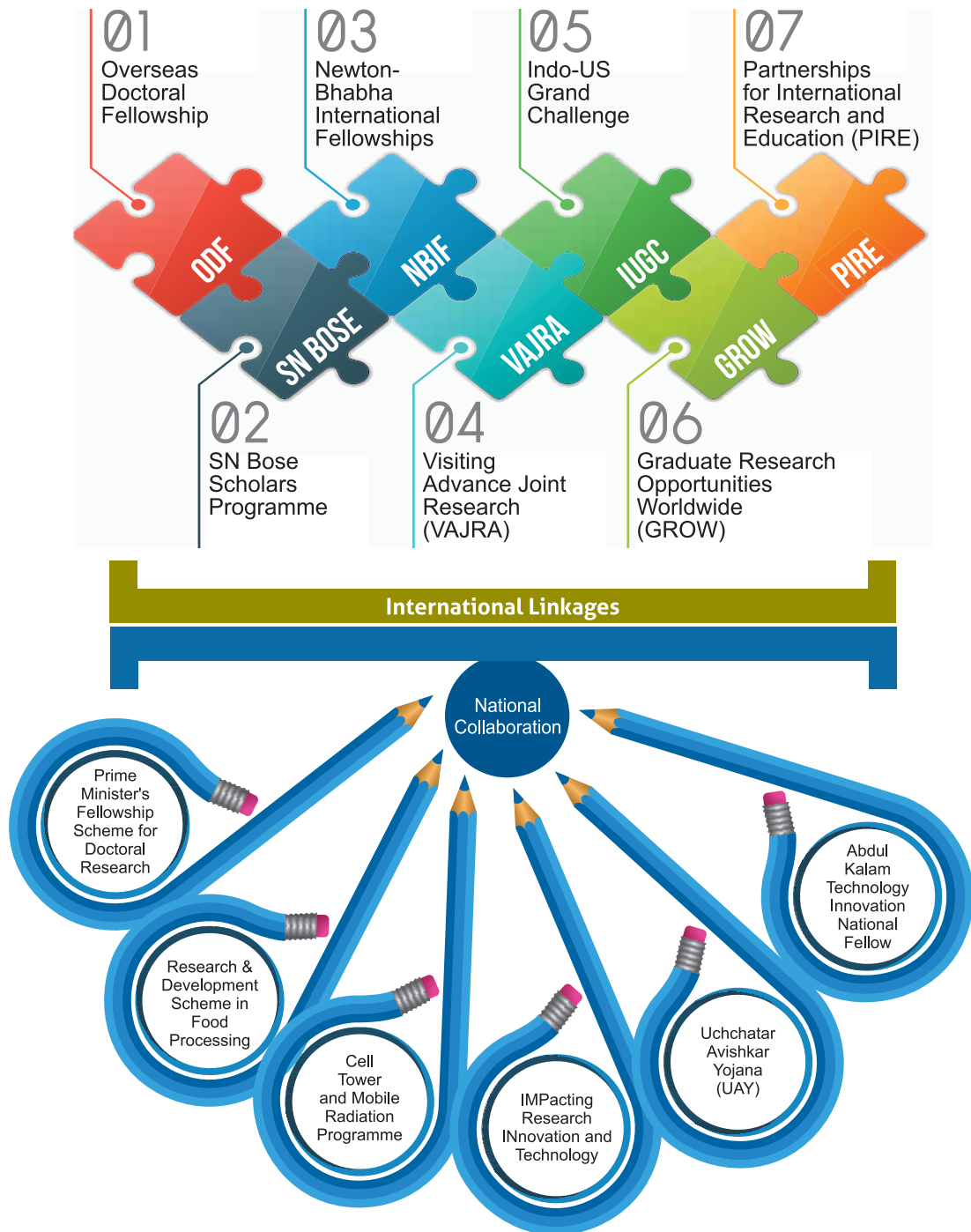


Figure 81 : International Linkages and National Collaborations at a Glance.

6 Strengthening Linkages with Society

The pillar "Strengthening Linkages with Society (SLS)" aims at providing research support to scientists belonging to weaker sections, focusing on the programmes that have direct societal implications as well as garnering and leveraging the social responsibility of scientific community.

6.1 EMPOWERMENT AND EQUITY OPPORTUNITIES FOR EXCELLENCE IN SCIENCE (EMEQ)

Objective

To provide research support to scientists belonging to the Scheduled Caste and Scheduled Tribe category in undertaking research in newly emerging and frontier areas of science and engineering and thus to involve them in the National Science and Technology development process.

Features

The applicant(s) who are an active researcher belonging to the Scheduled Caste and Scheduled Tribe category working on regular basis in academic institutions/national labs or any other recognized R&D institutions in the field of Science and Engineering.

Tenure of a project is 3 years and ceiling amount is Rs. 50 lakhs.

Website links

http://serbonline.in/SERB/Weaker_section
<http://www.serb.gov.in/emeq.php>

A total of 850 proposals were received and 229 proposals were supported.

Table 4. Supported proposals under the EMEQ scheme during 2017-18

Broad Area	Sub Area	Number of projects sanctioned (Online)
Chemical Sciences	Inorganic Chemistry	04
	Organic Chemistry	18
	Physical Chemistry	05
Physical Sciences	Condensed Matter Physics & Materials Science	24
	Laser, Optics, Atomic and Molecular Physics	01
	Plasma, High Energy, Nuclear Physics, Astronomy & Astrophysics and Nonlinear Dynamics	02
Life Sciences	Animal Sciences	10
	Plant Sciences	23
	Health Sciences	29
	Biophysics, Biochemistry, Molecular Biology and Microbiology	20
Engineering Sciences	Chemical Engineering	10
	Electrical, Electronics & Computer	39
	Mining, Mineral & Materials	04
	Mechanical & Manufacturing Engineering and Robotics	17
	Civil & Environmental Engineering	05
Earth & Atmospheric Sciences	Earth Sciences	05
	Atmospheric Sciences	04
Mathematical Sciences	Mathematical Sciences	09

Research Highlights

Stem-cell based bioengineering of annulus fibrosus in an intervertebral disc model using north-east silk biomaterials: It is for the first time that Indian silk varieties has been explored for fabrication of IVD towards subsequent graft development. In the study, blends of three different silk proteins from two different sources (mulberry and non-mulberry) were used to fabricate the angle-ply constructs. The physicochemical properties of constructs changed considerably with addition of non-mulberry SF (*Antheraea assamensis*, AA and *Philosamia ricini*, PR) to mulberry (*B. mori*) SF. The blended SF constructs exhibited reduction in pore size or inter-lamellar distance, swelling behavior and in vitro enzymatic degradation rate, but enhanced the mechanical strength (compressive modulus), with increasing concentration of

non-mulberry SF in the blends than in *B. mori* SF constructs. This might be due to differential amino acids compositions and their sequences to make the secondary conformation that ultimately govern the physicochemical characteristics. The FESEM analysis of lamellar walls showed the characteristic features of blends. Spike-like-protrusions were observed in case of blended SF constructs as a consequence of different hydrophobicity intrinsic to non-mulberry SF. These spikes increased the gross surface area of lamellar wall that further helped in cellular attachment. Another important observation was that the presence of *Antheraea assamensis* (AA) SF (possessing RGD sequence that imparts the site for cells attachment) in the blends enhanced the cell proliferation rate that was further associated with improved ECM secretion. (Figure 82).

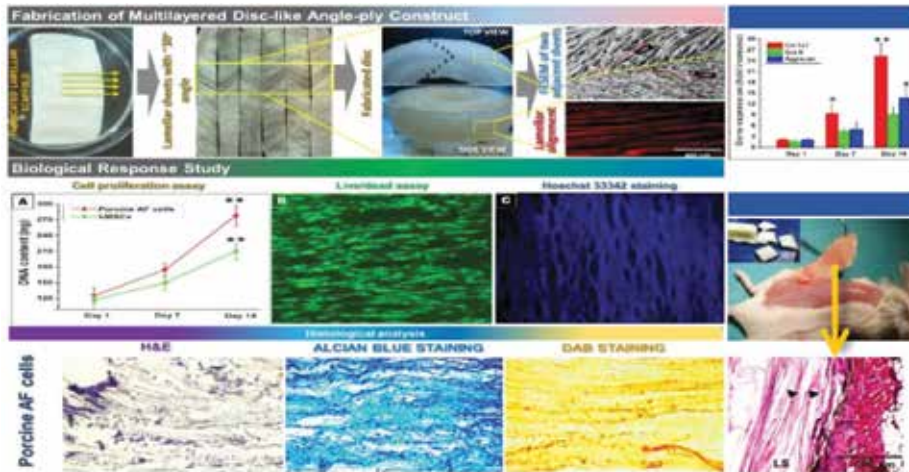


Figure 82 : IVD fabrication and subsequent biological assessment both in vitro and in vivo.

6.2 AYURVEDA BIOLOGY (AB)

Ayurveda transcends the practice of medicine and is identified with India's traditional system of medicine in vogue since the Buddhist era. It continues to serve 70% of India's rural population. AB Programme is designed to highlight scientific

underpinnings of concepts, procedures and products of Ayurveda in terms of modern sciences such as Molecular biology, Immunology and Chemistry.

Objective

To promote human resource development and collaborative research in Ayurveda Biology and related areas by offering fellowships, training opportunities, providing support to scientific meetings and workshops.

Features

Project proposals should emanate from the concepts, procedures or products of Ayurveda.

The project should be a joint effort of scientists and Ayurvedic experts.

Website links
<http://www.serb.gov.in/ayurved.php>

Table 5. Projects details of Ayurveda Biology

S. No.	Name of sub-disciplines	No of projects
1.	Rasa and Chemical Identification	01
2.	Traditional Ayurvedic Procedures	01

Research Highlights

NMR metabolomics and studies of chemosensory signature to address the fundamental question of rasa in ayurvedic pharmacology. The concept of 'rasa' plays an important role in ayurveda. In the context of dravya guna (ayurvedic pharmacology), rasa is generally taken to represent 'taste as a sensory perception'. Knowledge of 'rasa' of plants and drugs in ayurveda, can predict nearly 80% of the biological/pharmacological activity (from an ayurvedic perspective). Ayurveda has

categorised plants (as also all physical matter) under six types of rasa (*madhura, amla, lavana, katu, tikta, kashaya*) and each plant / plant part is associated with one or more rasa. The current research aim to understand the concept of 'rasa' using structural-functional information deduced from spectroscopic techniques and Electronic tongue, all of which are tools to understand functional chemistry.

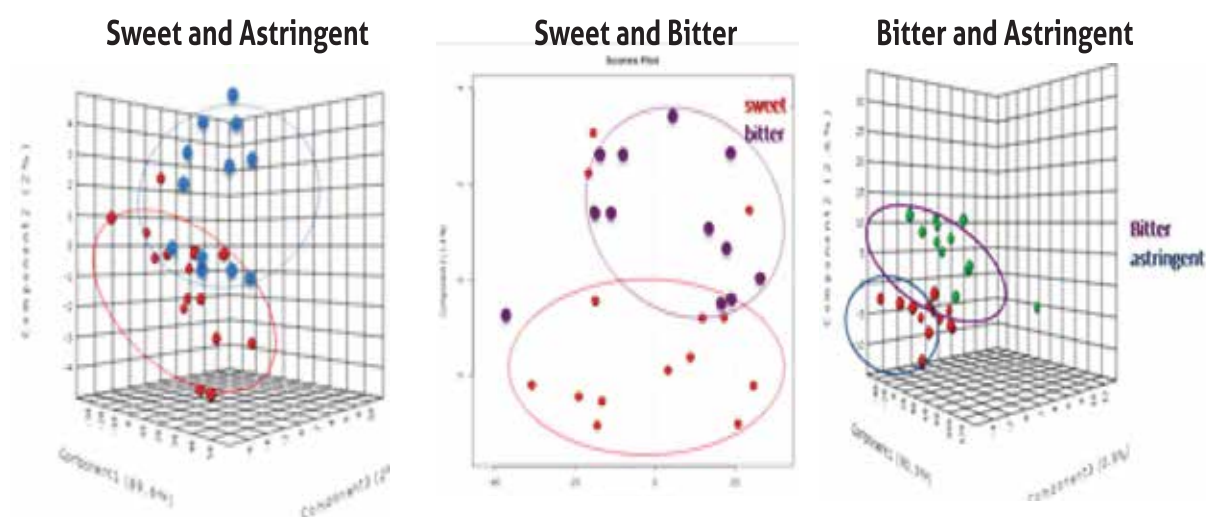


Figure 83 : Spectroscopic techniques and electronic tongue

Using Principal Component Analysis (PCA) of proton NMR spectroscopic data of single rasa categories were analysed. Distinct clusters are observed indicates that using NMR fingerprinting the classification of medicinal plants based on single or multiple rasa can be identified as per

Ayurvedic principles. Further this technique will help in explaining rasa based chemical profiling. However, there are also areas of overlap between the clusters indicating that there are regions of similarities between the taste groups.

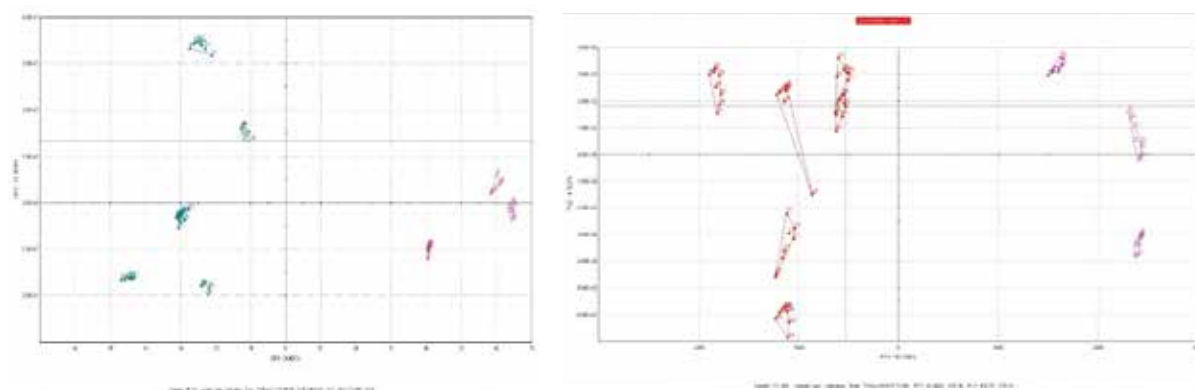


Figure 84 : Denotes the PCA plot of E-tongue data of medicinal plants from different taste categories. Figure shows discrimination between rasa categories

6.3 SCIENTIFIC SOCIAL RESPONSIBILITY (SSR)

SERB being a premier organization for funding basic research in the country caters to researchers belonging to various disciplines of science and engineering. With total R&D budget of Rs. 800 crore, about 10000 researchers were directly supported in the year 2017-18 through

its various programmes and schemes. SERB has devised its Scientific Social Responsibility (SSR) Policy which aims to spread the benefits beyond these direct beneficiaries especially to the less-endowed researchers.

Objective

Effectively utilize the R&D infrastructure and expertise of SERB grantee to benefit other S&T stakeholders and the society. Embed a participatory, inclusive and sustainable culture of social responsibility among SERB grantee

Features

- Infrastructure sharing
- Mentoring/Training
- Fostering research culture
- Public outreach and knowledge dissemination

Web Links:
<http://www.serb.gov.in/srs.php>

7 Awards and Recognitions

Awards and Recognitions (A&R) pillar of SERB has been centered around a number of awards and recognitions for the active as well as superannuated scientists, professors, and engineers for their extraordinary contributions in the field of Science and Technology. The objective is to motivate the scientists to aspire for excellence in scientific R&D.

7.1 YEAR OF SCIENCE CHAIR PROFESSORSHIP (YOSCP)

The Year 2012 is recorded as the Year of Science (YoS) in commemoration of outstanding scientific contribution emanating from Indian Science during the last 100 years. While Research and Development base in India is expanding, new measures are required to promote excellence in research in all areas of Science, Technology,

Engineering and Mathematics (STEM). YoS chairs are one such mechanism. These professors are regarded as bench mark for stature, value and eminence in the international area. Three new Chair Professors were supported during the year 2017 – 18.

<p>Objective</p> <p>To recognize outstanding contributions made by any of the Indian scientists towards excellence and highest impact in R&D in sciences at the national level as well as in the global context. This recognition is to impart rightful glory to the profession and should serve to elevate the aspirations of young and mid-career researchers.</p>	<p style="text-align: center;">Features</p> <ul style="list-style-type: none"> The awardee should be a distinguished Indian scientist in any one or more areas of expertise in Science, Technology, Engineering, Mathematics, and Biomedical Research. Should have made outstanding contributions in innovative research and science administration. Should have an excellent track record as evidenced by the election to prestigious Science and Engineering Academics in the world and high impact publications, patents and recognition as distinguished contributor to the growth of science in the country. Research grant of Rs.25.00 lakhs per annum and an honorarium of Rs.1.00 lakh per month will be given to each Fellow. 	<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Website link: http://www.serb.gov.in/yoscp.php</p>
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7.2 SERB DISTINGUISHED FELLOWSHIP

<p>Objective</p> <p>SERB Distinguished Fellowship Scheme is meant for eminent and performing senior scientists to continue active research even beyond their superannuation.</p>	<p style="text-align: center;">Features</p> <ul style="list-style-type: none"> The nominee should be a superannuated but an active resident Indian scientist/ academician who is associated with any recognized Indian laboratory / institute / university and should not hold any administrative position. Should have outstanding contribution in Science, Technology Engineering & Mathematics (STEM) in last decade with excellent research output in last five years. The duration of the fellowship is initially for three years. The scheme offers a fellowship amount of Rs. 60,000/- per month and a research grant of Rs. 20.00 Lakhs per annum. 	<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Website links http://www.serb.gov.in/sdf.php</p>
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Many active senior scientists who are passionate in research find it extremely difficult to continue their research after superannuation and forced to stop doing research against their choice. The great amount of knowledge and more importantly the experience that they have accumulated over many years, which may be considered a non-replaceable treasure, can be lost if some

avenues are not made available to them. In order to support research of eminent scientists who do not hold any administrative roles and functions but are active and performing, SERB has instituted Distinguished Fellowship Award. Three new fellows were supported for this award during the year 2017 – 18.

7.3 J. C. BOSE FELLOWSHIP

This Fellowships is scientist specific and very selective. During this year, a total of 35 fellows were awarded with J C Bose fellowship and based on the performance of these J C fellows in their previous term, few were recommended to continue their subsequent term. The growth of number of such fellows during last few years is

at Figure 85. The scientific contributions of the fellows under J C Bose fellowship have been well recognized all over the globe and published by the internationally reputed publishers such as ACS, APS, WILEY, Elsevier, RSC, AIP, Nature, IEEE, Springer, IOP Science, etc. During the year, 35 fellowships were awarded.

Objective
The J.C. Bose National Fellowship is meant to recognize active, performing scientists and engineers for their outstanding performance and contribution.

Features

- Proposer should be an Indian active scientist with a record of outstanding performance apparent from the recognitions like SS Bhatnagar Award and/ or fellowship of science academies (including engineering, agriculture and medicine).
- Should be in service at the time of nomination to this fellowship.
- Initial duration of the fellowship is for five years.
- The J.C. Bose Fellows are provided with a fellowship of Rs. 25,000/- per month and contingency grant of Rs. 15.00 Lakhs per annum towards research expenses, and Overhead expenses Rs. 1,00,000 per annum to host institute.

Website links
<http://www.serb.gov.in/jcbn.php>
http://serbonline.in/SERB/jcbose_fellowship?HomePage=New

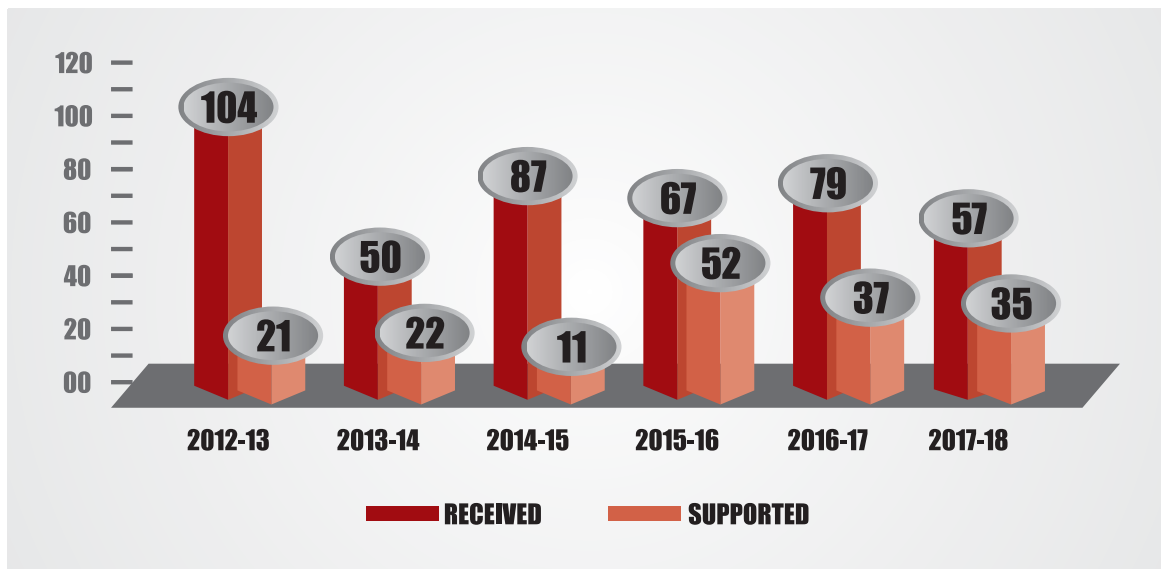


Figure 85 : J C Bose Fellow proposals received and supported during the last few years.

7.4 RAMANUJAN FELLOWSHIP

Objective

To encourage our Indian scientists working abroad to return back to the country.

Features

This fellowship is open to scientists and engineers below the age of 45 years.

Ramanujan Fellowship are only for those candidates who are doing Post-Doctoral abroad and not for the people who already have permanent position in a scientific organization in the country.

The duration of the fellowship is for five years.

The value of the fellowship is Rs. 85,000/- per month for the duration of 5 years.

Each Fellow, in addition, receives a research grant of Rs. 7.00 lakh per annum.

Website links

<http://www.serb.gov.in/mf.php>
http://serbonline.in/SERB/Ramanujan_fellowship?HomePage=New

Ramanujan Fellowship is for brilliant scientists and engineers from all over the world to return to the country and take up scientific research positions in India. During the year, a total of 49 fellows were awarded with Ramanujan fellowship. Till date, a total of 417 Ramanujan fellowships have been offered fellowship in different subject areas. The growth of Ramanujan

fellows during last few years are given at Figure 86. The awarded fellows have published several research articles on their scientific investigation in peer reviewed reputed journals of high impact factor. The research contributions of these fellows were published by the internationally reputed publishers. During the year, 49 fellowships were awarded.

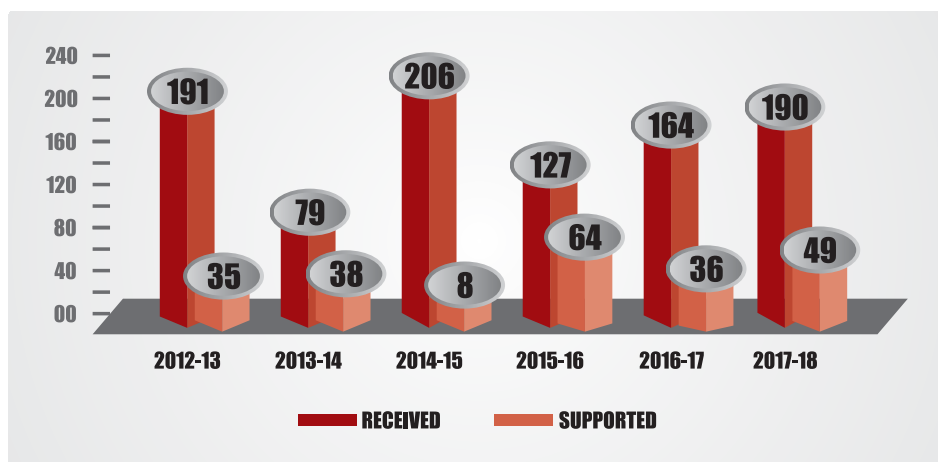


Figure 86 : Ramanujan Fellows proposals received and supported during the last few years

7.5 SERB WOMEN EXCELLENCE AWARD

Objective

To recognize and honour extraordinary women of outstanding professional excellence across the country for their remarkable contribution in science and engineering.

Features

The research grant is Rs.5.00 lakh per annum for a period of 3 years.

Applicant age should be below 40 at the time of application.

Website links

<http://www.serb.gov.in/wea.php>

SERB Women Excellence Award is a one-time award given to women scientists below 40 years of age, and who have received recognition from the any of the national academics in science and engineering.

7.6 SERB DISTINGUISHED INVESTIGATOR AWARD (SERB-DIA)

Objective

SERB Distinguished Investigator Award (DIA) has been initiated to recognize and reward Principal Investigators (PIs) of SERB/DST projects who have performed remarkably well. The scheme aims not only to reward the best PIs of completed projects but also to motivate the ongoing PIs to perform exceedingly well.

Features

The applicant should have completed SERB CRG project in the previous financial year and the project should have been rated "Excellent".

The applicant should be in regular service and should have at least 5 years of service remaining before superannuation.

The support will include fellowship of Rs. 15,000/- p.m. for three years. In addition, PI can also choose for a research grant, subject to submission of research proposal and its acceptance by SERB based on this peer review.

Website links
<http://www.srb.gov.in/dia.php>

SERB has been supporting basic research in frontier areas of science and engineering through its various programmes and schemes. The number of researchers under the ambit of SERB has increased over the years and they contribute significantly through their research output towards the progress of science and engineering of the country. To recognize and reward Principal Investigators of SERB projects Distinguished Investigator Award (SERB-DIA) has been initiated.

DIA through positive reinforcement strategy is expected to effectively improve the productivity of research undertaken and overall efficiency of the research ecosystem.

The process for DIA awards pertaining to projects completed in the year 2016-2017 was initiated during the year under review. Invitations were sent to 49 PIs whose CRG projects were rated "Excellent" to submit the application online for DIA in the month of March, 2018.

8 Supporting Science & Tech. Events

The pillar "Support for Science & Technology Events (SSTE)" provides support through two of its major components ITS and SS, for events pertaining to science and technological development in the country or abroad, organized by academic institutes/ national research & development labs or other professional bodies.

8.1 INTERNATIONAL TRAVEL SUPPORT (ITS) SCHEME

The ITS provides an opportunity to the Indian young and senior scientists to attend the international scientific events and interact with their counterparts in various places across the world.

<p>Objective</p> <p>The ITS Scheme provides an opportunity to the Indian young and senior scientists to interact with their counterparts in various places across the world.</p>	<p>Features</p> <p>The support is also provided to young scientists for attending training programmes and short-term schools/workshops/courses.</p> <p>Economy class air-fare by shortest route, airport-tax and visa fees are provided under the scheme. Registration Fee is provided to young scientist in addition to the support.</p>	<p>Website links</p> <p>http://serbonline.in/SERB/its http://serb.gov.in/its.php</p>
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SERB had strongly supported participation of the India team in the 6th IUPAP International Conference on Women in Physics (ICWIP) held in University of Birmingham, UK during 20-23 July 2017. It was highly appreciated by the Chair of Gender in Physics Working Group of the Indian Physics Association. Infact the team came out with a report on the participation and contribution in the event (Table 6).

Table 6. Discipline wise ITS grant during the year 2017-18

S N	Name of discipline	Received Proposals	Sanctioned Projects	Category		Gender	
				Senior Scientists (> 35 years)	Young Scientists (< 35 years)	M	F
				1	Engineering Sciences	1759	332
2	Life Sciences	2304	373	79	294	229	144
3	Chemical Sciences	441	121	31	90	80	41
4	Physical Sciences	872	239	44	195	161	78
5	Earth & Atmospheric Sciences	390	78	13	65	54	24
6	Mathematical Sciences	308	79	24	55	62	17

8.2 ASSISTANCE TO PROFESSIONAL BODIES & SEMINARS/SYMPOSIA

A total of 2022 applications received, out of which 568 were supported. In addition, partial financial support was extended to 25 organizations Professional Bodies / Institutes / Societies for publication of Journals. The broad subject area-wise distribution of activities is shown in Figure 87.

Objective

To support and popularise scientific events/activities across the country.

Features

Provides a platform to science professionals from academic/R&D/industrial institutions to have a dialogue on S&T issues of national and international importance.

Programme also extends support to professional bodies for publishing their work.

Website links
<http://www.serb.gov.in/>
apbs.php

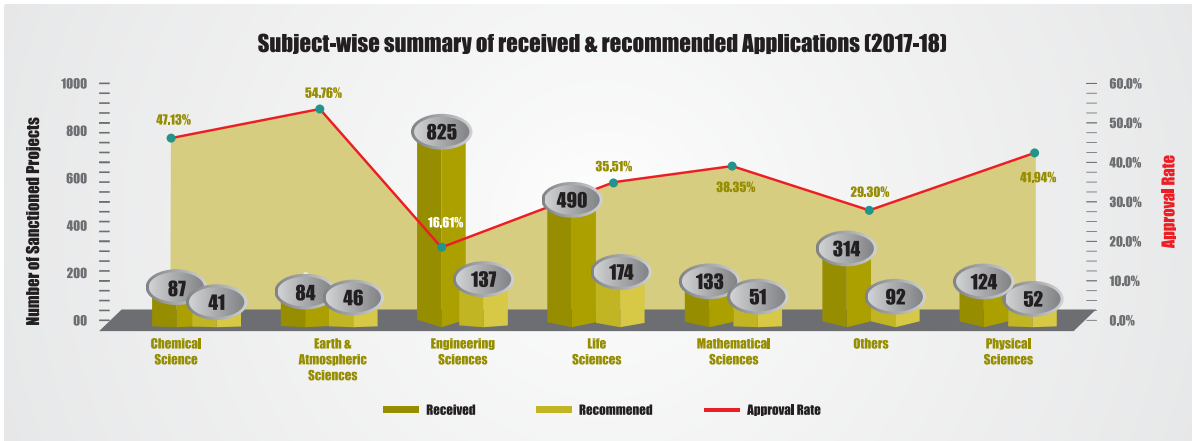


Figure 87 : Organization-wise summary of received & supported proposals.

9 Patents and Publications

A large number of projects have been funded by the Board during the year. The endeavor also has been to capture the outcomes of these projects. Patents and publications that have come out from some of the funded projects during the year, are detailed as under:

9.1 PATENT FILED/GRANTED

S.No.	Patent Details
1.	Krishnan AM, Raja VS, Vaidya SM. Four-step thermal aging method for improving environmentally assisted cracking resistance of 7xxx series aluminium alloys. IN 201621026704;2017.
2.	Krishnan AM, Raja VS, Vaidya SM. Four-step thermal aging method for improving environmentally assisted cracking resistance of 7xxx series aluminium alloys. PCT PCT/IN2016/000280; 2017.
3.	Kumar R. The preparation of buffalo milk casein hydrolysates with enriched antioxidative peptides and the process thereof. Patent no.201711023424; 2017.
4.	Manivannan A, Shukla K D, Saxena N. Programmable Electrical Tester (PET) for ultrafast electrical characterization of electronic materials and devices. National. Patent no. – 201721016295; 2017.
5.	Kabeer J. Kumar DSP Flame retardant composition and a process for preparing the same. National, Patent no. – 201721023197; 2017.
6.	Kabeer J, Kumar DS. A process for preparing boron based nano-accordions and nano-sheets. National Patent no. – 201721026065; 2017.
7.	Sen A K, Srivastava A, Gaikwad R S, Karthick K S, Jayaprakash A, Raj S, Maria, Shivhare P. MicroFACS for detection and isolation of target cells. Patent no. 201741012180; 2018.
8.	Ravi Kumar Y, Malyala S, Biodegradable and Biocompatible Implants and Methods Thereof, Patent no. 201641013616; 2016.
9.	Ravi Kumar Y, Manmadhachary A, Alwala A M, Kumar VG. Implantable device for temporomandibular joint and method of production thereof. Patent no. 201741023907; 2017.
10.	Raghavendra S, Sathyabhama A. A passive leading-edge micro protuberance strip. Patent no. 201741035860;2017.
11.	Saikia S, Vig L, Shroff G, Agarwal P, Rawat R, Srinivasan A. Training Inductive logic programming enhanced deep belief network models for discrete optimization. IN-PA-2358; 2017.
12.	Arti M K, Govil GP. Health hazards avoidance due to base station radiation. IN Patent 299,862; 2017.
13.	Suri M, Sarkar M. Image Sensor. PCT IN2016/050460, PD022383PCT; 2017.
14.	Maharana M, Nayak S K, Sahoo N. Nonedible vegetable oil based dielectric liquid and use thereof in power and distribution transformer. Indian Patent Application No.201831013006; 2018 .
15.	Maharana M, Nanda A, Nayak S K, Sahoo N. Natural and force convection imposed accelerated thermal ageing simulator to predict the life of the insulating oil before using in transformer. Indian Patent Application No.201731045816 A; 2017.
16.	Bordeori MM, Maharana M, Baruah N, Nayak S K, Sahoo N. Design and development of an automated open beaker oxidative ageing assessment apparatus. Indian Patent Application No.201731047043 A; 2017.
17.	Supradeepa V R, Balaswamy V, Arun S, Aparanji S. High power tunable fibre lasers. Indian Patent Application No: 201841016649; 2018.

18.	Maity T, Sharma M. Low power, portable smart device for real-time monitoring of mine environment and methods thereof. Indian Patent No. 201731017005; 2017.
19.	Chatterjee A, Bhatia V, Prakash S. Fingerprint acquisition system for anti-theft fingerprint biometry and method thereof. Indian Patent Application No. 201721024430; 2017.
20.	Maji SK, Ghosh, S, Sengupta, S, Salot S, Navalkar, A, Das, S, Jacob, RS Method of preparation of amyloid-induced cancer cell, model. Indian Patent 201721014784; 2018.
21.	Jairajpuri MA, Abid M, Gupta N, Ahmad I. A method for reduction of in vivo thrombus formation using Diosmin 2'',2''',3',3''',4'',4''',5-O-octasulfate (DOS), as a potential antithrombotic agent. Indian Patent No. 201811006488; 2018.
22.	Jairajpuri MA, Abid M, Gupta N, Ahmad I. A method to reduce thrombus formation using Esculin 7, 3', 4', 5', 6'-O-pentasulfate (EPS) as a promising antithrombotic agent. Indian Patent No. 201811006489; 2018.
23.	Surolia A, Mishra A, Sreshty A, Raju R, Kumaran L, Shridharan. Anti-tubercular composition, and combinatorial implementations thereof. Indian Patent No.201841007013; 2018,

9.2 PUBLICATIONS

A large number of papers have been published during the year. A cumulative list of all the reported publications for all the disciplines is given below at Table 7.

Table 7. Publication in SERB funded project during the year 2017-18

S. No	Disciplines	Number of publications
1.	Chemical Sciences	142
2.	Life Sciences	305
3.	Earth & Atmospheric Sciences	123
4.	Physical Sciences & Mathematical Sciences	339
5.	Engineering Sciences	276
6.	Awards and Fellowships / National Linkages	231
Grand Total		1416

10 Capacity Building

Capacity building is the bedrock on which rests success of any human endeavor. SERB has been constantly striving to design and implement HRD modules that help S&T professionals update themselves with latest developments in frontier areas of science and technology. Another objective of SERB's capacity building efforts is to improve the ability to evaluate and address crucial questions related to policy choices and modes of implementation of SERB's Programmes.

10.1 HUMAN RESOURCE DEVELOPMENT

HRD initiatives undertaken through financial support, scholarships and training schemes of SERB are detailed in Table 8 & 9.

Table 8. Capacity building in different Schemes/Programmes during the year 2017-18

S.No.	Number of PhDs' produced	Number of JRF	Number of SRF	Staff other than JRF/SRF
1.	408	576	104	313

Table 9. Training/Schools during the year 2017-18

S. N.	Theme / Areas of training / Schools	Place of Training / Schools	Number of Participants
1.	Stratosphere Troposphere Radar	CUSAT, Cochin	89
2.	School on Glacier study and Remote Sensing	IISc Bangalore	25
3.	School on Field training course in glaciology - 2017	GSI, Lucknow	17
4.	3rd SERB school in Insect Biology	St. Joseph's College, Devagiri Calicut.	25
5.	1st SERB School in Chemical Ecology	NCBS, Bangalore	25
6.	Use of ICT in Sustainable Development	Hamdard Convention Centre, New Delhi	77
7.	Challenges and Opportunities in Data	Hamdard Convention Centre, New Delhi	69
8.	SERB Summer School on Robotics	IIT, New Delhi	45
9.	SERB Summer School on Noise Control	IIT Guwahati,	30
10.	Workshop on Application of IoT in Contemporary Civil Engineering	IISc, Bangalore	32
11.	SERB School on Mechanical Testing	IISc, Bangalore	41
12.	SERB School on Crystallographic Texture, Micro-texture and Residual Stress	IIT Bombay	25
13.	Radiation detector materials and its applications	SSN College of Engineering, Kalavakkam	40
14.	Observational Astronomy	Tezpur University, Tezpur, Assam	40
15.	Experimental High Energy Physics	NISER, Bhubaneswar	40
16.	Frontiers in Quantum Optics.	IIT Guwahati	40
17.	Electron Collisions with atomic systems	Ramakrishna Mission Residential College, Narendrapur, Kolkata	40
18.	Plasma Device: Science and Technology	CSIR, CEERI, Pilani	40
19.	Nonlinear Dynamics	Savitribai Phule Pune University, Pune	40

10.2 BRAINSTORMING SESSION

10.2.1 Brain storming session on "Taxonomy and phylogeny of vascular plants"

The University of Goa has organized a brain storming session on "Taxonomy and phylogeny of Vascular Plants" on 2nd June, 2017 at Goa university. This brain storming was recommended by Programme Advisory Committee, Plant Sciences of SERB with an objective to foster and promote researchers and young faculties to understand the problems and values of taxonomy and carryout research on classical and modern taxonomy using traditional and modern

tools/ techniques. Strategies for biodiversity conservation, its management and studies on plant taxonomy in association with other branches like molecular, chemical biology, ecology etc. are also important agenda of this brain storming.

Panel recommended documentation of floristic and studies on endemics and threatened species using traditional and molecular systematics of different region of the country through networking projects. Studies on bryophytes, pteridophytes and gymnosperm need to be promoted.

11 Administration

The administration of any organization plays a vital role in meeting its objectives. All efforts are made to ensure that SERB gets the institutionalized environment for producing results and meeting the targets.

11.1 ADMINISTRATION & RECRUITMENT

As per the Search cum Selection Committee (SSC) recommendation for modification/revision in the Recruitment Regulations pertaining to the post of Secretary, SERB, the Science and Engineering Research Board (Secretary, Terms and Conditions of the Service and Recruitment) (Amendment) Regulations, 2018 were notified on 09th March, 2018.

Dr. Rajiv Sharma, Scientist 'G' and Head, Technology Mission Division, DST has been assigned the additional charge of the post of Secretary, SERB w.e.f 01.03.2017 (F/N). As the

post of Secretary, SERB would be falling vacant w.e.f 31.07.2018 on superannuation of Dr. Rajiv Sharma, necessary action will be taken for filling up of the post of Secretary, SERB shortly.

Two posts of Scientist-G are lying vacant within the sanctioned strength and fall under the category "deemed abolished". A proposal has been forwarded to DST for revival of these two posts on 6th March, 2018 and the same is being pursued with DST. Recruitment process will follow after the approval for revival of these posts by the competent authority.

11.2 IMPLEMENTATION OF OFFICIAL LANGUAGE

The SERB, since its inception has been implementing the guidelines issued by the Department of Official Language, Ministry of Home Affairs. Hindi Fortnight was celebrated in SERB from 14 to 29 September 2017. Various activities were organized for the staff/officers, both Hindi speaking and Non-Hindi speaking to promote the official language. At the end of the Hindi Fortnight, a closing ceremony was held under the Chairmanship of Secretary, SERB, wherein the senior officers and staff of SERB were present in large number. The winners were awarded cash prizes, certificates and Hindi books by Secretary, SERB (Figure 88).

Further, four Hindi workshops were also conducted on 07.04.2017, 27.06.2017, 29.11.2017 and 27.02.2018 to enhance the knowledge of the officers/staff for the maximum

use of Hindi language in official work. Quarterly meetings of Official Language Implementation Committee were held to review the progress of the use of Hindi language in SERB and the quarterly reports were sent as per schedule.



Figure 88 : Hindi Pakhwara organized by SERB during the year.

11.3 AUDITED ANNUAL STATEMENT OF ACCOUNTS

As per the provisions laid down in Section 13 of the SERB Act, 2008, the Annual Accounts of the Board are required to be maintained in the prescribed formats and audited by the Comptroller and Auditor General of India (CAG) or by their appointed auditors annually. Accordingly,

the Annual Accounts for the Financial Year 2017-18 have been prepared and audited by a team of Auditors from CAG. The duly audited Financial Statements and Annual Accounts for the Financial Year 2017-18 are form part of this Annual Report.

11.4 RIGHT TO INFORMATION ACT 2005 (RTI)

Ninety RTI applications were received during the Financial Year 2017-18 including nine received as transfer from DST. Out of the total 90 RTI applications, six applications were transferred to other departments. Appropriate information was provided to the applicants under RTI Act, 2005.

Nine appeals were also received during the year and disposed-off by the appellate authority. A total fee of Rs.1030/- (Rupees one thousand thirty only) was received by SERB for providing information under RTI Act, 2005, during the period.

11.5 VIGILANCE AWARENESS

The Vigilance Awareness Week was observed by SERB during the period from 30.10.2017 to 04.11.2017 with the theme "My Vision-Corruption Free India". All Officers/Staff of SERB assembled in the Conference Room on 30th October, 2017 to take the integrity pledge, to

abide by the principles of honesty and integrity to fight against corruption.

A Quiz Competition was organized in SERB on November 3rd, 2017 with Vigilance Officer (SERB) as the Quiz Master. The Officers/Staff participated with enthusiasm in large numbers (Figure 89).



Figure 89 : Vigilance Awareness week commemorated in SERB during the year.

FINANCIAL STATEMENTS

FY 2017-18

Balance Sheet

as on 31.03.2018

Amount in Rs.

	Schedule	Current Year	Previous Year
CORPUS / CAPITAL FUND AND LIABILITIES			
Corpus / Capital Fund	Schedule 1	586,896,443.46	518,580,464.83
Reserves and Surplus	Schedule 2	-	-
Earmarked / Endowment Funds	Schedule 3A, 3B, 3C & 3D	170,249,246.00	240,793,367.00
Secured Loans and Borrowings	Schedule 4	-	-
Unsecured Loans and Borrowings	Schedule 5	-	-
Deferred Credit Liabilities	Schedule 6	-	-
Current Liabilities and Provisions	Schedule 7	45,425,773.00	40,648,150.00
Total		802,571,462.46	800,021,981.83
ASSETS			
Fixed Assets (Net)	Schedule 8	38,948,994.00	27,695,814.00
Investments-From Earmarked / Endowment Funds	Schedule 9	-	-
Investments-Others	Schedule 10	-	-
Current Assets, Loans, Advances etc.	Schedule 11	763,622,468.46	772,326,167.83
Miscellaneous Expenditure (to the extent not written off or adjusted)			
Total		802,571,462.46	800,021,981.83
Significant Accounting Policies	Schedule 26		
Contingent Liabilities and Notes to Accounts	Schedule 27		

For Science and Engineering Research Board



Secretary
SERB



Director-Finance
SERB

Date: 13-06-2018

Place: New Delhi

Income & Expenditure Account for the Year Ended

as on 31.03.2018


Amount in Rs.

	Schedule	Current Year	Previous Year
Income			
Income from Sales / Services	Schedule 12		-
Grants / Subsidies *	Schedule 13	7,975,894,650.00	7,657,044,309.00
Fees / Subscriptions	Schedule 14	-	-
Income from Investments	Schedule 15	-	-
Income from Royalty, Publication etc	Schedule 16	-	-
Interest Earned	Schedule 17	60,131,427.90	116,380,682.32
Other Income	Schedule 18	12,852,590.00	12,757,356.00
Increased/(Decrease) in stock of Finished Goods and Works-in-Progress	Schedule 19	-	-
Total (A)		8,048,878,667.90	7,786,182,347.32
Expenditure			
Establishment Expenses	Schedule 20	82,499,837.00	61,891,346.00
Other Administrative Expenses	Schedule 21	94,718,890.78	86,277,681.55
Expenditure on Grant, Subsidies etc	Schedule 22	7,985,840,954.46	7,686,163,096.12
Interest	Schedule 23	-	-
Depreciation (Net Total at the Year end)	Schedule 8	12,852,170.00	12,756,626.00
Total (B)		8,175,911,852.24	7,847,088,749.67
Excess of Income over Expenditure (A-B) (Before PPI & PPE)		-	-
Excess of Expenditure over Income (A-B) (Before PPI & PPE)		(127,033,184.34)	(60,906,402.35)
Prior Period Income	Schedule 24	185,100,328.97	102,196,700.73
Prior period Expenditure	Schedule 25	1,004,346.00	1,001,773.00
Excess of Income over Expenditure (A-B) (After PPI & PPE)		57,062,798.63	40,288,525.38
Excess of Expenditure over Income (A-B) (After PPI & PPE)		-	-
Transfer to Special Reserve (Specity each)		-	-
Transfer to / from General Reserve		-	-
Balance Being Surplus (Deficit) carried to Corpus/Capital Fund		57,062,798.63	40,288,525.38
Significant Accounting Policies	Schedule 26		
Contingent Liabilities and Notes to Accounts	Schedule 27		

* CY- This amount reflect total grant received by SERB of Rs. 8,00,00,00,000/- less Fixed Assets purchased of Rs. 2,41,05,350/- (transferred to Corpus Fixed Assets Sch. 1)

* PY- This amount reflect total grant received by SERB of Rs. 7,67,00,00,000/- less Fixed Assets purchased of Rs. 1,29,55,691/- (transferred to Corpus Fixed Assets Sch. 1)

For Science and Engineering Research Board


Secretary
SERB


Director-Finance
SERB

Date: 13-06-2018

Place: New Delhi

Schedules Forming Part of Balance Sheet

as on 31.03.2018

Amount in Rs.

Schedule 1 - Corpus / Capital Fund		
Particulars	Current Year	Previous Year
Corpus Balance at the beginning of the year	490,884,650.83	450,596,125.45
Add/(Deduct) : Balance of net income/(Expenditure) transferred from the Income & Expenditure Account	57,062,798.63	40,288,525.38
Corpus Balance at the end of the year (A)	547,947,449.46	490,884,650.83
Corpus (Fixed Assets) Balance at the beginning of the year	27,695,814.00	27,496,749.00
Add: Contributions towards Corpus/Capital Fund (Fixed Assets)		
FY 2016-17	-	12,955,691.00
FY 2017-18	24,105,350.00	
Deferred Revenue Grant for FY 2016-17	-	(12,756,626.00)
Deferred Revenue Grant for FY 2017-18*	(12,852,170.00)	-
Corpus (Fixed Assets) Balance at the end of the year (B)	38,948,994.00	27,695,814.00
Total of Corpus & Corpus (Fixed Assets) (A) + (B)	586,896,443.46	518,580,464.83

Refer Point No. 12 In Schedule 26 Significant Accounting Policies

Amount in Rs.

Schedule 2 - Reserve and Surplus				
Particulars	Current Year		Previous Year	
1. Capital Reserves :				
As Per Last Account	-	-	-	-
Addition during the year	-	-	-	-
Less : Deductions during the year	-	-	-	-
2. Revaluation Reserves :				
As Per Last Account	-	-	-	-
Addition during the year	-	-	-	-
Less : Deductions during the year	-	-	-	-
3. Special Reserve :				
As Per Last Account	-	-	-	-
Addition during the year	-	-	-	-
Less : Deductions during the year	-	-	-	-
4. General Reserve :				
As Per Last Account	-	-	-	-
Addition during the year	-	-	-	-
Less : Deductions during the year	-	-	-	-
Total		-		-

Schedules Forming Part of Balance Sheet

as on 31.03.2018

Amount in Rs.

Schedule 3A - Earmarked/Endowment Funds MFPI		
Particulars	Current Year	Previous Year
a) Opening Balance of the Funds	18,637,884.00	8,625,676.00
b) Additions to the funds		
i) Donations / Grants		-
Grant in Aid (MFPI- General)	31,295,098.00	42,784,535.00
ii) Income from Investments made on account of Funds	-	-
iii) Other Additions	-	-
Interest from SERB on Saving Balance	398,123.00	480,001.00
Refund from previous year Grant FY 2012-13	-	186.00
Refund from previous year Grant FY 2013-14	550,005.00	166,737.00
Refund from previous year Grant FY 2014-15	418,116.00	231,612.00
Refund from previous year Grant FY 2015-16	39,471.00	3,731,313.00
Refund from previous year Grant FY 2016-17	313,927.00	-
Total (a+b)	51,652,624.00	56,020,060.00
c) Utilization / Expenditure towards objectives of funds		
i) Capital Expenditure	-	-
Fixed Assets	-	-
Other Additions	-	-
Grant-in-aid (MFPI- Capital)	799,832.00	13,340,227.00
ii) Revenue Expenditure		
Salary, Wages and allowance etc	-	-
Rent	-	-
Other Administrative Expenditure		
Grant-in-aid (MFPI- General)	13,950,775.00	24,041,949.00
Total (c)	14,750,607.00	37,382,176.00
Net Balance as at the year end (a+b-c)	36,902,017.00	18,637,884.00

Schedules Forming Part of Balance Sheet

as on 31.03.2018

Amount in Rs.

Schedule 3B - Earmarked/Endowment Funds S & T Programme		
Particulars	Current Year	Previous Year
a) Opening Balance of the Funds	6,878,792.00	34,175,045.00
b) Additions to the funds		
i) Donations / Grants	-	-
Grant in Aid (S & T Programme - Schedule Castes)	103,777,689.00	-
Grant in Aid (S & T Programme - Schedule Tribe)	6,900,000.00	-
ii) Income from Investments made on account of Funds	-	-
iii) Other Additions	-	-
S & T SC-Interest from SERB on Saving Balance	137,201.00	1,162,362.00
S & T ST-Interest from SERB on Saving Balance	41,536.00	52,517.00
S & T SC- Refund from previous year Grant FY 2013-14	689,212.00	166,451.00
S & T ST- Refund from previous year Grant FY 2013-14	-	21,985.00
S & T SC- Refund from previous year Grant FY 2014-15	-	145,913.00
S & T SC- Refund from previous year Grant FY 2016-17	1,162.00	-
S & T - Interest on Refund -SC	-	30,900.00
S & T - Interest on Refund -ST	9,348.00	-
Total (a+b)	118,434,940.00	35,755,173.00
c) Utilization / Expenditure towards objectives of funds		
i) Capital Expenditure	-	-
Fixed Assets	-	-
Other Additions	-	-
Grant-in-aid (S & T- Schedule Castes - Capital)	-	-
Grant-in-aid (S & T- Schedule Tribe - Capital)	-	-
ii) Revenue Expenditure		
Salary, Wages and allowance etc	-	-
Rent	-	-
Other Administrative Expenditure	-	-
Grant-in-aid (S & T- Schedule Castes - General)	-	28,876,381.00
Grant-in-aid (S & T- Schedule Tribe - General)	-	-
Total (c)	-	28,876,381.00
Net Balance as at the year end (a+b-c)	118,434,940.00	6,878,792.00

Schedules Forming Part of Balance Sheet

as on 31.03.2018

Amount in Rs.

Schedule 3c - Earmarked/Endowment Funds AISTDF		
Particulars	Current Year	Previous Year
a) Opening Balance of the Funds	215,276,691.00	-
b) Additions to the funds		
i) Donations / Grants	-	-
Grant in Aid- General (AISTDF)	-	214,396,671.00
ii) Income from Investments made on account of Funds	-	-
iii) Other Additions	-	-
Interest earned on Saving Account	613,295.00	880,020.00
Total (a+b)	215,889,986.00	215,276,691.00
c) Utilization / Expenditure towards objectives of funds		
i) Capital Expenditure		-
Fixed Assets	-	-
Other Additions	-	-
ii) Revenue Expenditure		
Salary, Wages and allowance etc	-	-
Rent	-	-
Other Administrative Expenditure- Bank Charges	15.00	
Total (c)	15.00	-
Total (d) = (a+b-c)	215,889,971.00	215,276,691.00
e) LESS : Balance transferred to new Bank A/c opened no. 349902010047466 in the name of Asean India Science and Technology Development Fund on 27.04.2017	215,889,971.00	-
Net Balance as at the year end (d) - (e)	-	215,276,691.00

Note: The balance of the new Bank A/c will be used for AISTDF activities and not for the SERB.

SERB will facilitate management of AISTDF A/c as per the provisions of the MOU between DST & SERB. Accordingly separate financial accounts of AISTDF shall be prepared and submitted to DST.

Schedules Forming Part of Balance Sheet

as on 31.03.2018

Amount in Rs.

Schedule 3D - Earmarked/Endowment Funds DOT		
Particulars	Current Year	Previous Year
a) Opening Balance of the Funds	-	-
b) Additions to the funds		
i) Donations / Grants	-	-
Grant in Aid (DOT- General)	19,100,000.00	-
ii) Income from Investments made on account of Funds	-	-
iii) Other Additions	-	-
Total (a+b)	19,100,000.00	-
c) Utilization / Expenditure towards objectives of funds		
i) Capital Expenditure		-
Fixed Assets	-	-
Other Additions	-	-
Grant-in-aid (DOT- Capital)	87,711.00	-
ii) Revenue Expenditure		-
Salary, Wages and allowance etc	-	-
Rent	-	-
Other Administrative Expenditure		-
Grant-in-aid (DOT- General)	4,100,000.00	-
Total (c)	4,187,711.00	-
Net Balance as at the year end (a+b-c)	14,912,289.00	-

Note: Total earmarked funds received during the FY 2017-18 from DOT is Rs.4,95,00,000/- , out of which Rs. 3,04,00,000/- has been set off against the expenditure already incurred by SERB on behalf of DOT in FY 2014-15, FY 2015-16 & FY 2016-17 and taken in Schedule 24- Prior Period Income as "Refund from DOT against previous year grants". So net balance of Rs. 1,91,00,000/- as shown in Schedule - 3D above is the Earmarked receipt Grant-in-Aid for current FY 2017-18.

Schedules Forming Part of Balance Sheet

as on 31.03.2018

Amount in Rs.

Schedule 4 - Secured Loans and Borrowings

Particulars	Current Year		Previous Year	
1. Central Government	-	-	-	-
2. State Government	-	-	-	-
3. Financial Institutions				
a) Term Loans	-	-	-	-
b) Interest accrued & dues	-	-	-	-
4. Banks :				
a) Term Loans	-	-	-	-
Interest accrued and due	-	-	-	-
b) Other Loans	-	-	-	-
Interest accrued and due	-	-	-	-
5. Other Institutions and Agencies	-	-	-	-
6. Debentures and Bonds	-	-	-	-
7. Others	-	-	-	-
Total				

Schedule 5 - Unsecured Loans and Borrowings

Particulars	Current Year		Previous Year	
1. Central Government	-	-	-	-
2. State Government	-	-	-	-
3. Financial Institutions	-	-	-	-
4. Banks :				
a) Term Loans	-	-	-	-
b) Other Loans	-	-	-	-
5. Other Institutions and Agencies	-	-	-	-
6. Debentures and Bonds	-	-	-	-
7. Fixed Deposits	-	-	-	-
8. Others	-	-	-	-
Total				

Schedule 6 - Deferred Credit Liabilities

Particulars	Current Year		Previous Year	
a) Acceptances secured by Hypothecation of Capital Equipment & other assets			-	-
b) Others			-	-
Total			-	-

Schedules Forming Part of Balance Sheet

as on 31.03.2018

Amount in Rs.

Schedule 7 - Current Liabilities And Provisions

Particulars	Current Year		Previous Year	
A) Current Liabilities				
1. Acceptances	-	-	-	-
2. Sundry Creditors	-	-	-	-
a) For Goods	-	-	-	-
b) Others	-	-	-	-
Global Computer & Communication, New Delhi	-	-	89,580.00	-
Shree Bhagatrams, New Delhi	12,150.00	-	25,814.00	-
Unecode Inc., Delhi	15,627.00	-	6,189.00	-
Suresh Malik & Co.	637,200.00	-	538,200.00	-
National Mission on Bamboo Application	1,080,145.00	-	1,080,145.00	-
FDS Management Services Private Limited	313,080.00	-	-	-
Mansarover Industrial Corporation, New Delhi	2,350.00	-	2,350.00	-
Sonu Printing Press Pvt. Ltd.	6,264.00	-	4,857.00	-
Suncity Projects Private Limited, New Delhi	115,064.00	-	92,981.00	-
Balmer Lawrie & Co. Ltd., New Delhi	113,429.00	-	251,986.00	-
Dinesh Singh Tomer, New Delhi	2,679.00	-	2,647.00	-
Carrider, Delhi	33,454.00	-	-	-
K B Enterprises	-	-	36,554.00	-
Shalu Tour And Travels, New Delhi	211,700.00	-	92,941.00	-
R S Travels Solution Private Limited	242,205.00	-	223,273.00	-
Sonpal	15,770.00	-	10,620.00	-
Sr. Post Master Sarojini Nagar, H.P.O.	-	-	6,101.00	-
Deldsl-Digital NTC	75,400.00	-	73,255.00	-
Digital NTC-New Delhi	23,200.00	-	22,540.00	-
Airtel	36,108.00	-	35,190.00	-
National Informatics Centre Service INC., New Delhi	24,241.00	-	-	-
NSDL E Governanace Infrastructure Limited	826.00	-	1,387.00	-
Net Creative Mind Solutions Private Limited	-	2,960,892.00	43,950.00	2,640,560.00
3. Advances Received	-	-	-	-
4. Interest accrued but not due on :				
a) Secured Loans / Borrowings	-	-	-	-
b) UnSecured Loans / Borrowings	-	-	-	-
5. Statutory Liabilities				
a) Over Due	-	-	-	-
b) Others : TDS - Section 194C	17,113.00	-	10,030.00	-
TDS - Section 194J	4,118.00	-	-	-
TDS - Section 192	668,902.00	690,133.00	454,516.00	464,546.00
Total (1)		3,651,025.00	-	3,105,106.00
6. Other Current Liabilities				
Expenses Payable				
Salary Payable	5,731,865.00	-	4,273,838.00	-
Wages Payable	-	-	90,695.00	-
EPF Payable Employee Contribution	142,200.00	-	108,000.00	-
EPF Payable Employer Contribution	158,398.00	-	120,350.00	-
NPS Contribution Payable	480,066.00	-	440,139.00	-
Audit Fee Payable	540,500.00	-	459,250.00	-
Telephone Expenses Payable (Reimbursement)	12,677.00	-	27,778.00	-

Particulars	Current Year		Previous Year	
Newspaper Expenses Payable (Reimbursement)	-	-	11,741.00	-
Medical Expenses Payable (Reimbursement)	85,044.00	-	75,892.00	-
Honorarium Expenses Payable (Non-Official)	-	7,150,750.00	35,000.00	5,642,683.00
Expenses Current Liabilities Staff				
Satish Marar	2,065.00	-	-	-
Prahlad Ram	-	-	1,000.00	-
Dr. G. Harish Kumar	751.00	-	751.00	-
Praveen Kumar S	418.00	3,234.00	418.00	2,169.00
Time barred cheques taken back (FY 2011-12)	-	344,235.00	-	344,235.00
Time barred cheques taken back (FY 2012-13)	-	11,933,916.00	-	11,933,916.00
Time barred cheques taken back (FY 2013-14)	-	16,251,065.00	-	16,251,065.00
Time barred cheques taken back (FY 2014-15)	-	222,593.00	-	222,593.00
Total (2)	-	35,905,793.00	-	34,396,661.00
Total (A) =(1) + (2)	-	39,556,818.00	-	37,501,767.00
B. Provision				
1. For Taxation	-	-	-	-
2. Gratuity	-	-	-	-
3. Superannuation / Pension	-	-	-	-
4. Accumulated Leave Encashment	-	5,868,955.00	-	3,146,383.00
5. Trade Warranties / Claims	-	-	-	-
6. Others	-	-	-	-
Total (B)		5,868,955.00		3,146,383.00
Total (A+B)		45,425,773.00		40,648,150.00

Amount in Rs.

Schedule 9 - Investments from Earmarked/Endowment Funds

Particulars	Current Year	Previous Year
1. In Government Securities	-	-
2. Other approved Securities	-	-
3. Shares	-	-
4. Debentures and Bonds	-	-
5. Subsidiaries and Joint Ventures	-	-
6. Others (to be Specified)	-	-
Total	-	-

Amount in Rs.

Schedule 10 - Investments - Others

Particulars	Current Year	Previous Year
1. In Government Securities	-	-
2. Other approved Securities	-	-
3. Shares	-	-
4. Debentures and Bonds	-	-
5. Subsidiaries and Joint Ventures	-	-
6. Others	-	-
Total	-	-

SCHEDULES FORMING PART OF BALANCE SHEET

as on 31.03.2018

SCHEDULE 8-FIXED ASSETS			GROSS BLOCK				DEPRECIATION				NET BLOCK		
DESCRIPTION	Rate of Depreciation	Cost / valuation as at beginning of the year	Additions during the year	Deductions during the year	Cost / valuation at the year end	As at the beginning of the year	On Opening balance	On Additions during the year	On Deductions during the year	Total up to the year end	As at the current year end	As at the previous year end	
		(Rs)	(Rs)	(Rs)	(Rs)	(Rs)	(Rs)	(Rs)	(Rs)	(Rs)	(Rs)	(Rs)	
A. FIXED ASSETS													
1. LAND													
a) Freehold	-	-	-	-	-	-	-	-	-	-	-	-	
b) Leasehold	-	-	-	-	-	-	-	-	-	-	-	-	
2. BUILDING													
a) On Freehold Land	-	-	-	-	-	-	-	-	-	-	-	-	
b) On Leasehold Land	-	-	-	-	-	-	-	-	-	-	-	-	
c) Ownership Flats/Premises	-	-	-	-	-	-	-	-	-	-	-	-	
d) Interior work	10%	18,436,973.00	2,810,448.00	-	21,247,421.00	8,023,815.00	1,041,316.00	178,868.00	-	9,243,999.00	12,003,422.00	10,413,158.00	
3. PLANT & MACHINERY	15%	653,288.00	475,980.00	-	1,127,268.00	235,665.00	62,643.00	35,549.00	-	333,857.00	793,411.00	417,623.00	
4. VEHICLES	-	-	-	-	-	-	-	-	-	-	-	-	
5. FURNITURE & FIXTURES	10%	9,728,715.00	1,938,835.00	-	11,667,550.00	3,235,340.00	649,337.00	133,269.00	-	4,017,946.00	7,649,604.00	6,493,373.00	
6. OFFICE EQUIPMENT	15%	3,729,893.00	199,111.00	-	3,929,004.00	1,379,108.00	352,619.00	27,360.00	-	1,759,087.00	2,169,917.00	2,350,785.00	
7. COMPUTER/PERIPHERALS													
a) Computer Softwares	40%	34,093,736.00	13,921,406.00	-	48,015,142.00	28,492,168.00	2,240,627.00	5,568,562.00	-	36,301,357.00	11,713,785.00	5,601,568.00	
b) Peripherals	40%	612,754.00	381,524.00	-	994,278.00	392,385.00	88,148.00	138,176.00	-	618,709.00	375,569.00	220,369.00	
c) Printers/Scanners	40%	2,155,176.00	994,261.00	-	3,149,437.00	1,729,198.00	170,391.00	237,960.00	-	2,137,549.00	1,011,888.00	425,978.00	
d) Computers	40%	7,149,861.00	1,990,271.00	-	9,140,132.00	6,127,710.00	408,860.00	657,222.00	-	7,193,792.00	1,946,340.00	1,022,151.00	
8. ELECTRIC INSTALLATIONS	10%	296,647.00	1,005,491.00	-	1,302,138.00	194,082.00	10,257.00	583,936.00	-	788,275.00	513,863.00	102,565.00	
9. LIBRARY BOOKS	40%	17,821.00	50,023.00	-	67,844.00	17,821.00	-	20,009.00	-	37,830.00	30,014.00	-	
10. TUBEWELL & W. SUPPLY	-	-	-	-	-	-	-	-	-	-	-	-	
11. INTANGIBLE ASSETS													
a) SERB Website	25%	449,440.00	-	-	449,440.00	325,010.00	31,108.00	-	-	356,118.00	93,322.00	124,430.00	
b) Logo	25%	412,000.00	-	-	412,000.00	238,188.00	43,453.00	-	-	281,641.00	130,359.00	173,812.00	
c) Vajra Website	25%	-	690,000.00	-	690,000.00	-	-	172,500.00	-	172,500.00	517,500.00	-	
TOTAL OF CURRENT YEAR (A)		77,736,304.00	24,455,350.00	-	102,191,654.00	50,390,490.00	5,098,759.00	7,753,411.00	-	63,242,660.00	38,948,994.00	27,345,814.00	
PREVIOUS YEAR		65,130,613.00	12,605,691.00	-	77,736,304.00	37,633,864.00	6,990,872.00	5,765,754.00	-	50,390,490.00	27,345,814.00	27,496,749.00	
B. CAPITAL WORK IN PROGRESS													
		350,000.00	118,000.00	468,000.00								350,000.00	
TOTAL (A+B)		78,086,304.00	24,573,350.00	468,000.00	102,191,654.00	50,390,490.00	5,098,759.00	7,753,411.00	-	63,242,660.00	38,948,994.00	27,695,814.00	

Schedules Forming Part of Balance Sheet

as on 31.03.2018

Amount in Rs.

Schedule 11 - Current Assets, Loans, Advances Etc

Particulars	Current Year		Previous Year	
A) Current Assets				
1. Inventories :				
a) Stores and Spares (Stationery Stock)		66,883.00		67,721.00
b) Loose Tools		-		-
c) Stock-in-Trade				
Finished Goods		-		-
Work-in-Progress		-		-
Raw Material		-		-
2. Sundry Debtors :				
a) Debts outstanding for a period exceeding six months		-		-
b) others:		-		-
3. Cash Balances in Hand (including Cheques / Drafts and Imprest)				
Petty Cash Account		20,000.00		20,000.00
4. Bank Balances :				
a) With Scheduled Banks :				
On Current Accounts		-		-
On Deposit Accounts		-		-
On Savings Accounts - SERB (Union Bank of India)	738,773,151.78		530,512,306.83	
SERB EPFO Account (UBI)	9.00		-	
SERB RTI Account (UBI)	176.68		10.00	
AISTDF Account (UBI)	-	738,773,337.46	214,396,671.00	744,908,987.83
b) With non-Scheduled Banks :				
On Current Accounts		-		-
On Deposite Accounts	-		-	
On Savings Accounts		-		-
5. Post Office - Savings Accounts		-		-
Total (A)		738,860,220.46		744,996,708.83
B) Loans, Advancees and Other Assets :-				
1. Loans:				
a) Staff Loan				
b) Other entities engaged in activities/objectives similar to that				
c) Others				
2. Advances and other amounts recoverable in cash or in kind or for value to be received:				
a) On Capital Account		-		-
b) Prepayments				
Computer software expenses	190,860.00		-	
Video Conferencing License	689,020.00		-	

Schedules Forming Part of Balance Sheet

as on 31.03.2018

Particulars	Current Year		Previous Year	
Vajra Website-Update Expenses	120,263.00		-	
Membership Fee - India International Centre, New Delhi	61,360.00		51,750.00	
AMC Photocopier	-		8,950.00	
Conference Expenses	-		2,000.00	
Cyberoam Firewall - Licence Fee	72,852.00		130,408.00	
NIC Software Maintenance	-	1,134,355.00	331,202.00	524,310.00
c) Security Deposit				
BNPL Sarojini Nagar PO Security Deposit	446.00		50,000.00	
Deldsl-Digital NTC (Security Deposit)	20,000.00		20,000.00	
Digital NTC (Security Deposit)	10,000.00	30,446.00	10,000.00	80,000.00
d) Others-				
Gung HO Marketing Services Pvt. Ltd., New Delhi	1,063,475.00		-	
Centre for Development of Advanced Computing, Noida	6,898,280.00		-	
Society for Environment & Development, Delhi	-		250,000.00	
Dr. Praveen Kumar S	-		20,100.00	
Sujit Mohanta	10,000.00		-	
Dr. Pramod Kumar Prasad''''	10,000.00		-	
MFPI Expenditure by SERB	2,590,604.00	10,572,359.00	4,110,493.00	4,380,593.00
3. Income Accrued:				
a) On Investments from Earmarked/ Endowment Funds	-		-	
b) On Investment – Others	-		-	
c) On Loans and Advances	-		-	
d) Others (includes income due unrealized)	-		-	
Interest accrued on Saving A/c Balance - SERB UBI	13,025,086.00		21,464,512.00	
SERB RTI Account (UBI)	2.00			
SERB EPFO Account (UBI)	-		24.00	
AISTD Account (UBI)	-	13,025,088.00	880,020.00	22,344,556.00
4. Claim Receivable				
Total = (B)		24,762,248.00		27,329,459.00
Total (A) + (B)		763,622,468.46		772,326,167.83

Schedules Forming Part of Income & Expenditure for the year ended 31.03.2018

Amount in Rs.

Schedule 12 - Income From Sales / Services		
Particulars	Current Year	Previous Year
1. Income from Sales		
a) Sale of finished Goods	-	-
b) Sale of Raw Material	-	-
c) Sale of Scraps	-	-
2. Income from Services		
a) Labour and Processing Charges	-	-
b) Professional / Consultancy Services	-	-
c) Agency Commissions and Brokerages	-	-
d) Maintenance Services (Equipment/Property)	-	-
e) Others	-	-
Total	-	-

Amount in Rs.

Schedule 13 - Grants / Subsidies				
Particulars	Current Year		Previous Year	
1. From Central Government				
a) Grant in Aid (General)	5,800,000,000.00		4,220,000,000.00	
Transferred to Corpus/Fixed Assets (Schedule 1)	(24,105,350.00)	5,775,894,650.00	(12,955,691.00)	4,207,044,309.00
b) Grant in Aid (Capital)	-	1,675,000,000.00	-	2,875,000,000.00
c) Grant in Aid (Scheduled Castes - General)		290,000,000.00		295,000,000.00
d) Grant in Aid (Scheduled Castes - Capital)	-	210,000,000.00	-	250,000,000.00
e) Grant in Aid (Scheduled Tribe - General)		-		-
f) Grant in Aid (Scheduled Tribe - Capital)		-		-
g) Grant in Aid (Salaries)		25,000,000.00		30,000,000.00
2. State Government(s)		-		-
3. Government Agencies		-		-
4. Institutions Organisations		-		-
5. International Organisations		-		-
6. Other		-		-
Total		7,975,894,650.00		7,657,044,309.00

Amount in Rs.

Schedule 14 - Fees / Subscriptions		
Particulars	Current Year	Previous Year
1. Entrance Fees		
2. Annual Fees / Subscriptions		
3. Seminar / Programme Fees		
4. Consultancy Fee		
5. Others		
Total		

Schedules Forming Part of Income & Expenditure for the year ended 31.03.2018

Amount in Rs.

Schedule 15 - Income From Investments (Income on Invest. From Earmarked/Endowment Funds transferred to Funds)

Particulars	Investment from Earmarked Funds		Investment -Others	
	Current Year	Previous Year	Current Year	Previous Year
1. Interest	-	-	-	-
a) On Govt. Securities	-	-	-	-
b) Other Bonds/Debentures	-	-	-	-
2. Dividends	-	-	-	-
a) On shares	-	-	-	-
b) On Mutual Fund Securities	-	-	-	-
3. Rents	-	-	-	-
4. Others : Interest on MFPI Balance in Saving Account	398,123.00	480,001.00	-	-
Interest on S & T SC Balance in Saving Account	137,201.00	1,162,362.00	-	-
Interest on S & T ST Balance in Saving Account	41,536.00	52,517.00	-	-
Interest on AISTDF Balance in Saving Account	613,295.00	880,020.00	-	-
Total	1,190,155.00	2,574,900.00	-	-
Transferred to Earmarked/Endowment Funds	1,190,155.00	2,574,900.00		

Amount in Rs.

Schedule 16 - Income from Royalty, Publication Etc.

Particulars	Current Year	Previous Year
1) Income from Royalty	-	-
2) Income from Publications	-	-
3) Other	-	-
Total	-	-

Schedules Forming Part of Income & Expenditure for the year ended 31.03.2018

Amount in Rs.

Schedule 17 - Interest Earned		
Particulars	Current Year	Previous Year
1. On Term Deposits		
a) With Scheduled Banks	8,003,425.00	51,889,397.00
b) With Non-Scheduled Banks	-	-
c) With Institutions	-	-
d) Others	-	-
2. On Savings Accounts	-	-
a) With Scheduled Banks	50,153,121.00	62,074,651.00
b) With Non-Scheduled Banks	-	-
c) Post Office Savings Accounts	-	-
d) Others	-	-
3. On Loans :		
a) Employees / Staff	-	-
b) Others	-	-
4. Interest on Debtors and Other Receivables	-	-
5. Interest on Refund	1,974,881.90	2,416,634.32
Total	60,131,427.90	116,380,682.32

Amount in Rs.

Schedule 18 - Other Income		
Particulars	Current Year	Previous Year
1. Profit on sale / disposal of Assets		
a) Owned assets	-	-
b) Assets acquired out of grants, or received free of cost	-	-
2. Export Incentives realized	-	-
3. Fees for Miscellaneous Services	-	-
4. Deferred Revenue Grant (AS-12)	12,852,170.00	12,756,626.00
5. Miscellaneous Income- Other Income RTI Receipts	420.00	730.00
Total	12,852,590.00	12,757,356.00

Schedules Forming Part of Income & Expenditure for the year ended 31.03.2018

Amount in Rs.

Schedule 19 - Increase / (Decrease) in stock of Finished Goods & Work in Progress		
Particulars	Current Year	Previous Year
a) Closing Stock		
Finished Goods	-	-
Work-in-Progress	-	-
b) Less : Opening Stock		
Finished Goods	-	-
Work-in-Progress	-	-
Total	-	-

Amount in Rs.

Schedule 20 - Establishment Expenses		
Particulars	Current Year	Previous Year
a) Salaries and Wages	73,293,485.00	54,325,750.00
b) Allowances and Bonus	-	-
c) Contribution to Provident Fund- Employer	1,724,554.00	1,316,042.00
d) Contribution to Other Fund (NPS Employer Contribution)	2,697,004.00	2,474,949.00
e) Staff Welfare Expenses	-	-
f) Expenses on Employee's Retirement & Terminal Benefits	-	-
Leave Encashment Provision	2,722,572.00	2,127,517.00
g) Others		
Telephone Expenses Reimbursement	227,455.00	213,947.00
School Fee Reimbursement	6,150.00	186,962.00
Newspaper Reimbursement	18,062.00	22,555.00
Medical Reimbursement	744,060.00	524,386.00
Leave Encashment	247,344.00	56,918.00
Leave Travel Concession	819,151.00	642,320.00
Total	82,499,837.00	61,891,346.00

Schedules Forming Part of Income & Expenditure for the year ended 31.03.2018

Amount in Rs.

Schedule 21 - Other Administrative Expenses		
Particulars	Current Year	Previous Year
a) Bank Charges	71,515.78	11,442.55
b) Car Hire Charges	5,353,622.00	3,699,638.00
c) Professional Fees	3,521,468.00	972,354.00
d) Electricity Charges	1,529,656.00	1,346,018.00
e) Membership fee : India International Centre, New Delhi	51,750.00	51,525.00
f) Meeting Expenses	36,664.00	6,289,741.00
g) Honorarium Expenses (Non- Official)	746,000.00	638,000.00
h) Hospitality Expenses	1,918,788.00	1,356,357.00
i) Printing & Stationery	6,922,371.00	4,955,972.00
j) Rent- Building	47,964,925.00	47,522,437.00
k) Advertisement/Publication	5,332,115.00	1,859,428.00
l) Conference Expenses	-	98,108.00
m) Conveyance Expenses	2,950.00	1,796.00
n) Housekeeping/Security Expenses	3,014,266.00	1,765,066.00
o) International Conference	877,539.00	101,135.00
p) Repair & Maintenance	775,599.00	952,256.00
q) Travelling Expenses (Domestic)	8,794,675.00	9,240,647.00
r) Travelling Expenses (International)	1,549,000.00	408,870.00
s) Audit Fee	305,500.00	264,250.00
t) Accommodation Expenses	173,847.00	113,511.00
u) Computer Hardware & Software	618,134.00	923,829.00
v) Internet Charges	1,356,832.00	1,297,994.00
w) Newspaper & Periodicals	16,775.00	14,797.00
x) Postage Expenses	99,106.00	160,748.00
y) Telephone Expenses	281,400.00	275,900.00
z) Festival Expenses	121,820.00	132,400.00
aa) NSDL E Governance Charges	3,450.00	5,508.00
ab) Training Expenses	95,000.00	204,835.00
ac) AMC	1,381,342.00	998,917.00
ad) Video Conferencing System Licence	662,197.00	-
ae) Miscellaneous Expenses	1,140,584.00	614,202.00
Total	94,718,890.78	86,277,681.55

Amount in Rs.

Schedule 22 - Expenditure on Grants, Subsidies Etc		
Particulars	Current Year	Previous Year
Grants given to Institutions/Organisations		
a) Grants in Aid (Capital Assets)	1,505,083,752.00	2,977,741,371.00
b) Grant in Aid (General)	5,804,208,358.06	4,278,052,334.12
c) Grant in Aid (Scheduled Castes - Capital)	275,143,100.00	155,866,966.00
d) Grant in Aid (Scheduled Castes - General)	345,933,316.40	139,014,000.00
e) Grant in Aid (Scheduled Tribe - Capital)	18,445,000.00	72,352,425.00
f) Grant in Aid (Scheduled Tribe - General)	37,027,428.00	63,136,000.00
Total	7,985,840,954.46	7,686,163,096.12

Schedules Forming Part of Income & Expenditure for the year ended 31.03.2018

Amount in Rs.

Schedule 23 - Interest		
Particulars	Current Year	Previous Year
a) On Fixed Loans (Including Bank Charges)	-	-
b) On Other Loans (Including Bank Charges)	-	-
c) Others	-	-
Total	-	-

Amount in Rs.

Schedule 24 - Prior Period Income		
Particulars	Current Year	Previous Year
A) Refund received against previous year grants		
a) Refund from Projects (Capital) FY 2011-12	1,786,873.00	533,516.00
b) Refund from Projects (General) FY 2011-12	126,548.00	881,201.00
c) Refund from Projects (Capital) FY 2012-13	1,217,645.00	8,921,405.00
d) Refund from Projects (General) FY 2012-13	3,472,349.00	2,982,914.93
e) Refund from Projects (Capital) FY 2013-14	11,797,447.06	9,822,105.00
f) Refund from Projects (General) FY 2013-14	6,463,020.00	9,863,313.74
g) Refund from Projects (SC-Capital) FY 2013-14	670.00	3,100,000.00
h) Refund from Projects (SC-General) FY 2013-14	26,235.00	660,000.00
i) Refund from Projects (Capital) FY 2014-15	7,124,707.59	2,110,205.00
j) Refund from Projects (General) FY 2014-15	6,434,513.54	11,373,564.70
k) Refund from Projects (SC-General) FY 2014-15	-	5,813.00
l) Refund from Projects (ST-General) FY 2014-15	44.00	616,554.00
m) Refund from Projects (Capital) FY 2015-16	6,664,882.00	6,714,724.00
n) Refund from Projects (General) FY 2015-16	23,876,868.47	42,251,620.36
o) Refund from Projects (SC-Capital) FY 2015-16	900,000.00	-
p) Refund from Projects (SC-General) FY 2015-16	1,411,811.00	2,299,355.00
q) Refund from Projects (ST-General) FY 2015-16	94,348.00	4,169.00
r) Refund from Projects (Capital) FY 2016-17	20,424,494.00	-
s) Refund from Projects (General) FY 2016-17	57,307,594.31	-
t) Refund from Projects (SC-Capital) FY 2016-17	3,750,000.00	-
u) Refund from Projects (SC-General) FY 2016-17	1,433,106.00	-
v) Refund from Projects (ST-General) FY 2016-17	233,694.00	-
w) Refund from Projects SERC	153,479.00	56,240.00
B) Refund from DOT against previous year grants		
a) Grant-in-Aid (General) FY 2014-15	4,939,798.00	-
b) Grant-in-Aid (Capital) FY 2014-15	5,310,202.00	-
c) Grant-in-Aid (General) FY 2015-16	5,280,650.00	-
d) Grant-in-Aid (Capital) FY 2015-16	10,169,350.00	-
e) Grant-in-Aid (General) FY 2016-17	4,700,000.00	-
Total A) + B)	185,100,328.97	102,196,700.73

Schedules Forming Part of Income & Expenditure for the year ended 31.03.2018

Amount in Rs.

Schedule 25 - Prior Period Expenditure		
Particulars	Current Year	Previous Year
a) Professional Fees	14,000.00	-
b) Telephone Expenses	-	1,408.00
c) International Conference	18,075.00	-
d) Travelling Expenses (Domestic)	20,445.00	30,586.00
e) Travelling Expenses (International)	-	23,300.00
f) Leave Encashment	-	44,275.00
g) Newspaper Reimbursement	2,817.00	6,616.00
h) Medical Expenses Reimbursement	31,352.00	11,112.00
i) Telephone Expenses Reimbursement	34,552.00	15,041.00
j) School Fee Reimbursement	18,000.00	3,065.00
k) Salary Arrear (Regular Employees)	718,905.00	737,296.00
l) NPS Employer Contribution (Arrear)	72,015.00	70,697.00
m) Salary (Regular Employees)	-	(29,730.00)
n) Salary (Contract Employees)	-	12,000.00
o) EPF Employer Contribution	-	(2,003.00)
p) AMC Video Conferencing System	1,570.00	-
q) Pension Contribution	-	9,054.00
r) Housekeeping Expenses	58,122.00	-
s) Rent Secretary Accommodation	-	66,000.00
t) Internet Charges	-	3,056.00
u) Video Conferencing System Licence	14,493.00	-
Total	1,004,346.00	1,001,773.00

Receipts & Payments for the Year Ended 31.03.2018

Receipts		Current Year	Previous Year	Payments		Current Year	Previous Year
1	Opening Balances			1	Expenses		
a)	Cash in hand	20,000.00	45,000.00	a)	Establishment Expenses (corresponding to Schedule 20)	79,552,811.00	59,904,076.00
b)	Bank balances			b)	Administrative Expenses (corresponding to Schedule 21)	95,135,195.78	87,730,118.55
	i) In Current Accounts	-	-	2	Payments made against funds for various projects		
	ii) In Deposit Accounts	-	-		Grants given to Institutions/Organisations		
	iii) Savings Accounts : SERB UBI	530,512,306.83	513,710,026.45	a)	Grants in Aid (Capital Assets)	1,505,083,752.00	2,977,741,371.00
	: AISTDF UBI	214,396,671.00	-	b)	Grant in Aid (General)	5,804,208,358.06	4,278,052,334.12
	: SERB RTI	10.00	-	c)	Grant in Aid (Scheduled Castes - Capital)	275,143,100.00	155,866,966.00
	: SERB EPFO	-	-	d)	Grant in Aid (Scheduled Castes - General)	345,933,316.40	139,014,000.00
2	Grants Received			e)	Grant in Aid (Scheduled Tribe - Capital)	18,445,000.00	72,352,425.00
a)	From Government of India	8,000,000,000.00	7,670,000,000.00	f)	Grant in Aid (Scheduled Tribe - General)	37,027,428.00	63,136,000.00
b)	From State Government	-	-	3	Investments & Deposits made		
c)	From Other Sources (details)	-	-	a)	Out of Earmarked/Endowment Funds	-	-
3	Income on Investments from			b)	Out of Own Funds (Investments-Others)	-	-
a)	Earmarked/Endowment Funds	-	-	4	Expenditure on Fixed Assets & Capital Work-in Progress		
b)	Own Funds	-	-	a)	Purchase of Fixed Assets	24,105,350.00	12,634,666.00
4	Interest Received			b)	Expenditure on Capital Work-in Progress	-	185,000.00
a)	On Bank Deposits	67,172,854.00	100,462,508.00	5	Refund of surplus money/loans		
b)	Loans Advances	-	-	a)	To the Government of India	-	-
c)	Interest on Refund	1,974,881.90	2,416,634.32	b)	To the State Government	-	-
5	Other Income	420.00	730.00	c)	To other providers of Funds	-	-
6	Amount Borrowed	-	-	6	Finance Charges (Interest)	-	-
7	Any Other Receipts			7	Other Payments (Specify)		
a)	Refunds Received Against Previous Year Grant	185,100,328.97	102,196,700.73	a)	MFP Earmarked Payment	14,750,607.00	37,382,176.00
b)	MFP Earmarked Receipt	32,616,617.00	46,914,383.00	b)	S & T Earmarked Payment	-	28,876,381.00

Receipts & Payments for the Year Ended 31.03.2018

Receipts	Current Year	Previous Year	Payments	Current Year	Previous Year
c) S & T Earmarked Receipt	111,377,411.00	365,249.00	AISTDF Earmarked Transferred (new Bank A/c no. 349902010047466)*	215,889,986.00	-
d) AISTDF Earmarked Receipt	1,493,315.00	214,396,671.00	MFPI Expenditure by SERB	950,000.00	1,900,000.00
e) Receipt against MFPI Expenditure by SERB	3,422,892.00	8,007,707.00	DOT Earmarked Payment	4,187,711.00	-
f) DOT Earmarked Receipt	19,100,000.00	-	Pramod Kumar Prasad	10,000.00	-
g) UBI Recoverable	-	308,000.00	Praveen Kumar S	-	20,100.00
h) Dr. Vinod Kumar	-	4,086.00	Society for Environment & Development, Delhi	-	250,000.00
i) Research Council, UK (GRC Meeting)	-	1,146,906.00	Centre for Development of Advanced Computing, Noida	6,898,280.00	-
			Gung Ho Marketing Services Pvt Ltd, New Delhi	1,063,475.00	-
			8 Sujit Mohanta	10,000.00	-
			Closing Balances	-	-
			Cash in hand	20,000.00	20,000.00
			Bank balances	-	-
			i) In Current Accounts	-	-
			ii) In Deposit Accounts	-	-
			iii) Savings Accounts : SERB UBI	738,773,151.78	530,512,306.83
			: AISTDF UBI	-	214,396,671.00
			: SERB RTI	176.68	10.00
			: SERB EPFO	9.00	-
Total	9,167,187,707.70	8,659,974,601.50	Total	9,167,187,707.70	8,659,974,601.50

For Science and Engineering Research Board


 Date: 13-06-1018
 Place: New Delhi

Secretary
SERB


 Director-Finance
 SERB

Refer Schedule 3C- Earmarked/Endowment Fund AISTDF

SCHEDULE FORMING PART OF THE ACCOUNTS FOR THE YEAR ENDED 31.03.2018

SCHEDULE 26

SIGNIFICANT ACCOUNTING POLICIES

1. Basis of Preparation of Financial Statements

These financial statements have been prepared on the accrual basis of accounting, under historical cost convention, in accordance with the accounting principles generally accepted in India.

2. Fixed Assets

Fixed assets are stated at cost of acquisition less accumulated depreciation and impairment losses, if any. Cost of fixed assets comprises purchase price, duties, levies and other directly attributable costs of bringing the assets to its working conditions for the intended use.

3. Capital Work in Progress

Expenditure incurred on construction of assets which are not ready for their intended use are carried at cost less impairment (if any), under Capital work-in-progress.

4. Depreciation

Depreciation on fixed assets is computed on the written down value (WDV) method at the rates and in the manner prescribed under the Provisions of Income Tax Act.

In respect of additions to/deductions from fixed assets during the year, depreciation is considered on pro-rata basis. Assets costing Rs.5,000/- each or less are fully provided.

Note: New depreciation rates prescribed under the Income tax Act for AY 2018-19 (FY 2017-18) and onwards have been followed for preparation of Annual Accounts of SERB for AY 2018-19 (FY 2017-18).

5. Grant/ Subsidies Received

Grants, subsidies or similar assistance received for the general purposes and objectives of the Entity, on an irrevocable basis, be treated as income on receipt basis.

6. Expenditure on Grants, Subsidies etc.

Grants, subsidies or other similar assistance given to the Institutions/Organisations for general purposes and objectives of the Entity, on an irrevocable basis, be treated as expenditure when they are released.

7. Interest Income of SERB

Besides the grant-in-aid received from Central Government, SERB also generates income from: -

- a. Interest on Short term FD's of the Grant-in Aid
- b. Interest on the Saving A/c Balance
- c. and Interest on Refund

Further the above income generated is applied for meeting the expenses as indicated in para 10(2) of the SERB Act 2008.

8. Prior period Income/Expenditure

Income/expenditure relating to previous Financial Years has been booked as Prior Period Income/Expenditure in the Income and Expenditure Account.

9. Refund from beneficiaries:

- Refund/repayment of grant/assistance received by SERB from the beneficiaries as per the conditions stipulated in the sanction document is accounted for on receipt basis.
- Refund/repayment of grant/assistance given and received back in the same financial year has been netted off with Grant-in-Aid (expenditure) in the Income and Expenditure Account.
- Refund/repayment of grant/assistance given in previous years and received back in later years (i.e. not in same financial year) has been shown as "Refund received against Previous Year Grant" in the Income and Expenditure Account under "Prior Period Income".

10. Unspent balances of Grants received from DST:

The unspent balances of Grants received from DST are not to be refunded to DST as grants released by the Government are credited to Science and Engineering Research Board in terms of Section 10(1) of SERB Act, 2008.

11. Time barred cheques

All cheques issued by SERB during the FY 2017-18 have been encashed within its validity period of 3 months from the date of the issue of Cheque. So, no amount has been transferred to the head "Time Barred Cheques Taken Back" under Current Liabilities for cheques issued during the FY 2017-18.

12. Government Grant for Fixed assets of SERB

In order to comply with AS-12 Accounting for Government Grants under direction of C&AG, amount equivalent to cost of acquisition of fixed assets out of Grants in Aid (General) has been shown as Corpus Fixed Assets. Depreciation for the year amounting Rs. 1,28,52,170/- is being credited to Income & Expenditure A/c as Deferred Revenue Grant as per para 8 of AS 12.

13. Retirement Benefits

SERB makes provision for liability towards encashment of leave lying to the credit of employees as on the last day of current financial year subject to the maximum period of leave allowable as per extant rules and retirement benefits shall be governed by the National Pension System (NPS) as applicable to the officers of equivalent rank of the Central Government as amended from time to time.

14. Surplus/Deficit in Income & Expenditure A/c

Surplus/Deficit in Income & Expenditure Account at the year-end has been transferred to Corpus/Capital Account.

For Science and Engineering Research Board


Secretary
SERB


Director-Finance
SERB

Date: 13.06.2018
Place: New Delhi

SCHEDULE FORMING PART OF THE ACCOUNTS FOR THE YEAR ENDED 31.03.2018

SCHEDULE- 27 CONTINGENT LIABILITIES AND NOTES TO ACCOUNTS

1. CONTINGENT LIABILITIES

1.1 Claims against the Entity not acknowledge as debts Rs. NIL (Previous year Rs. NIL)

1.2 In respect of

- Bank Guarantees given by/on behalf of the Entity Rs. NIL (Previous year Rs. NIL)
- Letters of Credit opened by Bank on behalf of the Entity Rs. NIL (Previous year Rs. NIL)
- Bills discounted with banks Rs. NIL (Previous year Rs. NIL)

1.3 Disputed demands in respect of:

- Income tax Rs. NIL (Previous year Rs. NIL)
- Sales Tax Rs. NIL (Previous year Rs. NIL)
- Municipal Taxes Rs. NIL (Previous year Rs. NIL)
- In respect of claims from parties for non-execution of orders, but contested by the Entity Rs. NIL (Previous year Rs. NIL)

1.4 Income Tax (Refer Para 6 below)

- Current Year – Rs 12,12,88,862/- Previous year – Rs 21,11,96,149/-

	Current Year	Previous Year
FY 2011-12	Rs. 9,43,38,079/-	Rs. 9,43,38,079/-
FY 2012-13	Rs. 2,69,50,783/-	Rs. 2,69,50,783/-
FY 2013-14	Nil	Nil
FY 2014-15	Nil	Nil
FY 2015-16	Nil*	Rs. 8,99,07,287/-
FY 2016-17	Nil	Nil
FY 2017-18	Nil	----
Total	Rs. 12,12,88,862/-	Rs. 21,11,96,149/-

*Income Tax Return for the FY 2015-16 have been processed at CPC Bengaluru with Nil demand vide order dated 21.05.2017. Therefore, the contingent liability for Income Tax relating to FY 2015-16 stands as Nil.

2. CAPITAL COMMITMENTS

- Estimated value of contracts remaining to be executed on capital account and not provided for (net of advances) Rs. NIL (Previous year Rs. NIL)

3. LEASE OBLIGATIONS

- Future obligations for rentals under finance lease arrangements for plant and machinery amount to Rs. NIL (Previous year Rs. NIL)

4. CURRENT ASSETS, LOANS AND ADVANCES

- In the opinion of the Management, the current assets, loans and advances have a value on realization in the ordinary course of business, at least equal to the amount at which they are stated in the Balance Sheet.

5. Gross Loss in Current FY 2017-18 and Net Profit after considering Prior Period Income & Expenditure

Total Income of Current FY 2017-18 is Rs. 8,04,88,78,667.90 whereas Total Expenditure of Current FY is Rs. 8,17,59,11,852.24

In Income & Expenditure A/c excess of Expenditure over Income shows a difference of Rs. 12,70,33,184.34 as Gross Loss.

SERB is having Net Profit of Rs. 5,70,62,798.63/- in FY 2017-18 after considering Prior Period Income of Rs. 18,51,00,328.97 and Prior Period Expenditure of Rs. 10,04,346/-

6. TAXATION

SERB has got exemption u/s 10(46) of the Income Tax Act, 1961 for 5 financial years from FY 2013-14 to FY 2017-18 vide gazette notification no. 24/2017/F.No.196/15/2013-ITA-I published on 31st March, 2017.

After getting exemption u/s 10(46) of the Income Tax Act, 1961 we have rectified/revised SERB Income Tax returns of previous Financial Years and final order have been passed by the Income Tax Officer for **Nil Demand**.

Since our original application for exemption u/s 10(46) was from inception of SERB, the matter has been taken up again with CBDT to grant us exemption for FY 2011-12 and FY 2012-13 also.

Further we have applied for exemption u/s 10(46) of the Income Tax Act, 1961 to CBDT and Income Tax Department for FY 2018-19 and onwards.

In such a situation we have shown Contingent Liability for Income Tax at point 1.4.

7. FOREIGN CURRENCY TRANSACTIONS

(Amount Rs.)

7.1 Value of Imports Calculated on C.I.F. Basis:	Current Year	Previous Year
Purchase of finished Goods	Nil	Nil
Raw Materials & Components (Including in transit)	Nil	Nil
Capital Goods	Nil	Nil
Stores, Spares & Consumables		

7.2 Expenditure in foreign currency:

a) Travel	Rs. 8,77,539/-	Rs. 1,01,135/-
b) Remittances and Interest Payment to Financial Institutions/ Banks in Foreign Currency	Nil	Nil
c) Other expenditure:		
- Commission on Sale	Nil	Nil
- Legal and Professional Expenses	Nil	Nil
- Miscellaneous Expenses	Nil	Nil
- Grant-in-Aid (General)	RS. 5,14,00,759/-	Rs. 3,22,41,301/-

7.3 Earning:

Value of Exports on FOB basis

Nil

Nil

7.4 Remuneration to Auditors:

- Auditors Fee (CAG)	Rs. 40,000/-	Rs. 40,000/-
- Auditors Fee (CA)	Rs. 2,65,500/-	Rs. 2,24,250/-
- Taxation matters
- For management services
- For certificate
- Others

8. Previous Year figures have been regrouped /recast wherever found necessary.
9. Schedules 1 to 27 are annexed to and form an integral part of the Balance Sheet as at 31.03.2018 and the Income and Expenditure Account for the year ended on that date.

For Science and Engineering Research Board


Secretary
SERB



Director-Finance
SERB

Date: 13.06.2018
Place: New Delhi



कार्यालय महानिदेशक लेखापरीक्षा,
वैज्ञानिक विभाग

ए.जी.सी.आर. भवन, आई.पी. एस्टेट,
नई दिल्ली 110 002

OFFICE OF THE DIRECTOR GENERAL OF AUDIT,
SCIENTIFIC DEPARTMENTS,
A.G.C.R. BUILDING, I.P. ESTATE
NEW DELHI-110002

DGA/SD/Insp/1(22)/SAK/SERB/Audit01/2017-18/1023-1025

Dated: 05.12.2018

सेवा में,

निदेशक

विज्ञान और इंजीनियरी अनुसंधान बोर्ड
5 और 5ए, निचला भू-तल,
वसंत स्क्वायर मॉल,
सैक्टर - बी, पॉकेट-5, वसंत कुंज,
नई दिल्ली - 110070

विषय: विज्ञान और इंजीनियरी अनुसंधान बोर्ड, नई दिल्ली के वर्ष 2017-18 के लेखों पर पृथक ऑडिट रिपोर्ट।
महोदय,

मुझे विज्ञान और इंजीनियरी अनुसंधान बोर्ड, नई दिल्ली के वर्ष 2017-18 के लेखों पर पृथक ऑडिट रिपोर्ट अग्रहित करने का निर्देश हुआ है।

संसद के दोनों सदनों में प्रस्तुत करने से पहले वर्ष 2017-18 के वार्षिक लेखों को विज्ञान और इंजीनियरी अनुसंधान बोर्ड, नई दिल्ली द्वारा अपनाया जाए। प्रत्येक दस्तावेज जो संसद में प्रस्तुत किया जाए उसकी तीन प्रतियां इस कार्यालय तथा दो प्रतियां भारत के नियंत्रक महालेखापरीक्षक को अग्रहित की जाए। संसद के दोनों सदनों में प्रस्तुत करने की तिथि (यां) भी इस कार्यालय को सूचित की जाए।

आपसे अनुरोध है कि पृथक ऑडिट रिपोर्ट का हिन्दी अनुवाद अपने कार्यालय में कराने के पश्चात सॉफ्ट कॉपी तथा हार्ड कॉपी दोनों में हमें भेज दें ताकि हिन्दी प्रति को शीघ्र अग्रहित किया जा सके।

यह महानिदेशक द्वारा अनुमोदित है।

भनदीय,

संलग्नक: यथोपरि।

निदेशक (निरीक्षण)

**SEPARATE AUDIT REPORT OF THE COMPTROLLER & AUDITOR GENERAL OF INDIA ON
ACCOUNTS OF THE SCIENCE & ENGINEERING RESEARCH BOARD, NEW DELHI FOR THE
YEAR ENDED 31 MARCH 2018**

We have audited the attached Balance Sheet of the Science & Engineering Research Board (SERB), New Delhi as at 31st March, 2018 and the Income & Expenditure Account/ Receipts & Payments Account for the year ended on that date under Section 19(2) of the Comptroller and Auditor General's (Duties, Power and Condition of Service) Act, 1971 read with Section 13(3) of the SERB Act, 2008. These financial statements are the responsibility of the Board's management. Our responsibility is to express opinion on these financial statements based on our report.

2. This Separate Audit Report contains the comments of the Comptroller and Auditor General of India on the accounting treatment only with regard to classification, conformity with the best accounting practices, accounting standard and disclosure norms, etc. Audit observations (Propriety and Regularity) and efficiency – cum – performance aspects, etc., if any, are reported through Inspection Reports/ Comptroller and Auditor General's Audit Report separately.

3. We have conducted our audit in accordance with auditing standards generally accepted in India. These standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatements. An audit includes examining, on a test basis, evidences supporting the amounting and disclosure in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of financial statements. We believe that our audit provides a reasonable basis for our opinion.

4. Based on our audit, we report that:

- i) We have obtained all the information and explanation, which to the best of our knowledge and belief were necessary for the purpose of our audit:-
- ii) The Balance Sheet, Income & Expenditure Account and Receipts & Payments Account dealt with by this report have been drawn up in the common format of Accounts approved by the Government of India, Ministry of Finance.

iii) In our opinion, proper books of Accounts and other relevant records have been maintained by SERB, New Delhi except those stated in this audit report, in so far as it appears from the examination of such books.

iv) We further report that: -

A General

A.1. Current Liabilities and Provisions (Schedule 7)-₹ 4.54 crore

A.1.1 This includes an amount of ₹2.88 crore relating to grants-in-aid to 44 institutions shown as time barred cheques taken back for the period from 2011-12 to 2014-15. These static balances are long standing in the accounts. As these amounts were required to be released for the project activities to institutions which might have already completed the projects and may no longer require the grants, the Board needs to ascertain the reasons for non-requisition of the funds by these institutions and adjust the Liabilities accordingly.

This issue was already reported in the Separate Audit Report for the year ended 31 March 2017 , but no action had been initiated by SERB.

A.1.2 SERB did not disclose liability towards gratuity accrued to permanent staff of the Board as prescribed in the Uniform Format of Accounts.

B Grants-in-aid

Out of the grants-in-aid of ₹ 824.52 crore available under "Fund for Science and Engineering Research", including ₹ 800.00 crore received during the year from Department of Science and Technology, interest earned amounting to ₹ 6.01 crore and ₹ 18.15 crore received as 'Refund from Projects', the Board could utilize a sum of ₹ 818.8 crore leaving a balance of ₹ 5.71 crore as on 31 March 2018.

C Management letter

Deficiencies, which have not been included in the Separate Audit Report, have been brought to the notice of the Management through a management letter issued separately for remedial/ corrective action.

(v) Subject to our observations in the preceding paragraphs, we report that the Balance Sheet, Income & Expenditure Account and Receipts & Payments Account dealt with by this report are in agreement with the books of accounts.

(vi) In our opinion and to the best of our information and according to the explanations given to us, the said financial statements read together with the Accounting Policies and Notes to Accounts, and subject to the significant matters stated above and other matters mentioned in Annexure to this Audit Report give a true and fair view in conformity with accounting principles generally accepted in India.

a. In so far as it relates to the Balance Sheet, of the state of Affairs of the SERB as at 31st March, 2018: and

b. In so far as it relates to Income & Expenditure Account of the surplus for the year ended on that date.

For and on behalf of C&AG of India



Director General of Audit
(Scientific Departments)

Place : New Delhi

Date :

Annexure – I to Audit Report

Internal Audit/ Control System

Internal Control Mechanism

Scrutiny of the vouchers for the year 2017-18 along with allied record revealed the following deficiencies in the internal control mechanism in implementation of various rules and regulations as per the SERB Act :-

(A) Adequacy of Internal Audit System

Internal Audit of SERB was required to be conducted by the Internal Audit Wing (IAW) of Principal Pay & Accounts Office of the Department of Science & Technology, New Delhi which was completed upto March 2018.

(B) Monitoring of Utilization Certificates (UCs)

Rule 238 (1) of GFRs 2017 provided that a certificate of actual utilization of the grant received for the purpose for which it was sanctioned in form GFR 12-A should be insisted upon which should be submitted within twelve months of the closure of the financial year by the institution/ organization concerned. However, due to weak monitoring of the UCs, 7,937 number of UCs related to grants-in-aid of ₹ 752.86 crore pertaining to the years 2011-12 to 2016-17 were outstanding till March 2018. This issue was also highlighted in the Separate Audit Report for the year ended 31 March 2017.

(C) Adequacy of Internal Control Systems

Following deficiencies in relation to internal control system were observed in audit:

(i) Non-disclosure of information relating to grantee bodies on SERB website

Rule 230(1) of GFRs 2017 governing the Principles and Procedure for award of Grants-in-aid stipulates that the Institution or Organization seeking grants-in-aid should also certify that it has not obtained or applied for grants for the same purpose or activity from any other Ministry or Department of the Government of India or State Government. of the GFRs 2017. The details of projects/ programme implemented by the institutions or organizations, which were getting the Grants-in-aid from SERB were not uploaded on the website of the SERB as required by Rule 230(2) of the GFRs 2017. In

the absence of such information, it is not clear as to how the SERB ensured that there was no duplicity in receipt of grants-in-aid by the grantee for the same purpose.

(ii) Non-conduction of Peer Review of SERB by the Ministry

During 2011-12 to 2017-18, the SERB, New Delhi released grants-in-aid aggregating to ₹ 3,844.82 crore to the various Institutions/ Universities but no external or peer review of the SERB was conducted by the Ministry as envisaged in Rule 229 (ix) of the GFRs 2017.

(iii) Non-maintenance of record of assets created out of Grants for creation of Capital Assets

Ministry of Science and Technology released Rs 188.50 crore as grant-in-aid for creation of capital asset out of which SERB had released Rs 179.86 crore to various universities/autonomous bodies/groups/institutions. Assets created out of Grants-in-aid for creation of capital assets are required to be returned to the Board after completion of the project, unless approval of the Board was obtained by the grantee institution for keeping the same. Even the disposal of such assets by the grantee institutes requires prior approval of the Board when they become obsolete or unserviceable. However, the Board did not maintain any record of these assets created out of grants provided for creation of capital assets to various grantee institutions and further there was no disclosure in 'Notes on Accounts' in this regard. This issue was also highlighted in the Separate Audit Report for the year ended 31 March 2017.

(iv) Non-maintenance of the Register of Grants released by the board

As per Rule 234 of the GFRs 2017, a register of Grants needs to be prepared by the sanctioning authority as per Form GFR – 21. The same was not being maintained despite release of grants-in-aid amounting to ₹ 3,844.82 crore during the period from 2011-12 to 2017-18 by the Board. This issue was also highlighted in the Separate Audit Report for the year ended 31 March 2017.

(D) System of Physical Verification of Fixed Assets

The Physical verification of fixed assets has been carried out for the year financial year 2017-18 and no discrepancy was reported.

(E) System of Physical Verification of Inventory

Physical verification of consumable items and materials has been carried out for the financial year 2017-18 and no discrepancy was reported.

(F) Regularity in payment of statutory dues

Though the Board had no undisputed statutory dues outstanding for more than six months from the date of becoming due during 2017-18, an amount of ₹ 12.13 crore was disclosed as contingent liability towards Income Tax for the period 2011-12 & 2012-13 against which the Board had applied for exemption u/s 10(46) of the Income Tax Act 1961.

Maith Kuma

Director General of Audit (SD)



About SERB

Set up through an Act of Parliament, viz. the Science and Engineering Research Board Act, 2008, SERB serves as the national premier funding agency for planning, promoting and steering internationally competitive research in science and engineering. The mandate is to promote basic research in frontier areas of Science and Engineering and provide financial assistance to persons engaged in such research, academic institutions, research and development laboratories, and other agencies. This is achieved through various schemes like extramural research funding fellowships, grants, awards, scholarships and joint industrial relevant collaborations.



Science and Engineering Research Board

Submit R&D proposals online at: www.serbonline.in

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