



**National Institute of
Science Education and
Research Bhubaneswar**

ANNUAL REPORT

& AUDITED STATEMENT
OF ACCOUNTS

**2019
2020**





ANNUAL REPORT

&

Audited Statement of Accounts

2019 - 2020

National Institute of Science Education
and Research (NISER) Bhubaneswar

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FROM THE DIRECTOR'S DESK

"When everything seems to be going against you, remember that the airplane takes off against the wind, not with it."

- Henry Ford



Whistling past a year and getting richer by the experiences and learnings that the year bestowed upon, I am pleased to present the annual report of National Institute of Science Education and Research (NISER) for the financial year 2019-20.

The year 2019-20 was extremely satisfying on academic front, yet a challenging one due largely to the strikes of two cyclones and the prevailing coronavirus pandemic. Among the major achievements during this year, the stand out ones were the academic laurels received and research publications made by the faculty members of NISER. The extra mural research funding and grants also saw a very encouraging and upward surge. The year witnessed several academic conferences and seminars hosted in the campus before this pandemic came down heavily on us. The year that started with an upsetting note with the cyclone Phani that left a long trail of devastation in the campus, was unfortunately destined to end with another gloomy one. The onset of the COVID-19 pandemic unsettled our academic and other activities and forced us to take certain unprecedented measures. However, we constituted a COVID-19 task force and coordination committee to continuously monitor the situation and suggest appropriate steps taking into account the health advisories and

guidelines issued by the central and state governments and the Department of Atomic Energy from time to time.

Our students were hit the most during this year. The cyclone hit them during the middle of their end semester examinations in May 2019 and then the pandemic that left them with almost null academic activities, from the middle of an active semester in March 2020. Despite all these, it is a matter of immense pride to note the success stories scripted by our students that graduated in 2019. Since the first batch graduated in 2012, our alumni have been continuously keeping the NISER flag flying at some of the most sought after places all over the globe. Most of the graduated students of class of 2019 have enrolled for PhD programmes with fellowships from esteemed Universities and Institutes like, Johns Hopkins University, Michigan State University, University of California, NUS-Singapore, Ohio State University, Universities of Utah, Minnesota, Stony Brook, Penn State, Purdue, Georgia Tech, Iowa, Wisconsin Madison, Illinois-Urbana Champaign, Arizona, Max Plank Institute, Syracuse, Texas Tech, Rutgers, Hawaii, Florida, Rochester, Southern California, Kansas State, San Diego, Colorado, TIFR, IISc, IUCAA, etc. which reinforces the mandate that NISER is committed to create quality manpower for fundamental research in different areas of basic sciences.



The constraints associated with the post cyclone rebuilding have got intensified further by the current pandemic. We had to nearly shut down the campus to ensure that the health concerns of the NISER members were appropriately and adequately addressed. I believe that hard times are sometimes blessings in disguise. The challenges and sufferings make us stronger, wiser and better than before. I must place on record a huge note of thanks to the task force for continuously monitoring and advising, and the NISER community at large for their support and cooperation. An unprecedented situation like this can go haywire. However, we have managed to mitigate the damages to the minimum extent possible. I hope and pray that this crisis is behind us soon. We thank DCSEM and DAE for their timely damage assessment post-Phani and subsequent assistance in carrying out the rebuilding activities.

The Department of Atomic Energy has been extremely generous in providing continuous financial support to establish NISER in the forefront of research and development. We do place on record our gratitude to the DAE for that. We are trying our best to orient and reorient the research being done here in our laboratories to translate into tangible benefits for the society at large, justifying the public funding that we receive and also reinforcing our commitment to pay back to the nation. Some of the major non-DAE sources that also have poured in funding, include Dept. of Science and Technology (DST), Dept. of BioTechnology, (DBT) Science and

Engineering Research Board (SERB), Indian Council of Medial Research (ICMR), and the Council of Scientific and Industrial Research (CSIR).

NISER recognizes that innovative approaches and contribution to furthering the intellectual environment are the only keys to creating a niche in the scientific community. For that we must uncompromisingly raise the bar and keep striving for newer heights. Transcending academic and intellectual boundaries, the students and research scholars are being nurtured here with an unwavering focus to contribute meaningfully to the growth and development of the country and to create an enviable synergy through interdisciplinary and cutting edge research activities. I take this opportunity to thank each member of the NISER family for choosing to grow with this growing Institution and congratulate them for their persistent efforts in bagging academic fellowships and awards, publishing in high impact journals, being invited for talks, attending conferences, engaging in collaborative research with leading Universities across the globe, etc.

Last but not the least, I take this opportunity to thank the editorial team in bringing out this comprehensive Annual Report. Their efforts are sincerely appreciated.

'Jai Jawan, Jai Kisan, Jai Vigyan, Jai Anusandhan'

Prof. Sudhakar Panda
DIRECTOR



ABOUT THE INSTITUTE

National Institute of Science Education and Research (NISER), is an initiative of the Government of India. The primary objective of the Institute is to train and nurture human resources in the Sciences for the knowledge economies of the future. This is in tune with a general shift in social and national thought that seeks to create new sites of knowledge production centred in our country.

Such a strategic shift in perspective has been necessitated by the realization that the unique circumstances of our nation demand unique scientific and pedagogic responses. Consequently, we are called upon to question and account for conventional categorizations of science, technology, environment, learning, innovation, design and being. The predominant discourse that seeks to structure these superficially hard categories is predicated on justifications that till date have not moved beyond regimes of hierarchy, control and access. These strictures are an inherent feature of "Institutionalized Science" where Newtonian principles of organizing domains of cognition and mechanisms of representation constrain debates on what new conceptualizations of science ought to be like. More problematically this stifles the

potential for inter-disciplinary approaches of learning. This means we continue to think in and with straight jacketed binaries such as natural / artificial, real / virtual or being / thing. The founding of this Institute is rooted in the understanding that the contexts we inhabit are dynamic and in flux, while we have not begun to think in terms of solutions to most of these problems we realize that they exist and that we need to quickly participate in the process of finding out some answers.

NISER recognizes that modern scientific research is carried out in interstices amongst fuzzy domains and blurred boundaries. This entails encouraging a new scientific culture where members of our community attain to an intellectual agility unconstrained by the limitations of disciplinary conventions from the past. Faculty and Students will be given generous material support in the pursuit to realize this objective. Time and conversational space will be devoted to nascent propositions and hypothesis and the significantly small student-faculty ratio, an eventual full strength of 2000 students and 300 faculty members, manifests the Institutes investment and hope in the future.





ACADEMIC OVERVIEW

To deliver on the promise NISER initiated efforts in 4 major areas of science by establishing School of Biological Sciences (SBS), School of Chemical Sciences (SCS), School of Mathematical (SMS) and School of Physical Sciences (SPS). A School of Humanities and Social Sciences (SHSS) has also been established to understand the positionality of science in a socio-cultural context.

At NISER, students are admitted for a 5 year Integrated MSc (iMSc) program or for a Ph. D program. In the Integrated M Sc program, students learn all core subjects in basic sciences and specific courses in the humanities in the first year, following which they select their stream of choice in the basic sciences. Each school has its own program of core and elective courses and a student can finally graduate with one major and two minors in the areas of their choice. NISER has also added two more schools, one in Computer Sciences (CS) and other one being Earth and Planetary Sciences (EPS). NISER has already started post-B.Sc Integrated Ph. D programme in Physics since 2016. Going forward, it will be extended to other schools as well.

NISER shifted from its transit campus at Institute of Physics, Bhubaneswar to its permanent campus at Jatni, Khurda and the Institute has been dedicated to the nation by Honorable Prime Minister of India Shri Narendra Modi on February 07, 2016. The permanent campus has over 870 students spread over five batches of students admitted to the flagship M. Sc programme through a Pan-Indian entrance test known as National Entrance

Screening Test (NEST). NISER also carries out Doctoral Programme in all Basic Sciences and Humanities and Social Sciences.

Curriculum

The academic curriculum, including the structure of courses, laboratory hours, emphasis to study interdisciplinary subjects etc. have been framed with a vision that NISER will provide strong foundations in subjects of specialization with a broad perspective in fundamental sciences.

In addition to the established programmes in Chemistry, Physics, Mathematics and Biology, NISER has initiated new programmes in Computer Science and Earth and Planetary Sciences. With the help of eminent scientists drawn from across the country, NISER has drawn a road map that will allow it progressively to initiate these new schools and their academic programmes.

NISER recognizes that modern scientific research is carried out in a domain transcending conventional academic boundaries. The undergraduate students and research scholars are being nurtured in the ambience of this scientific culture. Going forward, there would be many centres of research in interdisciplinary areas opening more and bigger windows for cutting edge scientific research. NISER has started an integrated post-BSc PhD programme in Physics since Academic Session 2016-17. Going forward, NISER will extend the integrated PhD programme to other schools too.





School of Biological Sciences

The School of Biological Sciences (SBS) is one of the major schools at NISER established in September 2007. Since its inception, SBS has been involved in mixing and imparting traditional wisdom with modern technology by developing a research programs along with a vibrant teaching curriculum. SBS promotes scholarly and innovative thinking to conduct cutting edge research in diverse areas ranging from molecular to organismic biology. To facilitate the process, the school offers 5-year integrated MSc programme, Ph. D programme and Post-Doctoral programme to motivate and train students. SBS aims to establish as a center of excellence with its efforts grown up rapidly and signs of its achievements are being noticed at national and international levels in terms of work and student placements. To further strengthen the SBS research program, an Integrated Ph. D program initiative is under progress.

The school is on a mission

- ❑ To strive to become a centre of excellence in education and research in biological sciences providing training at undergraduate, graduate, doctoral and post-doctoral level.
- ❑ To provide effective interdisciplinary learning ambience through extensive subject coverage in all fields of modern biology and inter-phasing with other scientific disciplines.
- ❑ To equip its students to keep pace with recent developments in the field of scientific research.
- ❑ To undertake high quality research activities in defined areas of biosciences so as to make an impact at national and international level.
- ❑ To impart professional training for skilled human resource development across the state and country through short term training courses.
- ❑ To strive to develop state of the art infrastructure comparable to best anywhere in the world.

Facilities for Research and Teaching

- ❑ Confocal Microscope Facility

- ❑ DNA sequencing
- ❑ Cell culture facility
- ❑ Green house
- ❑ Fly Laboratory for handling Drosophila
- ❑ X-ray diffractometer for protein crystal structure study
- ❑ Small animal handling facility

School of Chemical Sciences

The vision of the School of Chemical Sciences is to promote, inspire and nurture the fundamentals as well as applications of chemistry among the 5 year integrated M.Sc. and PhD. Students. The School aims to provide ample of opportunities to explore various aspects of chemistry through high-level teaching and cutting-edge research. In order to achieve this goal, the course structure has been set in a manner that it covers the several branches of chemistry from basics to advanced concepts. The School also offers the relevant practical courses along with the theory courses that give the 'hands-on' activities to develop the research aptitude and to help the students to understand the scientific concepts and phenomena in a better way. The project dissertation in the final years of the course gives research exposure to fourth and fifth year students that enable them to become world leaders in the frontier of the chemistry research. The School has produced many proud alumni who have established themselves and/or are pursuing academic career in premier institutes like BARC, TIFR, IISc, MIT, ETH, YALE and Stanford university to name a few. The School also offers a vibrant PhD programme for the students from all the parts of the country. The school has well equipped facilities that enable the PhD students to carry out research in the following areas.

- Synthetic Chemistry
- Medicinal Chemistry
- Organometallic Chemistry
- Polymer Chemistry



- Bioinorganic Chemistry
- NMR spectroscopy
- Ultrafast laser spectroscopy
- Catalysis
- Material Chemistry
- Theoretical & Computational Chemistry

Facilities for Research and Teaching:

- 700 MHz and 400 MHz Solution and Solid-state NMR spectrometer
- Single crystal and powder X-ray diffractometer
- Femto-second fluorescence upconversion facility
- TCSPC and Fluorimeter
- EPR spectrometer
- CD Spectrometer
- TGA, DSC and BET facility
- High performance computation facility
- ESI-MS and GC-MS spectrometers
- CHNS analyser

School of Computer Sciences

The School of Computer Sciences has been established to provide high quality education and carry out front-line research in various areas related to computer sciences. The school envisages to become a center of international repute for fundamentals of Computer Science.

The school offers a Ph.D program in computer science with focus on following areas.

Algorithm, Cryptography, Computational Geometry, Cyber Physical Systems, Information Theory, Machine Learning, Multiparty Secure computation.

School of Mathematical Sciences

The School of Mathematical Sciences (SMS) strives to become a citadel for mathematics and allied subjects in terms of teaching and research. The faculty of Mathematics has a strong penchant for

acquiring and updating their knowledge and imparting it to the students. The undergraduate program in the school is carefully designed to train the students to acquire creative mind and analytical skills that are needed to pursue their career. SMS aspires to become the foremost centre in the Ph.D. program in the forefront areas of Mathematics. In addition to formal courses and research, seminars are conducted regularly. In the seminars, outstanding mathematicians from throughout the world present their latest research findings in various fields of mathematics. SMS envisages to introduce strong curriculum in the fields of applied mathematics, financial mathematics and computer science so that students can take up prominent careers in financial/industrial establishments.

The Curriculum of the School

The curricula of SMS stresses interdependence and unified structure of science and at the same time emphasizes intensity of study in order to achieve a good understanding and skills in Mathematics. To fulfil this objective, a basic common core has been identified which constitutes the courses of the first two semesters. The courses on Mathematics in the 3rd semester onwards will focus on reading and understanding of mathematical proofs, emphasizing precise thinking and presentation of mathematical results both orally and in written form. The courses for the second and third year have been designed to provide an understanding of foundational level mathematics in the areas of logic, number theory, algebra, analysis, geometry, discrete mathematics and informatics. The students are encouraged to develop minor areas of interest in other streams of study by a system of open electives running up to the end of the sixth semester. The last four semesters have been reserved for advanced level courses and specialized courses. Provision has also been made for pursuing studies in special areas and writing an innovative project leading to a dissertation.

The aim and mission of the doctoral program in the



School of Mathematical Sciences is to produce good and efficient scholars who will excel in acquiring and imparting good and deep knowledge in Mathematics. The program is carefully designed to understand mathematics both vertically and horizontally, that is, to obtain a fundamental understanding of basic fields of mathematics and a thorough state-of-the-art understanding of one major field of interest in which the student writes his thesis. Though the emphasis is placed on the abilities of the student recognizing significant research problems on their own and solving them, we create a sense of rapport between the students and the experts in the field, that is to say that an ambience is created for the students to have the excitement and stimulation on their own but at the same time with support and mentoring provided by the teachers.

The Ph. D. degree is generally a four-year program culminating in an original piece of mathematical research for a thesis and eventual publications in good and scholarly journals. While the thesis is in a specific area, the coursework leading up to this is designed to provide breadth to prepare the students for successful careers in the academics. Besides, there are many opportunities for our students to enrich their background in mathematics. Students are strongly encouraged to talk in the research seminars in the school, and to attend national/international conferences as well as regional meetings amply supported by NISER.

Facilities for Research and Teaching

- State-of-the-art Computing facility and a High Performance Computing Cluster for theoretical calculation.

School of Physical Sciences

The 5-year integrated Master of Science (M. Sc.) programme in Physics includes courses from core areas of physics such as Classical Mechanics, Quantum Mechanics, Electromagnetism, Statistical Mechanics and Mathematical Physics. In addition,

elective courses based on upcoming areas in physical sciences are also offered for final and pre-final year students. Each semester of the programme includes one laboratory component where the students experimentally verify their theoretical understanding of concepts. For the pre-final year students, the laboratories offer state-of-the-art experimental facilities for addressing open-ended problems in physical sciences research. Final year of the programme includes one project course (depending on the expertise of the available faculty in the school) where the students learn about the various research methodologies and many aspects associated with carrying out active research in physics.

The Ph. D. students undergo one year of course work (spread over two semesters) which includes courses from the core-areas of physics such as Classical Mechanics, Quantum Mechanics, Electromagnetism, Statistical Mechanics, particle physics and condensed-matter physics.

The school offers the following broad areas in physics for carrying out research work leading to degree of Ph.D.

- High-energy physics (Theoretical) – String theory, Lattice Quantum Chromodynamics
- High-energy physics (Experimental) – Experiments at Large Hadron Collider (LHC), Switzerland
- Condensed-matter physics (Theoretical) – Electronic structure of matter, Colloids, Soft-condensed matter and statistical mechanics, density functional theory etc.
- Condensed-matter physics (Experimental) – Magnetism, superconductivity, low-temperature physics, semi-conductors and nano-fabrication, spectroscopy
- Ultra-cold atoms and Bose-Einstein condensation (Experimental)
- Photonics – Nonlinear optics, Laser Physics, Nano-photonics



Facilities for Research and Teaching

- Scanning Electron Microscope and Lithography
- Ultrafast Time-resolved Spectroscopy for quantum life measurements of molecular dynamics and Ultracold atoms and BEC facility using atom trapping by lasers
- Facility of Magnetic nanostructures and multilayers

School of Earth and Planetary Sciences

School of Earth and Planetary Sciences, NISER is a unique research-driven academic center in India that has been established to emerge and excel in high quality and interdisciplinary scientific research works in Planetary Sciences, Earth Sciences, and Atmospheric-Ocean Sciences. This school is different since it envisions to provide the best unique opportunities and freedom to better serve and enjoy the academic cum research life. The Focus, the Vision, and the Mission of our school are as follows.

Focus: The focus of this school is three broad and multidisciplinary areas:

- Planetary Sciences that will cover major sub-areas of Solar System and planetary formation, planetary surface and interior processes, planetary and exoplanetary atmosphere, astrochemistry and astrobiology, planetary astronomy and astrophysics, small bodies and meteorites, and exoplanetary sciences;
- Earth Sciences that will cover major sub-areas of geosciences to better understand Earth's surface and interior processes, geochemistry, geochronology, geophysics as well as early Earth history;
- Atmospheric-Ocean Sciences that will cover major sub-areas of atmospheric, ocean, and climate sciences and their implications to the natural and Earth System Sciences as well as current trends in climate change.

Vision: The vision of this school is to emerge as a centre of excellence in research and teaching in the areas of Planetary Sciences, Earth Sciences, and Atmospheric-Ocean Sciences.

Mission: The main mission of this school are, as per priority:

- Pursue high quality and world class research works with research freedom and start-up grant;
- Provide the best quality education and learning facilities;
- Best support and freedom to PhDs and postdocs, who will be colleagues to the faculties and tomorrow's scientists and faculties;
- Nurturing young students and interns for a successful and enjoyable career in science education and research;
- Idealize science education and research for the maximum benefit of the society and human mankind.

Academic Program: SEPS has kicked off its PhD program offering research areas in emerging fields of Planetary and Atmospheric sciences, i.e., Planetary Geology, Asteroids and Meteorites, astrochemistry, star and planetary formation, atmospheric physics, regional hydroclimatology, land-climate coupling.

School of Humanities and Social Sciences

Scientific temper can sustain and advance in a holistic environment. Creative thinking along with skill based expertise is essential for new age scientists. The School of Humanities and Social Sciences plays a crucial role in the NISER undergraduate programme. The purpose of Humanities and Social Sciences is to help students to identify a set of values which will help them exercise integrity, vision, community involvement,



and knowledge of self. It also helps students equip themselves with strong communication skills, interpersonal and team building skills and apply the same in their respective profession. Students must understand the application of their discipline to contemporary issues, they must acquire strong communication and team-building skills, and they must understand the definitions of leadership, personal responsibility, and professionalism. The Humanities and Social Sciences curriculum provides students the opportunity to explore and master communication skills, critical thinking skills, innovative problem-solving skills, and other learning opportunities offered by the department. The school focuses on bridging the gap between society-science interfaces. The School of Humanities and Social Sciences (SHSS) is encompassing five specific areas of study. The school aims to become an innovative centre for research in the fields of English, Economics, Sociology, Philosophy and Psychology. With faculty drawn from diverse background and experience, it targets to be a thriving academic community, ensuring a fertile ground for true multi-disciplinary research, where academic programs are nationally recognized for high levels of quality and clear multi – disciplinary research.

The curricula of the school for the 5-year Integrated Program emphasize interdisciplinary and holistic approach to impart training and skills in humanities and social sciences. To achieve this objective, a set of core has been identified which constitutes the courses of the first two semesters, and one in each in third and fourth semester. The curriculum generally begins with a two-course in communication skills, the purpose of which is to develop the required proficiency necessary to communicate, both orally and in writing, in their classes, in the workplace, and in community. Subsequent courses consist of introductory courses humanities and social science courses in sociology, psychology and economics that

introduce students to the concepts of community, society, and self. In the third and fourth semester students are offered a variety of humanities and social science with an opportunity to select any two courses. Students are required to complete a minimum 16 credits. The electives are designed to provide advanced and applied knowledge in the areas of science communication, science, technology and society, organizational behaviour, urban planning, applied behavioural sciences, Indian society and social problems. This installs holistic vision and importance of responsible and sensitive global citizenship, through cultural self-reflection, ethical reasoning and historical understanding among the students.

The Ph.D programme aims to cultivate high quality research in various fields of English, Economics, Philosophy, Psychology and Sociology. Graduates of the programme are expected to design and execute original, high quality, interdisciplinary research that can be published in major scholarly journals and books of the profession. The Ph. D. degree is generally a four-year program culminating in an original piece of humanities and social science research for a thesis and eventual publications in good and scholarly journals. The programme consists of both course Work and research work independently carried out by the student. While the thesis is in a specific area, the coursework leading up to this is designed to provide breadth to prepare the students for successful careers in the academics and industry. Students are expected to participate in the research seminars in the school, and to attend national/ international conferences as well as regional meetings amply supported by NISER. Tata Institute of Social Sciences, Mumbai has conveyed approval to host NISER students for the Ph. D programme in Humanities and Social Sciences. The institute has started the Ph. D program in Humanities and Social Sciences from the even semester of academic year 2015-16.



CENTRAL LIBRARY

"A library in the middle of a community is a cross between an emergency exit, a life-raft and a festival. They are cathedrals of the mind; hospitals of the soul; theme parks of the imagination. On a cold rainy island, they are the only sheltered public spaces where you are not a consumer, but a citizen instead."

— Caitlin Moran

The Central Library acts as the main learning resource centre of the Institute and is privileged to support the Institution's march towards its vision- to be the pioneer research Institute in India. The Library not only acquires, organizes, and disseminates knowledge; it has put its foot ahead towards policies, procedures, systems and services and created an atmosphere which offers assimilation and generation of new knowledge.

All the students, faculty members and employees of the Institute are entitled to make use of the Library Facilities. The library building has a carpet area of 60,000 Sq. Meters and occupied a central location. It has a rich reference section of Physics, Chemistry, Mathematics, Biology and Literature studies, Humanities, Computersciences.

Library presently holds over **22,222 print books** that include: **20959 purchased books, 319 gift books** received from National Board for Higher Mathematics (NBHM) and **912** books from other institutions and publishers. It also has rich collection of electronic books (Approx. **10, 000 subscribed ebooks** from Springer and Elsevier and Open Access ebooks from NCBI, Intech Open, online book page and Project Gutenberg), **58 scholarly print journals and magazines**, nine electronic databases, six hundred bound volume journals and approx. **3923 e-Journals** (with archive for ejournals subscribed from IOP, AIP, Springer Nature and Wiley. Electronic Journals

are subscribed from all STM Publishers and Learned Societies i.e. AAAS, Elsevier, Royal Society of Chemistry (RSC), American Chemical Society (ACS), American Mathematical Society (AMS), Canadian Mathematical Society(CMS), Walters Kluwer , BMJ, Rockefeller University Press, Cambridge University press, Portland Press, National Academy of Science US, CSHL, Oxford University Press, Thieme, T&F, Optical Society of Aemactical Society , Ramanujan Math Society, Duke University Press, University of Chicago Press, Unmerica, International Press, European Mathiversity of Calgary, De Paw University, John Hopkins University, Khayyam publishing, CBRC, Emerald, SAGE, IEEE and ACM, Meteorological Society of America (MSA), Geological Society of America (GSA) etc. Library has Print archive for Ars Combinatoria Journal (1976-2017).

As part of DAE-Elsevier Consortium, NISER library has subscription to nine CORE journals with Approx. 2200 peer reviewed journals with Archival Access since 1997 onwards that adds fuel to our learning and research in several schools and Interdisciplinary studies as well.

NISER Library is having Institutional membership of American Mathematical Society (2011 onwards) and Category –A Membership of Canadian Mathematical Society (2013 onwards) and gets benefits on subscription to society publications and online Databases (Depending on the Membership Category).



Library Collection comprises the following:

Sl#	Type of Resource	Approx. Volume
1	Purchased Books and Gratis Books	22,222
2	E-books	10,000
3	Print journals and Scholarly Magazines	58
4	Bound Volume Journals	600
5	Electronic Journal	3923
6	CD/DVD	212
7	Thesis submitted by Students as partial fulfillment of Int. MSc./PhD at NISER	179
8	Gift Journals/Magazines	76

Major contributors to Gift Journals are Indian Academy of Science, American Physical Society, Centre for Air Power Studies, Mathematical Association of America.

Bibliographical Databases:	Name of the Database	Publisher
	1. Scifinder Web Enabled Version	CAS Division, American Chemical Society
	2. Mathscinet	American Mathematical Association
	3. Web of Science core Collection (Back file since 1945)	Clarivate Analytics
	4. CCDC-CSD Enterprise License	Cambridge Crystallographic Data Centre
	5. Science of Synthesis	Thieme
Literature Updating Service	Name of the Database	Publisher
	1. Natural Product Updates	Springer Nature
	2. Synthetic Reaction Updates	Royal Society of Chemistry
Digital Library	Name of the Product	Publisher
	JSTOR	ITHAKA
	ACM Digital Library	Association for Computing Machinery (ACM)
Sl No.	Plagiarism Detection software subscribed by Library	Publisher
1	iThenticate	iParadigms, LLC



Library Services:

The Library homepage serves as an integrated interface of all services avail from the Library. The interface is available at (www.niser.ac.in/Library/) inside NISER Website and is based on Drupal open source content management system. Apart from procuring, processing and distributing books, periodicals, and other documents, library offers the following innovative services:

1. Current awareness service: New arrival display and alert (Both physical and online)

2. Alert Service to patrons such as new arrival, overdue notice, collect notice, different email alerts regarding services.

3. Self- Services (Check-In) of issued books through book dropper installed inside Library

4. Web based Public Access Catalogue (Web OPAC) to search and retrieve records from the online catalogue of Library resources, auto renewal of issued Books, to check fine status of users and to put hold on issued books.

5. Research Support: Article on request from the STM publishers, premier research institutions of the country and from prominent Public Research Universities i.e. Princeton University Library and University of York for students and faculties to fuel their research activities as an extension of research support from library acquisition division. NISER Library received increasing article request from research scholars and faculties during the academic year.

6. User awareness programme on various subscribed resources.

Library conducts user awareness programmes,

author workshops in collaboration with Schools and Domain experts from Publishers on subscribed electronic resources. These events are highly useful for the users in information literacy, improving their research writing and familiarize them with latest tools and technologies which can be used for study, research and information retrieval. It also offers glimpse of available resources for library users and procedure to use them.

7. Procurement of books for departmental libraries.

Library procured books for Departmental libraries and processed invoices for payment from the budget approved for the same by Chairperson of the concerned Department and the Director. Library committee approves the same after financial approval received from the Finance and Accounts. Library has procured books for schools for skill development of staffs as requested by departmental library committee member of the school to library committee and Committee approved extended support.

8. Technical processing of books purchased by faculties from contingency grant annually.

Library offers extended support in physical verification and technical processing of Books procured by faculties under contingency grant allocated annually for Research assistance.

9. Institutional repository powered by DSpace that reflects the institutional research outputs of students and faculties.

10. Anti-plagiarism software iThenticate subscribed by the Library for students and faculties to check for plagiarism to ensure originality of work before publication.



11. Display of Publisher's Catalogue for assisting Faculties for recommending Books for Library.

12. Stock verification of Library print resources.

Annual stock verification is conducted for 2019 by subcommittee approved by the Director. The committee submitted report to library committee after successfully completion of stock check and there was no missing resource for 2019.

13. Promotion of scholarly writing competitions conducted by other DAE-Aided institutions for active engagement of students interested from NISER.

Library Facilities:

1. RFID based book circulation system: Library is fully automated with KOHA and also integrated with RFID devices which control the circulation system for Issue, return, searching of books and weeding out miss shelved books during Annual stock verification.

2. Wi-Fi Access: Library is functional with Wi-Fi service in order to enable internet accessibility for the easy access of e-resources avail at the Institute Library.

3. Air conditioned reference and reading areas for the comfort of readers and researchers in long reading hours.

4. CCTV Surveillance: The library has installed high tech cameras at the very entrance point to library, circulation division, reference section and reading hall to ensure the safety and security of its users and resources.

5. Remote Access facility to electronic resources subscribed by Library through Cloud Based RemoteXs Software:
<http://elibraryniser.remotexs.in/user/login>

Library provides remote access facility to current Students, Faculty Members, and Staff Members to access the subscribed e-resources from an off-campus location, through RemoteXs software service. By using the Remote Access Facility, the user agrees to the following conditions:

- That you are authorized users of NISER Library (Limited to current faculty, staff, and students only).
- That you will not share access with anyone else (Usage of the remote access facility is monitored, please do not share your login credentials with anyone).
- That you will use the scholarly content accessed through RemoteXs only for academic purpose.

6. Book dropper for self-check-in of books: Library has installed Book dropper to facilitate self check in of issued books by patrons without any staff assistance.

7. Textbook and reference books collection as per recommendations received from all schools. The textbooks are the most useful collection of the library, especially for Course/Syllabus, related readings. The books for this section are purchased usually on the recommendations from faculty members from the schools through the concerned heads of the Department. Library committee expedited procurement of textbooks and reference books under UGCS and PGCS Syllabus subsequent to recommendations received from all schools and financial allocation from Non-Plan budget allocated to library.

8. Classic books on Mathematics and Humanities: Library houses a rich collection of



classic books procured as per recommendation received from School of Mathematical Sciences and School of Humanities and Social sciences. Collected papers on mathematics from Russian Academy of Science, Oxford Uni. Press, and Uni. Of Chicago press, MIT Press, Springer, Rutledge, Emerald and Guilford press are the most prominent ones.

9. Conference Room: Library is also having Air Conditioned Conference Room that is used for library committee meetings, meeting with journal publishers, Service providers to library and discussion. Library also permits other schools and sections of the Institute to use conference room with advance notice to library.

10. Cashless payment of overdue on issued books from Library: Library users are facilitated with cash less payment of overdue and other charges through POS during semester registration.

11. Reading Facility to Students, researchers and Delegates visiting library for Seminar, Conference, workshop etc. Library allows visitors to use reading space and print resources inside library. Also library facilitates promotion of library services and resources through Institutional visit from Universities to Library.

12. Systematic Re-shelving of Books: Library books and other print resources i.e. bound volume journals, loose issues of periodicals and

magazines are reshelved properly by dedicated staffs two times a day.

13. Subscription to Newspapers, Magazines and periodicals for library visitors and user community. Library has subscription to selected newspapers in English, Hindi and Odia language and magazines for general reading area allocated in 1st floor of library building. It encouraged number of visitors to library substantially.

14. Computer Terminals installed in Reference section to facilitate information retrieval. Library is equipped with four more terminals in reference section for students and researchers to use for study and novelty search.

15. Procurement of Books to promote Rajbhasha and language section. Library committee approved procurement of Sahitya Academy awardees Books from Hindi and Odia literature as per list exhibited by Parliamentary committee.

Library Timing:

Library remains open from 9:00 am to 9:00 pm. throughout the year and 9:00 am-5:30 pm. on Institute Holidays. Library facilitates extended working hours during semester exams and as per request from schools. The library fosters an atmosphere for academic learning and ensures decorum of discipline.

Initiatives taken by Library to improve usage of Subscribed resources:
User Awareness Program on subscribed electronic resources

Sl No.	Name of the Event and Date	In Co-ordination with Publisher, Library committee & Schools	Briefing and interaction between delegates and Asst. Scientific Editor of Science of Synthesis.
1	Science of Synthesis (SOS) Orientation session held on August 05TH, 2019.	Thieme Medical Publisher, School of Chemical Sciences and Library committee Chairman.	I) Selection of volume editors to edit the series on Organic synthesis ; II) How to draw reliable transformations; III)Houben -Weyl methods of Molecular transformations; IV) Patent search and V) Chapter wise book download using SOS.

Given its central place to the academic activities of the Institute, NISER Library is getting ready with the necessary infrastructure including furniture, developing the academic ambience and amenities.

Library Committee:

Institute Library committee constitutes one member from each School, and a staff member from library. The Committee meetings are conducted bi - monthly and as and when required to discuss about the development of Library activities, procurement of books, journals, databases and queries received from users etc. Other subcommittees for the library are constituted for Annual Stock Verification of Library Resources and infrastructure Development of Library to facilitate more reading space and sophisticated learning environment. Library committee and Library team is dedicated to provide best possible services to improve learning, enhance research activities of NISER ahead.



Utkal University Student Visit NISER Library





HEALTH CENTRE

Health centre in NISER, Bhubaneswar has been established to provide health care facility to the Institute members and their dependent entitled family members, students, research fellows. It aims at providing comprehensive primary health care. Apart from basic health care it also provides health promotional activities like health education, periodical health check-up and dietary advices.

Initially Health Centre was started in a residential quarter and moved to its permanent building in 16th April, 2018. The health centre at present is staffed by 2 doctors, two staff nurses, one physiotherapist, one radiographer, one medical laboratory technician and one pharmacist. During the month of November 2019 X ray facility was added to the health centre. At present Health Centre has facilities for OPD treatment, Laboratory Investigation, X-ray, Minor surgical procedures and dressing. It has one well equipped emergency ward to provide emergency medical facility. Two basic life support ambulances are also available to shift patient during emergency to higher centre for further medical facility. Health Centre also conduct pre-employment health examination of employees prior to joining at NISER and periodical examination of employees.

From 1st January 2019 DAE Contributory Health Service Scheme was implemented at NISER. Under the scheme different government and private hospitals are empanelled for providing treatment to referred patients on cashless basis. At present Apollo Hospital, Kalinga Hospital,

Kalinga Institute of Medical Sciences, Sparsh Hospital, AMRI Hospital at Bhubaneswar are empanelled under CHSS Scheme for providing treatment under different speciality. Further L V Prasad Eye Institute and Hemlata Hospital are also empanelled to provide specialised service for eye diseases and cancer diseases respectively.

Staff:

- 1 Dr. Biswajit Mishra, SO-E
- 2 Dr. Bandita Dash, SO-D
- 3 N Bharati Reddy, Nurse-A
- 4 Sibani Bhuyan, Nurse-A
- 5 Adhikari Suryakanta Dash, Pharmacist-B
- 6 Ram Jeet, Radiographer
- 7 Bholanath Karmali, Medical Lab Technician
- 8 Jyotiranjana Sahoo, Physiotherapist

Facilities:

1. OPD consultation
2. Laboratory Investigations
3. X-ray
4. ECG
5. Minor OT and Dressing room
6. Emergency ward

Statistics:

- | | |
|------------------------------------|------|
| ❖ No OPD patients | 6025 |
| ❖ No Laboratory Investigations | 3615 |
| ❖ No of Pre-employment examination | 45 |



FACULTY

School of Biological Sciences		
SL	Name & Designation	Field of Specialization
1.	Prof. B. Ravindran, Adjunct Professor	Pathogen biology and Host Inflammation
2.	Dr. Abdur Rahaman, Reader-F	Biochemistry
3.	Dr. Asima Bhattacharyya, Associate Professor	Physiology / Host-Pathogen Interaction, Cancer Biology
4.	Dr. Chandan Goswami, Associate Professor	Cell Biology
5.	Dr. Harapriya Mohapatra (Chairperson) Associate Professor	Microbiology
6.	Dr. Kishore CS Panigrahi, Reader - F	Plant Biology
7.	Dr. Debasmita Pankaj Alone, Associate Professor	Human Genetics
8.	Dr. Manjusha Dixit, Associate Professor	Human Genetics
9.	Dr. Palok Aich, Associate Professor	Systems Biology
10.	Dr. Pankaj Vidyadhar Alone, Reader - F	Molecular Biology
11.	Dr. Praful Singru, Associate Professor	Neurobiology
12.	Dr. Subhasis Chattopadhyay, Associate Professor	Immunology
13.	Dr. V. Badireenath Konkimalla, Reader-F	Bioinformatics
14.	Dr. Rudresh Acharya, Reader-F	Macromolecular X-ray Crystallography, Structural Biology, De Novo Protein Design
15.	Dr. Tirumala Kumar Chowdary, Reader-F	Structural Virology
16.	Dr. Ramanujam Srinivasan, Reader-F	Bacterial Pathogenesis, Cytoskeletal Dynamics and Functions
17.	Dr. Renjith Mathew, Reader-F	Cell Biology, Development Biology
18.	Dr. Aniruddha Datta Roy, Assistant Professor	Phylogenetics, Biogeography
19.	Dr. Mohammad Saleem, Reader-F	Membrane, Biochemistry/Biophysics
School of Chemical Sciences		
SL	Name & Designation	Field of Specialization
1.	Prof. A. Srinivasan, Professor	Inorganic Chemistry Bio-Inorganic Chemistry-Pyrrole Based Receptors



2.	Dr. Arindam Ghosh, Reader-F	Physical Chemistry Methodology development in NMR
3.	Dr. B. L. Bhargava, Associate Professor	Physical Chemistry Computational studies of Materials
4.	Dr. Bidraha Bagh, Assistant Professor	Inorganic and organometallic Chemistry
5.	Dr. C. S. Purohit, Associate Professor	Organic Chemistry Bio-organic and Organic Synthesis
6.	Dr. C. Gunanathan, Associate Professor	Organic Chemistry Organometallic Chemistry and Catalysis
7.	Dr. Himansu Sekhar Biswal (Chairperson) Associate Professor	Laser Spectroscopy and Instrumentation
8.	Dr. J. N. Behera, Associate Professor	Inorganic Chemistry Low temperature multiferroics from single source precursors and Porous Magnetic Materials
9.	Dr. Moloy Sarkar, Associate Professor	Physical Chemistry Fluorescence Spectroscopy
10.	Dr. Nagendra K Sharma, Associate Professor	Inorganic Chemistry Bio-Organic and Organic Synthesis
11.	Dr. P. C. Ravikumar, Associate Professor	Inorganic Chemistry
12.	Dr. Prasenjit Mal, Associate Professor	Inorganic Chemistry Supramolecular chemistry and Photochemistry
13.	Dr. S. Peruncheralathan, Associate Professor	Organic Chemistry Synthetic Organic chemistry and Asymmetric Catalysis
14.	Dr. Sanjib Kar, Associate Professor	Inorganic Chemistry Bio-inorganic chemistry: Metals in Medicine
15.	Dr. S. Nembenna, Associate Professor	Inorganic Chemistry Main Group Organometallic chemistry and Low oxidation state metal chemistry
16.	Dr. Subhadeep Ghosh, Associate Professor	Physical Chemistry Single Molecule Spectroscopy, Molecular Dynamics
17.	Dr. Sudip Barman, Associate Professor	Physical Chemistry Synthesis and Functionalization of Graphene



18.	Prof. T. K. Chandrashekar, Sr. Professor	Inorganic Chemistry Bio-Inorganic Chemistry-Expanded porphyrin Chemistry
19.	Dr. U Lourderaj, Associate Professor	Physical Chemistry Theoretical and Computational Chemistry
20.	Prof. V. Chandrasekhar, Adjunct Professor	Synthetic Inorganic Chemistry
21.	Dr. V. Krishnan, Associate Professor	Inorganic Chemistry Catalysis and Materials Synthesis

School of Mathematical Sciences

SL	Name & Designation	Field of Specialization
1.	Prof. MS Narasimhan, Honorary Fellow	Algebraic and differential geometry
2.	Prof. Ritabrata Mushi, Adjunct Professor	Number Theory
3.	Prof. V Muruganandam, Professor	Harmonic Analysis
4.	Dr. Anil Kumar Karn, Associate Professor	Theory of operator spaces
5.	Dr. Biond Kumar Sahoo, Associate Professor	Representations of Geometries
6.	Dr. Brundaban Sahu, Associate Professor	Number Theory
7.	Dr. Deepak Kumar Dalai, Reader-F	Cryptography
8.	Dr. Kamal Lochan Patra (Chairperson), Reader-F	Algebraic Graph Theory
9.	Dr. Nabin Kumar Jana, Reader-F	Probability Theory
10.	Dr. Sanjay Parui, Reader-F	Harmonic Analysis
11.	Dr. Shyamal Krishna De, Reader - F	Statistics
12.	Dr. Manas Ranjan Sahoo, Reader - F	Differential Equations
13.	Dr. Jaban Meher, Reader - F	Number Theory
14.	Dr. Ritwik Mukherjee, Reader - F	Differential Geometry
15.	Dr. Sutanu Roy, Reader-F	Functional Analysis
16.	Dr. Panchugopal Bikram, Reader-F	Functional Analysis
17.	Dr. Dinesh Kumar Keshari, Reader-F	Functional Analysis
18.	K. Senthil Kumar, Assistant Professor	Number Theory

School of Physical Sciences

SL	Name & Designation	Field of Specialization
1.	Prof. Ashoke Sen, Honorary Fellow	String Theory
2.	Prof. Jean-Yves Ollitrault, Adjunct Professor	High Energy Physics
3.	Prof. Meenakshi Narain, Adjunct Professor	Experimental High-Energy Physics
4.	Prof. Jnanadeva Maharana, Adjunct Professor	String Theory
5.	Prof. Nu Xu, Adjunct Professor	Experimental High Energy Physics
6.	Prof. Tapan Kumar Nayak, Visiting Professor	Experimental High Energy Physics
7.	Prof. Sudhakar Panda, Sr. Professor	String Theory
8.	Prof. Bedangadas Mohanty, Professor	Experimental High Energy Physics
9.	Dr. Subhasis Basak, Reader-F	HEP Theory: Lattice QCD
10.	Dr. Sanjay Kumar Swain, Associate Professor	Experimental HEP: LHP Physics
11.	Dr. A.V. Anil Kumar, Reader-F	Statistical Mechanics and Modeling of Soft Matter
12.	Dr. Ashok Mohapatra, Associate Professor	Ultra cold Atoms and Bose-Einstein Condensation
13.	Dr. Chethan N. Gowdigere, Reader-F	String Theory
14.	Dr. Colin Benjamin, Associate Professor	Theoretical CMP and Quantum Information
15.	Dr. Joydeep Bhattacharjee, Reader-F	Computational Condensed Matter Physics
16.	Dr. Kartikeswar Senapati, Reader-F	Experimental CMP
17.	Dr. Prasanjit Samal, Associate Professor	Theoretical CMP, Atomic and Molecular Physics
18.	Dr. Pratap Kumar Sahoo, Associate Professor	Nano fabrication and Ion/Photon matter interaction
19.	Dr. Prolay Kumar Mal, Reader-F	Experimental High Energy Physics (Collider experiments)
20.	Dr. Ritwick Das, Associate Professor	Nonlinear optics, and Integrated Optics
21.	Dr. Subhankar Bedanta, Associate Professor	Experimental condensed matter physics (Nanomagnetism and multiferroics)



22.	Dr. Sumedha, Reader-F	Special Mechanics and Interdisciplinary Applications
23.	Dr. Yogesh Kumar Srivastava, Reader-F	String Theory
24.	Dr. V Ravi Chandra, Reader-F	Theoretical Condensed Matter Physics
25.	Dr. Nishikant Khandai, Reader-F	Astrophysics and Cosmology
26.	Dr. Anamitra Mukherjee, Reader-F	Condensed Matter Physics
27.	Dr. Victor Roy, Reader-F	Theoretical & phenomenological study of high energy nuclear collisions, specifically the study of Quark Gluon Plasma (QGP).
28.	Dr. Ajaya Kumar Nayak, Reader-F	Condensed Matter Experiment: Magnetism
29.	Dr. Amaresh Kumar Jaiswal, Reader-F	Theoretical high energy nuclear physics
30.	Dr. Sayantani Bhattacharyya, Reader-F	String Theory
31.	Dr. Tuhin Ghosh, Reader-F	Cosmic Microwave Background Radiation, Dust Polarization, Primordial gravitational waves from cosmic inflation
32.	Dr. Najmul Haque, Assistant Professor	High Energy Physics (Theory)
33.	Dr. Ashis Kumar Nandy, Assistant Professor	Condensed Matter Physics (Theory)
34.	Dr. Kush Saha, Assistant Professor	Theoretical Condensed Matter Physics

School of Earth and Planetary Sciences

Sl	Name & Designation	Field of Specialization
1	Prof. Edward Cloutis, Adjunct Professor	Planetary Sciences
2	Dr. Guneshwar S Thangjam, Assistant Professor	Planetary Geology
3	Dr. Liton Majumdar, Assistant Professor	Astrochemistry, Radio/sub-mm/infrared astronomy, Astrobiology, Star and Planet formation Exoplanetary Atmospheres
4	Dr. Jaya Khanna, Assistant Professor	Land - atmosphere interaction, Regional climatology, Boundary layer processes
5	Dr. Subhanjoy Mohanty, Visiting Professor (Imperial College, UK)	Exoplanetary Science Origin of Planets in the disk of gas and dust orbiting young stars, Exoplanet, M Dwarf habitability
6	Dr. Murthy Gudipati, Visiting Professor (JPL/NASA, USA)	Planetary Ice Physics and Chemistry of Ices; Next Generation Space Instrumentation; Origin of Life; Laboratory Astrophysics



School of Humanities and Social Sciences

Sl	Name & Designation	Field of Specialization
1	Dr. Pranay K. Swain (Chairperson) Reader-F	Public Policy and Governance, Science-Society Interface, Contemporary Social Issues
2	Dr. Debashis Pattanaik, Assistant Professor	Social Innovation, Social Network Analysis, Social Study of Sciences and Technology
3	Dr. Rooplekha Khuntia, Assistant Professor	Business Ethics, Ethical Cynicism, Organizational Behavior and Leadership
4	Dr. Joe Varghese Yeldho, Reader - F	Critical History and Narratives of Race
5	Dr. Amarendra Das, Reader - F	Natural Resource Management, Public Economics
6	Dr. Amarjeet Nayak, Reader - F	Postcolonial Theory and Literature, Translation Studies, Speculative Fiction, Indian English Literature, Diaspora Studies

School of Computer Sciences

Sl	Name and Designation	Field of Specialisation
1	Prof. Manindra Agrawal, Adjunct Professor	Complexity Theory, Computational Number Theory
2	Dr. Rishiraj Bhattacharyya (Chairperson) Reader – F	Cryptography
3	Dr. Subhankar Mishra, Assistant Professor	Graph Theory, Cyber Security, Smart Grid
4	Dr. Aritra Banik, Assistant Professor	Computational Geometry
5	Dr. Manoj Mishra, Assistant Professor	Information Theory, Cryptography
6	Dr. Sabyasachi Karati, Assistant Professor	Cryptography
7	Dr. Sushmita Gupta, Assistant Professor	Algorithms



COURSES OFFERED

School of Biological Sciences

Biology-I : Science of Life, Biology-II: Cellular and Genetic basis of life, Microbiology, Biochemistry, Biophysics and Biostatistics, Cell Biology, Genetics, Immunology, Ecology, Molecular Biology, Physiology I (Animal Physiology), Physiology – II (Plant Physiology), Neurobiology, Principles of Drug design, Molecular genetics, Infection and immunity, Advance Molecular Biology, Advanced Biochemistry, Infectious Disease Biology, Enzymology, Virology, Structural Biology, Endocrinology, Plant Development Biology, Quantitative Biology, Bio-Techniques, Molecular Biology Laboratory, Immunology Laboratory, Plant Physiology Lab, Microbiology Laboratory, Cell Biology Laboratory, Genetics Laboratory.

School of Chemical Sciences

Theory: Chemistry-I, Chemistry-II, Basic inorganic Chemistry, Reaction Mechanisms in Organic Chemistry, Mathematical Methods for Chemists, Reagents in Organic Syntheses, Main group and Organometallic Chemistry, Quantum Chemistry I, Physical Organic Chemistry, Molecular Spectroscopy and group Theory, Thermodynamics and Electrochemistry, Coordination Chemistry, Chemical Binding, Physical Methods in Chemistry I, Physical Methods in Chemistry II, Chemistry of Heterocycles and Natural Products, Chemical Rate Processes Practical: Chemistry Laboratory-I, Chemistry Laboratory-II, Inorganic Chemistry Lab, Physical Chemistry Lab-I, Biomolecular Chemistry Lab, Organic Chemistry Lab I, Inorganic Chemistry Lab I, Physical Chemistry Lab II, Organic Chemistry Lab II

School of Computer Sciences

Introduction to Programming, Theory of Computations, Discrete Structures and Computations, Design and Analysis of Algorithms, Cryptography, Information and Coding Theory, Complexity Theory, Linear Programming and Combinatorial Optimization, Distributed Network Algorithms, Machine Learning, Approximation Algorithms, Paratemerized Complexity, Computational Number Theory, Secure Multiparty Computations.

School of Mathematical Sciences

General Mathematics – I & II, Computation Laboratory – I & II, Analysis-I, II & III, Algebra-I (Group Theory), Discrete Mathematics, Algebra-II (Linear Algebra), Probability Theory, Elementary Number Theory, Algebra-III (Rings and Modules), Differential Equations, Topology, Analysis-IV (Calculus of Several Variables), Algebra-IV (Field Theory), Complex Analysis, Optimization Theory, Differential Geometry, Functional Analysis, Representation of Finite Groups, Measure Theory, Advanced PDE, Advanced Probability and Stochastic Process, Nonlinear Analysis, Commutative Algebra, Advanced Linear Algebra, Information & Coding Theory, Algebraic Topology, Operator Algebra, Harmonic Analysis.

School of Physical Sciences

Core: Mechanics and Thermodynamics, Electricity, Magnetism and Optics, Classical Mechanics, Mathematical Methods I, Electronics,



Electromagnetism I, Mathematical Methods II, Quantum Mechanics I, Electromagnetism II, Statistical Mechanics, Quantum Mechanics II, Special relativity, Atoms, Molecules and Radiation, Introduction to Condensed Matter Physics, Nuclei and Particles

Electives: Classical Mechanics-II, Advanced Solid State Physics, Astronomy and Astrophysics, Computational Physics, Quantum Field Theory I, Quantum Optics, Particle Physics, Introduction to Phase-transition and Critical Phenomena, Plasma Physics and Magneto-hydrodynamics, Biophysics, Nonlinear optics and laser, Quantum Information, General Relativity and Cosmology, Soft Condensed matter, Applied Nuclear Physics, Many Body Physics, Quantum and Nano-Electronics, Nonlinear Physics, Chaos, Turbulence, Theory of Magnetism and Superconductivity, Density functional theory of atoms molecules and solids, Quantum Field Theory II.

School of Earth and Planetary Sciences

SEPS envisions starting its Integrated MSc program in the coming few years. Our UG curriculum is under development and will be submitted for approval process to NISER Academic Council and then HBNI in the coming weeks. The proposal includes courses on - Heat transfer and thermodynamics; Mathematical methods for EPS; Atomic, molecular and physical chemistry; Electromagnetism; Classical and

Celestial Mechanics; Continuum Mechanics; Numerical Methods; High performance computing in transport and wave phenomenon; Inverse Methods; Mineralogy and Crystallography; Petrology; Sedimentology and Stratigraphy; Ore and Economic geology; Geophysics; Seismology; Fracture Mechanics; Hydrology; Geochemistry; Time series analysis; Remote Sensing; Astronomy; Cosmochemistry; Planetary Formation; Solar and Exo- solar systems; Astrochemistry and Astrobiology; Exoplanets; Small bodies and Asteroids; Solar Physics and Space Weather; Space Instrumentation and Technology; Radiative Transfer and Planetary Atmospheres; Atmospheric and Oceanic Dynamics; Ocean Biogeochemistry; Atmospheric chemistry and aerosol pollution; Numerical modeling of the Earth system; Paleontology; Paleoclimate; Cloud Microphysics; Terrestrial Biosphere and climate; Weather Prediction; Boundary Layer Meteorology; Tropical Dynamics; Storm Surge Modeling.

School of Humanities and Social Sciences

Technical communication - I & II, Introduction to Psychology, Introduction to Sociology, Introduction to Economics, History of Science, Sociology of Science and Technology, Science Communication and Citizen, Organizational Behaviour, Applied Behavioural Science, Perspectives on Indian Society, Life and Community in the Urban World.



ACADEMIC ACHIEVEMENTS AND RESEARCH OVERVIEW

SCHOOL OF BIOLOGICAL SCIENCES

Systematics & Biogeography of Indian subcontinent

Dr. Aniruddha Datta Roy, Assistant Professor

The contemporary distribution of biota within the Indian subcontinent must have been shaped by its unique history. The Indian subcontinent was part of Gondwanaland and had close tectonic associations with Africa, Madagascar and Seychelles before eventually colliding with Eurasia, resulting in the orogenesis of the Himalayas. The initial contact of the Indian plate with Southeast Asia may have potentially resulted in exchange of biota across these two landmasses. On the other hand, the contemporary Indian subregion remains insular from other biogeographic zones areas owing to various geographic barriers. Prolonged insularity generally promotes diversification in lineages with limited dispersal ability, resulting in endemic radiations. Beyond bearing these unique spatial and temporal signatures in its biotic assembly, the Indian subcontinent itself is heterogeneous in its topography with about ten major river systems/ basins flowing out of the peninsula. Additionally, the Indian subcontinent has about six major hill ranges. Cumulatively, these factors would have had (or still have) a significant effect on the contemporary distribution of biota within the Indian subcontinent, resulting in an interesting mix of lineages. Indian biota may therefore be composed of ancient Gondwanan relicts to lineages that dispersed more recently from other regions. I am personally interested in South Asian herpetofauna (reptiles and amphibians), largely owing to their diversity and

antiquity. However, in my lab we have a set of broad interests ranging from understanding systematics, biogeographic patterns and evolution of characters in a diverse range of taxa from the Indian subcontinent.

Gastric Cancer: Disease Progression and Metastasis

Dr. Asima Bhattacharyya, Associate Professor

Gastric cancer is a major cause of mortality. Although various causative agents have been associated with this disease, *Helicobacter pylori*, a microaerophilic, gram-negative bacterium has been identified as one of the main carcinogens causing gastric cancer and contributing in gastric cancer metastasis. Like many epithelial-origin solid tumours, dissemination or gastric cancer (gastric cancer metastasis) is mediated by epithelial to mesenchymal transition (EMT), a mechanism that converts immotile epithelial cells into motile and invasive mesenchymal cells. Hypoxia is known to aggravate the EMT and metastatic properties. The molecular events in *H. pylori* and hypoxia-driven gastric cancer progression and metastasis are complex and multi-factorial. We are involved in identifying the molecular events and pathways that contribute in gastric cancer progression and metastasis. Our approach includes in vitro and in vivo studies as well as studies involving 3D organoids.

Drug Development and Delivery

Dr. KVS Badireenath, Reader – F

Rational drug discovery and development requires a streamlined interdisciplinary effort



from researchers working in a specialized area. From active collaboration, drug discovery process can be and has been shortened to a great extent by addressing bottlenecks in drug discovery (such as high-throughput screening, specificity, and chemoresistance). Our research efforts focus on some of these unaddressed questions that would potentially contribute to chemotherapy. On the other hand, while novel compounds are in great demand to be translated as a drug, nevertheless, it is hard to predict its activity (anti-cancer, anti-diabetic or as any chemotherapeutic) in the first instance. Therefore, as a pre-screening step we first try to understand the cellular response of the ligand or its affinity to a molecular target by applying suitable methods from computational and/or experimental (biochemical, molecular biology, microscopy, cell lines, animal models, etc).

Cell Biology of Thermo Sensitive ion Channels

Dr. Chandan Goswami, Associate Professor

Transient receptor Potential (TRP) ion channels are involved in a series of physiological functions and complex sensory events. Mutations and abnormal expressions in TRP channels often leads to pathophysiological conditions known as "channelopathy". TRP channels are special group of ion channels as these channels has thermogating behaviour, i.e. activation by higher or lower temperature. Our lab has focused to dissect out the importance of thermo-sensitive ion channels in different cellular functions, regulation of subcellular organization, organelle functions. For this purpose, we use different cell types ranging from neuron, osteoclasts, osteoblasts, keratinocytes, immune cells and haploid mature gametes. We analyse sequence variations and conservation of these TRP channels in order to understand the importance of critical regions

relevant for channel function, regulations and channelgating.

Cell mediated immunity (CMI)

**Dr. Subhasis Chattopadhyay,
Associate Professor**

Our research aims to dissect out the important roles of cellular and immunological aspects to decipher the cellular pathways, strategies associated to altered host cell responses for an ongoing infection, tumor progression, inflammation-immunity and immuno-regulatory processes associated to diseases biology in different contexts of cell mediated immunity (CMI). We have been working in the field cellular responses and cellular immunology towards T cell and Macrophage responses associated to CMI, Immune regulation, Chikungunya virus (CHIKV) infection-immunity. Our current investigations in the field of CMI and associated cellular responses reveal important findings towards transient receptor potential (TRP) channels, a group of thermosensitive and non-selective cation channels, in T cells activation, Chikungunya virus (CHIKV) infection driven inflammatory pathways, a critical requirement of Toll like receptor 4 (TLR4) responses during resting T cell activation and effector function. Research with cell lines, primary cells and mice models are the prime components for our ongoing experimental studies. Such understanding will be helpful towards designing future immuno-therapeutic strategies to control various diseases.

Establishing core gut microbiome for health

Dr. Palok Aich, Associate Professor

A large number of micro-organisms, collectively known as microbiota, colonize mammalian



epithelial surfaces. Majority (>99%) of this microbial ecosystem is populated by bacteria and live as mutualists in close contact with mucosal surfaces. The largest density of bacteria is observed in the gastrointestinal tract (gut) and therefore this interface is subject of most studies. Bacteria in gut is multifunctional that include a) production of essential nutrients and co-metabolization of food, b) prevention of bacterial overgrowth and infection, c) influence on central physiological functions such as development of lymphatic tissue, the induction of mucosal tolerance, angiogenesis and fat storage.

Targeted manipulation of the gut flora is increasingly being recognized as a means to improve health. Yet, the temporal dynamics and intra- and inter-individual heterogeneity of the microbiome represent experimental limitations, especially in human cross-sectional studies. Therefore, rodent models represent an invaluable tool to study the host-microbiota interface. This approach is important to establish and identify the core gut microbiome that can maintain health.

Molecular Genetics of Aging Disorders: Neurodegeneration and Cancer

Dr. Debasmita Pankaj Alone,
Associate Professor

With the shifting demographics towards older age, there is a major concern for age-related disorders. 90% of individuals dying each year are due to age-related causes. Understanding the genome, epigenome and proteome between healthy and diseased state of these individuals pave a way for unravelling bio-markers for early diagnosis and/or therapeutics for various diseases. Our goal is to find these underlying players that change the micro-environmental niche differently in a diseased state during the

developmental process of aging and hence are responsible for these age related-disorders. We are currently focusing on understanding the pathogenesis of two neurodegenerative eye disorders (Glaucoma, the leading cause of irreversible World Blindness and Corneal Endothelial Dystrophies) as well as Cancer using a plethora of cellular, biochemical, genetics, genomics and molecular biology techniques involving human samples, *Drosophila* models as well as *in vitro* cell lines.

Molecular Microbiology: Functional significance of membrane proteins and Mechanisms underlying bacterial persistence

Dr. Harapriya Mohapatra, Associate Professor

An unprecedented increase in the proportion of resistance bacteria has threatened modern advances in medical science. The development of resistance in bacteria is not only due to acquisition of genes. Structures (proteins) intrinsic to cellular functions and survival play a significant role in the organism tiding over the unfavourable situation. Our research focuses on developing understanding of two such aspects involving the bacterial membrane protein and persistence mechanism. We are trying to address how membrane proteins help the organism deal with the external milieu including interaction with the host cells? In the second part of our research, we are trying to understand how isogenic population of cells respond differentially to a stress condition? We investigate these aspects in *Enterobacter* and *Klebsiella* that are opportunistic pathogens. Various microbial, molecular biology, biochemical and cell culture techniques are utilized for addressing these questions.



Light signaling and flowering time control in Plants

Dr. Kishore CS Panigrahi,
Associate Professor

Understanding the intricate network of Light signaling and flowering time Control in plants has been the core interest of our lab. We use three major model systems *Arabidopsis thaliana*, Rice and the nonflowering Bryophyte *Physcomitrella patens* to decipher the complex regulatory loop of cross-talk of light with biological clock influenced by external agents. Relatively recently we did work to understand root patterning influenced by various light fluence. At the same time, we also have discovered a novel non transgenic way of using carbon nanoparticle to increase productivity in Rice. We keep keen interest in understanding the molecular evolution and cross talk of Auxin and Light signaling from *Physcomitrella* to *Arabidopsis*. We not only showed recently the regulation of Evening Elements of the circadian clock but also working to unravel the role of *Gigantea* and *ABP1* in various aspects of plant development.

Angiogenesis and Tumorigenesis Regulation

Dr. Manjusha Dixit, Associate Professor

Angiogenic dysregulation contributes to many diseases, including cancer. Till date, all angiogenic-switch regulatory molecules and their mechanism are not known. We are interested in identifying new angiogenic regulators and establishing the mechanism, which can help in understanding the angiogenesis process completely. So far we have identified *FRG1* as regulator of angiogenesis

which affects tumorigenesis as tumor suppressor, using multiple cancer types. Mechanistic study in prostate cancer and breast cancer suggests that it affects ERK signaling. We identified *EEF1A2* and *IQGAP2*, as *FRG1*'s interacting partners. In breast cancer we identified that *IQGAP2* functions as tumor suppressor. *IQGAP2* suppresses the *IQGAP1* mediated oncogenic effect in breast cancer by modulating ERK signaling. *IQGAP2* also affects angiogenesis. Other interactant of *FRG*, namely *EEF1A2*, functions as an oncogene and affects angiogenesis in positive manner by affecting *HIF1A* levels. Our GST pull down assays validated the interaction of these three genes. Our current research focuses on if it is three protein complex which affects multiple molecular signaling pathways and therefore the tumorigenesis and angiogenesis.

Complex cell and tissue architecture

Dr. Renjith Mathew, Reader – F

The complexities of structures can be explained in terms of the shapes of the units building it and the organisational principles that the unit follow in order to construct the structure. In biology, the complex structures of tissues and organs are important since the forms directly relate to the function. At the foundation of the shapes is the highly flexible basic unit, the cell, and the myriads of shapes it can achieve. However, unlike in inanimate units, the cell has a complex network of processes inside; the sub-cellular activities, that actively control its shape. We are interested in how cells regulate their shapes, how the cell shapes organise to generate higher order tissue and organ architectures, and the mechanisms that maintain these complexities against degenerative forces.



Molecular mechanisms of eukaryotic translation initiation

Dr. Pankaj V. Alone, Associate Professor

Protein biosynthesis is an important step in the life cycle of cells where genetic information is converted into functional protein information. Selection of an open reading frame is a key function of the translation initiation apparatus and a key regulatory step that controls gene expression. Our research interests are to understand a) Mechanism of start codon recognition & translation fidelity. b) Translational control in molecular medicine and regulation of protein biosynthesis. c) Architecture of translation apparatus, molecular interactions and supra molecular assembly of translation initiation complex by using range of genetic, biochemical and biophysical techniques in the yeast model system.

Protein Crystallography, Structural biology, Protein engineering, De novo protein design

Dr. Rudresh Acharya, Reader – F

Proteins are workhorses of a cell, engaged in a wide range of task comprising structural stability, cell signaling, catalysis, transporting, molecular printing, membrane fusion, regulation, etc. Understanding the mechanism that underlies the functioning of these molecular gadgets is an intriguing question, and defines the fundamentals of biological processes. This is an interdisciplinary research program and we set out to address the question using X-ray crystallography coupled with biophysical and biochemical approaches. Our research group is pursuing the following projects:

Viral ion channels- Cation selective channels are

present in several enveloped pathogenic viruses (example: Influenza viruses, Chikungunya). Often, the channels are essential for virus life-cycle and production of infectious viruses. Our structural biology group aim to deduce the structure based mechanism for the functioning of the channels. The structures will be of fundamental interest, and provide leading point for the structure based drug design.

Two component systems in bacteria- We are interested in determining the structures of bacterial two component systems (Histidine kinase and its response regulator), a wide spread signal transducer in prokaryotes. Here, our focus is to provide structure-based mechanistic model for sensing and transmission of signal.

Polysaccharide Lyases (PLs)- Bacterial polysaccharide lyases catalyze the degradation of the anion polysaccharides in the host extracellular matrix and act as virulence factor. Infection ensue this process. We are exploring the structural basis for the pH dependent functioning of pathologically important polysaccharide lyases from PL-5 class. Further, we aim to design peptide-based inhibitors for this class of PLs.

De novo protein design- Our other research program is de novo protein design, which aim to put our understanding of principles that define protein folding and functioning into test. Here, inspired by nature we seek to design self-assembling scaffolds that harbor tailored functions, and bind co-factors to create new materials. In above research interests, methods involve protein purification, biochemical assays, screening for crystallization, collecting X-ray diffraction datasets, determining structures, interpretation for structure and biochemical data to explain the mechanism.



Cell cycle and Cytoskeletal Dynamics

Dr. Ramanujam Srinivasan, Reader – F

Bacteria are brainless lifeforms that carry out all functions a human cell carries out. Recent research has suggested that the unique cytoskeletal proteins once believed to be only in Eukaryotes had their origins in Bacteria and Archaea. We have recently shown that a Bacterial plasmid segregating protein thought to bind nucleoids are also membranes. We have also identified several new alleles of a tubulin homolog and used it to gain insights into bacterial cell division.

Mechanism and Regulation of Nuclear Expansion

Dr. Abdur Rahaman, Reader – F

Nuclear remodeling is a universal process that occurs in all eukaryotes including human. It is relevant to human health, since a number of known human diseases are linked to nuclear remodeling. Moreover, changes in nuclear size and shape are relevant to cancer, aging and other pathobiological conditions. Therefore, identifying and understanding factors associated with nuclear remodeling will make important contribution not only to basic research but also to understanding these diseases, and could provide potential means for therapeutic intervention.

Tetrahymena undergoes closed mitosis and nuclear envelope expands ~10 folds during specific stages in cell conjugation. Gene manipulation, generation of knockouts, maintenance of lethal alleles and in vivo structure-function analysis are easily achieved in Tetrahymena. This makes it a suitable model organism to study nuclear remodeling.

My group is interested in nuclear remodeling, specifically understanding the mechanism and cell cycle regulation of nuclear envelope expansion.

Neural circuits, neuropeptides and behaviour

Dr. Praful Singru, Associate Professor

Hypothalamic arcuate nucleus (ARC) has emerged as a crucial integrative center of the neural circuitry regulating energy balance. ARC neurons synthesize orexigenic [neuropeptide Y (NPY) and agouti-related protein] and anorexigenic [cocaine- and amphetamine-regulated transcript (CART) and α -melanocyte-stimulating hormone] neuropeptides and project to hypothalamic paraventricular nucleus (PVN). The axons from ARC innervate and regulate thyrotropin-releasing hormone (TRH)-synthesizing neurons in medial PVN to regulate energy expenditure. Another distinct group of TRH neurons resides in anterior PVN (PVNa) but its relevance has remained unexplored. Although TRH is fully conserved across the vertebrate phyla, believed to mediate neuronal communication, significance of TRH in the brain of non-mammalian vertebrates and evolutionary emergence of TRH as a regulator of energy balance are not well established.

We have been interested in understanding the significance of non-hypophysiotropic TRHergic system in brain, role of neuromodulators/neuropeptides/ion channels regulating TRHergic system and its regulatory pathways, and evolutionary significance of the peptide. We have observed that while PVNa TRH neurons innervate and regulate feeding-related neurons in ARC in rats, TRH neurons in the preoptic area of



teleost regulates dopaminergic neurons and reproduction (J. Comp. Neurol. 2019, 527; 1070-1101). Further, CART- and NPY-containing systems interact to regulate TRH neurons (J. Comp. Neurol. 2016, 524, 3014-41).

Mechanism of membrane remodeling and/or deformation in host-pathogen interaction and neurodegeneration

Dr. Mohammed Saleem, Reader – F

Ongoing research work:

- 1) Mechanism of Amyloid -40 mediated neuronal membrane deformation. To this end, we are using giant liposomes, lipid monolayers, supported bilayer, purified peptide and combination of biophysical tools to reconstitute in vitro the binding and deformation of biologically relevant neuronal membrane to capture the phase of Amyloid -40 aggregation kinetics that results in major disruption of the neuronal membrane. Our work carried out so far suggests that neuronal membrane deformation may be majorly driven by the coupling between local lipid defects besides the widely accepted electrostatics. Our findings address the missing link in the recently proposed two-step mechanism, by proposing that the channel formation and fibril mediated membrane disruption are dictated by the interplay of local lipid topology and electrostatics.
- 2) Mechanism of bacterial membrane vesicles mediated modulation of host signaling events by manipulation of local host cellular membrane properties. We are reconstituting the interaction of bacterial membrane vesicles with host cell membranes to investigate if the fusion of bacterial vesicles can modulate host cell membrane properties such as fluidity, tension, potential etc. Such

physicochemical properties of the host membrane, although globally regulated by cellular homeostasis, are often locally modulated to support various cellular signaling events.

Structural biology of viral protein complexes involved in viral entry, replication and genome packaging

Dr. Tirumala Kumar Chowdary, Reader – F

A virus, structurally, is a mere assembly of constituent biomolecules. The complex biological process in a viral infection are carried out by viral protein complexes and their dynamics interactions amongst themselves, and with the host proteins or cellular structures. Viral surface proteins and their interactions with cell surface proteins are the first step in a virus infection. My research interest is in understanding the structure of viral protein complexes involved in viral entry, genome replication and genome packaging in important human pathogens that have caused epidemics in recent past (such as chikungunya, Dengue and the current pandemic virus SARS CoV-2). We employ a structural biology (such as X-ray diffraction, single particle electron microscopy), molecular dynamics simulations, biochemistry and molecular biology tools to study interaction between viral surface 'spike' proteins and corresponding receptors, interactions amongst the viral replication proteins in Dengue virus replication complex non-structural proteins and genome packaging and packaging elements in viral genomes.)

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explain mechanism of E2-E1 dissociation during viral entry. Biosci Rep. 2019;39(6): BSR20191077. doi:10.1042/BSR20191077

BOOKS & BOOK CHAPTERS:

1. Shyamasree Ghosh, Computational Immunology, Basics: CRC Press, 2019
2. Shyamasree Ghosh, Computational Immunology, Applications, CRC Press, 2020
3. Shyamasree Ghosh, Sialic Acids and Sialoglycoconjugates in the Biology of Life, Health and Disease, Elsevier, 2020

CONFERENCES, SEMINARS, WORKSHOPS ATTENDED

1. Dr. Aniruddha Datta Roy was invited as a resource person at DBT sponsored workshop titled "Molecular taxonomy" at Institute of Life Sciences (ILS), Bhubaneswar, March 11 – 15, 2019.
2. Dr. Aniruddha Datta Roy has given an Oral presentation titled "Not quite Gondwanan: Molecular phylogeny of Scincines reveal independent origins of Indian and Sri Lankan skinks" included in the symposia "India-Sri Lanka Biotic turnover" held at Asian Tropical Biology conference – Asia Pacific chapter meeting in MAS Athena in Thulhiriya, Sri Lanka on September 12th, 2019.
3. Dr. Aniruddha Datta Roy has attended as an organizer of international workshop on "an introduction to Biogeography and biogeographical analysis" in Asian Tropical Biology conference – Asia Pacific chapter meeting in MAS Athena in Thulhiriya, Sri Lanka on September 10th, 2019.
4. Dr. Aniruddha Datta Roy has attended as an Organizer of international workshop on "An introduction to molecular phylogenetics and its applications" in Asian Tropical Biology conference – Asia Pacific chapter meeting in MAS Athena in Thulhiriya, Sri Lanka on September 11th, 2019.
5. Dr. Asima Bhattacharyya has attended 17th International Congress of Immunology, on Helicobacter pylori-mediated gastric cancer: at the crossroads between hypoxia and inflammation held in Beijing, during 19 – 23 Oct 2019.
6. Dr. Asima Bhattacharyya has attended a Conclave on Helicobacter pylori-mediated gastric cancer progression involves dynamic interplays between infection and inflammation at Utkal University on 25 Nov, 2019.
7. Dr. Asima Bhattacharyya has attended a National Conference on Cancer Biology and Therapeutics, at ILS Bhubaneswar, during 29-30 Nov 2019.
8. Dr. Chandan Goswami has attended Erasmus+ Staff Training Programme, University of Zadar, Croatia. (24th May -1st July 2019).
9. Dr. Chandan Goswami has attended National Conference on Recent advances in Energy, environment and health sciences (RAEEHS-2019) Organized by Siksha O Anusandhan (Deemed to be University). Bhubaneswar. 18-19th Oct, 2019.
10. Dr. Chandan Goswami has attended 88th SBCI meeting. Theme: Interface of Biology & Chemistry: Health and Nutrition" at Bhabha Atomic Research Centre (BARC), Mumbai,



Maharashtra 3rd Nov, 2019, Title: Molecular evolution of TRPV1 at the lipid-water interface and Cholesterol

11. Dr. Chandan Goswami has attended DAAD Research in Germany: Tailoring a Research Proposal. German Consulate General, 1, Hastings Park Rd, Alipore, Kolkata, West Bengal 700027, 20th Nov 2019
12. Dr. Chandan Goswami has attended Olympus FV Confocal User Meet, 21-22nd Nov 2019, Gurgaon-122002, India.
13. Dr. Chandan Goswami has attended Cell Biology conference and microscopy workshop 2019, Institute of Life Sciences, Bhubaneswar, 9-11th Dec 2019.
14. Dr. Chandan Goswami has attended 4th National Arabidopsis Meeting (2019) organized by NISER at Puri, 29-31st Dec 2019.
15. Dr. Chandan Goswami has attended 3rd International Symposium on "Genomics in Aquaculture"- (ISGA-III), CIFA, Bhubaneswar, 21-23 Jan 2020.
16. Dr. Chandan Goswami has attended 12th Young Investigator's Meeting 2020, 14-18th Feb 2020, Mahabalipuram.
17. Dr. Debasmita Pankaj Alone has attended National seminar on Drug repurposing, Challenges and Opportunities, 20th September, 2020, SOA University, Bhubaneswar, Odisha
18. Dr. Debasmita Pankaj Alone has attended 7th International conference of Molecular Signalling, 28th February, 2020, Post Graduate Department of Zoology, Utkal University, Vani Vihar, Odisha.
19. Dr. Debasmita Pankaj Alone has attended National Conference on Cancer Biology and Therapeutics, 29th-30th November, 2019, Institute of Life Science, Bhubaneswar.
20. Dr. Harapriya Mohapatra has attended the 3rd International Symposium on Genomics in Aquaculture - 2020 (ISGA-III) being held from 21 - 23 January 2020 at CIFA, Bhubaneswar, India and delivered a talk titled "How dreadful are the multidrug resistant environmental bacterial isolates?" as Lead Speaker.
21. Dr. Harapriya Mohapatra has attended the 88th annual meeting of Society of Biological Chemists of India (SBCI) and a conference on Advances at the interface of Biology and Chemistry during Oct 31 to Nov.3, 2019 in BARC, Mumbai and delivered a talk titled "Comparative study on AcrAB-TolC expression in clinical and non-clinical isolates of AcrAB-TolC", as invited speaker at
22. Dr. Kishore CS Panigrahi has attended National Conference on Biodiversity, Biotechnology and Bio-informatics, Innovative and Emerging trends, February 22- 23, 2019.
23. Dr. Kishore CS Panigrahi has attended an International symposium on Biotechnology for food nutritional Security and organic agriculture, Jorhat, 25-26, March 2019.
24. Dr. Manjusha Dixit has attended the 5th International Conference on Translational Research: Recent Trends in Pre-translational to Translational Research, 07-09 November, 2019; NCCS Pune, India.
25. Dr. Palok Aich has attended DAE-BRNS theme meeting and delivered an invited talk on "High Throughput Sequencing and genomic solution (HTS&GS)", Molecular



- Biology Division, Bhabha Atomic Research Center (BARC), Mumbai, India. Nov 09, 2019.
26. Dr. Pankaj V. Alone has attended 10th RNA group meeting (May 2-4th 2019) , Rajiv Gandhi centre for Biotechnology Trivandrum and delivered a talk on Role of helix 32 of 18S rRNA in the fidelity of eukaryotic translation start site selection.
27. Dr. Pankaj V. Alone has attended 9th International conference (Nov 27-29th 2019) on biology of yeast and filamentous fungi, University of Hyderabad and delivered a talk on Alteration in the fidelity of HIS4 start codon selection influences 3-amino-1, 2, 4-triazole sensitivity in hyper-GTPase defective eIF5 protein.
28. Dr. Praful Singru has attended a conference at Humbolt Kolleg on Comparative Endocrinology and Physiology, Department of Zoology, RTM Nagpur University, Nagpur, January 7-9, 2019.
29. Dr. R. Srinivasan has attended the Asia Pacific Microscopy Conference- 2020, 3rd - 7th February, 2020 at Hyderabad International Convention Centre, Hyderabad.
30. Dr. R. Srinivasan has attended a conference on Thirsting for Theoretical Biology- 2019, 3rd - 7th June, 2019. International Centre for Theoretical Sciences, TIFR.
31. Dr. R. Srinivasan has attended Soft Matter Young Investigator Meet 2019, 12th - 14th May, Hotel Pine Wood, Shillong. India 2019.
32. Dr. R. Srinivasan has attended a conference on Conflict and Cooperation in Cellular Populations, 3rd - 5th February, 2020. inStem, Bengaluru.
33. Dr. R. Srinivasan has attended EMBO Conference - Bacterial Morphogenesis, Survival and Virulence: Regulation in 4D, 24th Nov - 28th Nov, 2019, Monkey Valley Resorts, South Africa.
34. Dr. Subhasis Chattopadhyay has attended Global Bio-India 2019 as a Delegate, Power to Transform Lives, Led by Department of Biotechnology, Govt. Of India. 21st -23rd November 2019, Aerocity, New Delhi.
35. Dr. KV Badireenath has attended Nanotechnology conference, NISER, Bhubaneswar.
36. Dr. KV Badireenath has attended a conference of Society of Biological Chemists (SBCI). Oct 31- Nov 3, 2019. Bhabha Atomic Research Center (BARC), Mumbai, India.
37. Dr. KV Badireenath has attended a National Conference on Nanomaterials in Biology (NCNB). Oct 9 - Oct 12, 2019. Jointly organised by Soft Materials Research Society (SMRS) and University of Rajasthan, Jaipur, India.
38. Dr. KV Badireenath has attended a Global Conference on Pharmacy and Pharmaceutical Science (GPPS2019). Jun 26-27, 2019. Bali, Indonesia.
39. Dr. KV Badireenath has attended International Pharma Research & Drug Delivery summit (IPRDS-2019). Jun 10-12, 2019. Brussels, Belgium.
40. Dr. KV Badireenath has attended a conference on Cell-based Vehicles as tools for drug development and therapy: Opportunities and Challenges. Mar 02-03, 2019. Institute of Pharmacy & Technology, Salipur, Odisha, India.



41. Dr. Tirumala K. Chowdary has attended the 12th Asia Pacific Microscopy Conference (APMC) during 03-07, February 2020 at Hyderabad International Convention Centre (HICC), Hyderabad, India.
42. Dr. Shymasree Ghosh Basu has participated in the Official Language Seminar, conducted by NISER: 23/8/2019 on 'Parmanu Urja and Paryavaran'.
43. Dr. Shymasree Ghosh Basu has attended a Training Programme of one-hour duration on "Working in Hindi on Computer" conducted by Hindi Cell of NISER & Computer Centre on January 8th, 2020 under directions vide letter No.21/Hindi/2019-20/1233-1320 dated July 12th 2019 received from the Joint Director (OL) DAE.
5. Dr. Chandan Goswami has delivered an invited talk at University of Zadar, Zadar, Croatia 28th May 2019, Title: Molecular evolution of TRPV1 at the lipid-water interface and Cholesterol
6. Dr. Chandan Goswami has delivered an invited talk in the National Conference on Recent advances in Energy, environment and health sciences (RAEEHS-2019) Organized by Siksha O Anusandhan (Deemed to be University), Bhubaneswar. 19th Oct, 2019. Title: TRP ion channels in health: Bone disorders and remedy by efficient bone tissue engineering.
7. Dr. Chandan Goswami has delivered an invited talk in the 88th SBCI meeting. Theme: Interface of Biology & Chemistry: Health and Nutrition" at Bhabha Atomic Research Centre (BARC), Mumbai, Maharashtra 31st Oct – 3rd Nov, 2019. Title: Molecular evolution of TRPV1 at the lipid-water interface and Cholesterol.

INVITED TALKS DELIVERED

1. Dr. Aniruddha Datta Roy has delivered an invited talk at IISER Berhampur on 12-02-2019. Talk title: Unravelling historical biogeographic patterns of the Indian subcontinent using skinks as a model system
2. Dr. Aniruddha Datta Roy has delivered an invited talk in a webinar for Kottayam Nature society on 28-05-2020 titled "Mysteries of a scaly kind: Skinks of India".
3. Dr. Asima Bhattacharyya has delivered an invited talk on Host responses to Helicobacter pylori infection at the Induction Programme, Dept. of Biotechnology, Utkal University, 6 Sep 2019.
4. Dr. Asima Bhattacharyya has delivered an invited talk on down regulation of invasive potential of gastric cancer cells by histone acetyltransferase inhibitor CTK7A. ILS, Bhubaneswar, Dec 09-15, 2019
8. Dr. Chandan Goswami has delivered an invited talk in the Agharkar Research Institute, Pune. 4th Nov, 2019. Title: TRPV4 interacts with mitochondrial proteins and acts as a mitochondrial structure-function regulator.
9. Dr. Chandan Goswami has delivered an invited talk in the DAAD Research in Germany: Tailoring a Research Proposal. German Consulate General, 1, Hastings Park Rd, Alipore, Kolkata, West Bengal 700027. 20th Nov 2019. Title: Research atmosphere in Germany. What to look for.
10. Dr. Chandan Goswami has delivered an invited talk in the Cell Biology conference and microscopy workshop 2019. Institute of Life Sciences. Bhubaneswar, 10th Dec 2019. Title: TRPV4-mediated channelopathy: Imaging the cellular health and functions.



11. Dr. Chandan Goswami has delivered an invited talk in the 3rd International Symposium on "Genomics in Aquaculture"- (ISGA-III), CIFA, Bhubaneswar, 22nd Dec, 2019. Title: TRP channels are endogenously expressed in vertebrate spermatozoa and regulates sperm functions
12. Dr. Chandan Goswami has delivered an invited talk in the 12th Young Investigator's Meeting 2020, 18th Feb 2020, Mahabalipuram. Title: School of Biological Sciences, NISER, Bhubaneswar
13. Dr. Chandan Goswami has delivered an invited talk in the Institute of Chemical Technology, Bhubaneswar, 27th Feb 2020. Title: 400 Years of light microscopy, milestones in microscopy and challenges ahead.
14. Debasmita P Alone has delivered an invited talk on Repurposing of an anti-malarial drug, Dihydroartemisinin as a potential anti-cancer drug for brain tumour on 20th September, 2020, at National seminar on Drug repurposing, Challenges and Opportunities. SoA University, Bhubaneswar, Odisha
15. Debasmita P Alone has delivered an invited talk on Drosophila as a model for screening anti-cancer drugs, 18th October, 2020, Second Vigyan Pratibha Teacher's Training Workshop 18th October, 2019, NISER, Jatni, India.
16. D Debasmita P Alone has delivered an invited talk on Repurposing of an anti-malarial drug, Dihydroartemisinin as a potential anti-cancer drug for brain tumour. 13th January, 2020, Post Graduate Department of Zoology, Utkal University, Vani Vihar, Odisha
17. Debasmita P Alone has delivered an invited talk on Novel insights into altered gene regulation underlying disease pathogenesis of pseudoexfoliation glaucoma, 7th International conference of Molecular Signalling, 28th February, 2020, Post Graduate Department of Zoology, Utkal University, Vani Vihar, Odisha.
18. Dr. Harapriya Mohapatra has delivered a seminar talk on "Molecular basis of persister cell formation" at BARC, Mumbai on 16th January 2020.
19. Dr. Kishore CS Panigrahi has delivered an invited talk in the International Moss Meeting, Madrid, Spain.
20. Dr. Kishore CS Panigrahi has delivered an invited talk in the International Photobiology Symposium, Barcelona, Spain.
21. Dr. Kishore CS Panigrahi has delivered an invited talk at University of Zadar Department of ecology, agronomy and aquaculture, Croatia
22. Dr. Kishore CS Panigrahi has delivered an invited talk at Christian Frankhauser Lab, University of Lausanne, Switzerland.
23. Dr. Kishore CS Panigrahi has delivered an invited talk in the Department of Botany, Utkal University.
24. Dr. Kishore CS Panigrahi has delivered an invited talk in the Department of Agril. Biotechnology, College of Agriculture, Odisha University of Agriculture & Technology.
25. Dr. Kishore CS Panigrahi has delivered an invited talk in the Department of Botany, Gauhati University.



26. Dr. Kishore CS Panigrahi has delivered an invited talk in the Department of Botany, University of Kashmir.
27. Dr. Manjusha Dixit has delivered an invited talk on Cancer basics and molecular basis. World Cancer Day organized by Zaariya NISER, 8th Feb 2020.
28. Dr. Manjusha Dixit has delivered an invited talk on Brain tumor: EEF1A2 is not a tumor suppressor but an oncogene which affects EMT via PI3K-AKT pathway. 5th International Conference on Translational Research: Recent Trends in Pre-translational to Translational Research. 07-09 November, 2019; NCCS Pune, India.
29. Dr. Manjusha Dixit has delivered an invited talk on Glimpse of NISER: Path to Reach. Scicon: ODM Educational Group: 31st October 2019.
30. Dr. Palok Aich has delivered an invited talk on Foundation Day Oration: Exploring Gut-Brain axis by perturbation to establish stable consortia of beneficial microbiota. Central Calcutta Society for Advancement of Human Development & Research. Bose Institute Centenary Hall, Kolkata, July 22, 2019.
31. Dr. Palok Aich has delivered an invited talk on Journey to find a stable microbiome: Exploring gut-brain-gut axis by perturbation, Canadian Center for Health and Safety in Agriculture, U of Saskatchewan, July 09, 2019.
32. Dr. Palok Aich has delivered an invited talk on Role of probiotic on disease control. Medical Academy of Sofia, Bulgaria, Sep 26 2018..
33. Dr. Palok Aich has delivered an invited talk on Affluence of Microbiota may be a luxury: Comes in plenty but a few may be required @ VIDO-Intervac, U of Saskatchewan, May 31 2018.
34. Dr. Palok Aich has delivered an invited talk on DST Inspire, @ KSBT, KIIT, Bhubaneswar, Odisha, India, Feb 23, 2018.
35. Dr. Palok Aich has delivered an invited talk on On Technical Writing @ KSBT, KIIT, Bhubaneswar, Odisha, India, Feb 12, 2018.
36. Dr. Palok Aich has delivered an invited talk on "EPIGENETICS AND HUMAN DISEASE" organized by the Japan-India Forum for Advanced Study, Feb 07-09, 2018, Bose Institute, Kolkata, India.
37. Dr. Palok Aich has delivered an invited talk in a conference on GATC 2018 the Genomics Analysis and Technology Conference, Jan 7th - 9th, 2018, Institute of Science & Technology, Gauhati University & GATC.
38. Dr. Pankaj V. Alone has delivered a talk on Role of helix 32 of 18S rRNA in the fidelity of eukaryotic translation start site selection in the 10th RNA group meeting (May 2-4th 2019) , Rajiv Gandhi centre for Biotechnology Trivandrum.
39. Dr. Pankaj V. Alone has delivered a talk on Alteration in the fidelity of HIS4 start codon selection influences 3-amino-1,2,4-triazole sensitivity in hyper-GTPase defective eIF5 protein in the 9th International conference (Nov 27-29th 2019) on biology of yeast and filamentous fungi, University of Hyderabad.
40. Dr. Praful Singru has delivered an invited talk at Humbolt Kolleg on Comparative Endocrinology and Physiology, Department of Zoology, RTM Nagpur University, Nagpur, January 7-9, 2019.



41. Dr. Praful Singru has delivered an invited talk in the 5th meeting of the Japan Branch of the International Neuropeptide Society on Updates in Neuropeptides and Biologically Active Peptides. Tokyo University, Japan. October 2019.
42. Dr. R. Srinivasan has delivered an invited talk in the Asia Pacific Microscopy Conference-2020, 3rd-7th February, 2020. Hyderabad International Convention Centre, Hyderabad. Molecular Machineries in Bacteria.
43. Dr. R. Srinivasan has delivered an invited talk on Thirsting for Theoretical Biology- 2019, 3rd - 7th June, 2019. International Centre for Theoretical Sciences, TIFR. Biology and Reconstitution of Minimalistic Systems.
44. Dr. R. Srinivasan has delivered an invited talk in the Soft Matter Young Investigator Meet 2019, 12th - 14th May, Hotel Pine Wood, Shillong on Helical assembly of novel FtsZ mutants defective in ring assembly. India 2019.
45. Dr. Renjith Mathew has delivered an invited seminar in workshop on "Advances in Biotechniques", The Department of Biotechnology, Utkal University, 07.12.2018.
46. Dr. Renjith Mathew has delivered an invited Seminar at the Developmental Biology Unit, European Molecular Biology Laboratory, Heidelberg, Germany, 16.01.2019.
47. Dr. Renjith Mathew has delivered an invited seminar in "Zeiss Microscopy Conclave 2019" Bangalore, 15.02.2019.
48. Dr. Subhasis Chattopadhyay has delivered an invited talk in the programme on "Current trends in Bio Science and Biotechnology" on 29th January 2020 at UGC-Human Resource Development Centre (HRDC), Utkal University for a Refresher Course in Bio Science and Biotechnology, 25th January - 07th February, 2020.
49. Dr. Subhasis Chattopadhyay has delivered an invited talk in the National Seminar entitled "Probing Biology: In vivo, in vitro and in silico" on National Science Day organized by Department of Biophysics, Molecular Biology & Bioinformatics, University of Calcutta funded by UGC-Centre of Advanced Study in Biophysics, Molecular Biology & Bioinformatics seminar grant [F.5/2015/CASI/SAP(II)] held at MN Saga auditorium of Rajabazar Science College, dated 6th February 2020.
50. Dr. KV Badireenath has delivered an invited talk on "Rational design of combinational nanoformulations using cell-based model". Society of Biological Chemists (SBCI). Oct 31- Nov 3, 2019. Bhabha Atomic Research Center (BARC), Mumbai, India.
51. Dr. KV Badireenath has delivered an invited talk on "Development and Assessment of Combinational Nano-formulations using Cell-based". National Conference on Nanomaterials in Biology (NCNB). Oct 9 - Oct 12, 2019. Jointly organised by Soft Materials Research Society (SMRS) and University of Rajasthan, Jaipur, India.
52. Dr. KV Badireenath has delivered an invited talk on "Cominational Nano formulations to counteract Drug Resistance". Global Conference on Pharmacy and Pharmaceutical Science (GPPS2019). Jun 26-27, 2019. Bali, Indonesia.
53. Dr. KV Badireenath has delivered an invited talk on "Cell-based chemo resistance



models to evaluate combinational nanoformulations". International Pharma Research & Drug Delivery summit (IPRDS-2019). Jun 10-12, 2019. Brussels, Belgium.

54. Dr. KV Badireenath has delivered an invited talk on "Cell-based pre-formulation studies for selection of drug combination" in the Cell-based Vehicles as tools for drug development and therapy: Opportunities and Challenges conference held on Mar 02-03, 2019 in the Institute of Pharmacy & Technology, Salipur, Odisha, India.
55. Dr. Abdur Rahman has delivered an invited talk in the Department of Biotechnology, Utkal University, Bhubaneswar, on 5th September 2019.
56. Dr. Tirumala K Chowdary has delivered a invited talk on "Conformation dynamics of chikungunya virus cell entry proteins: structural characterization of membrane fusion protein, E1, intermediates" at 12th Asia Pacific Microscopy Conference (APMC) during 03-07, February 2020.
57. Dr. Tirumala K Chowdary has delivered a popular talk on "Structure and form in the living" – Talk delivered on 13th December 2019 in NCERT-National Talent Search awardees nurturance program conducted by NISER.
- b. Intramural project under Microbes, Immunity and Disease Biology (PI), DAE, 2014-2020.
3. **Dr. Kishore CS Panigrahi:** Development of a plant based platform for the production of human interleukin 33(hIL33) in moss, *Physcomitrella paten*.
4. **Dr. Manjusha Dixit:** CRISPR-RNA-Cas9 System: Syntheses and Biochemical Evaluations of Nucleobase Modified tropolonyl-Ribose Nucleoside in CRISPR-RNA'. DBT, 83.87 lakh, 03/01/2019 to 02/01/2022.
5. **Dr. Mohammad Saleem**
 - a. Force generation by Amyloid-beta aggregation mediated neuronal cell membrane rupture in neurodegeneration. (ongoing Core Research Grant, SERB – DST) (NISER code: BL1902) 2018 – 2021.
 - b. Spatio-temporal mapping of membrane deformation induced by Amyloid- beta 40 during neurodegeneration. (ongoing Extramural Research Grant – DBT) (NISER code: BL1905) - 2018-2021.
 - c. How do proteins bend membranes? Biophysical & Biochemical parameters that regulate membrane shaping by supra molecular assembly of Clathrin and HIV1. (ongoing DST INSPIRE Research Grant) (NISER code: BL1903) - 2014-2020.

SPONSORED PROJECTS

1. **Dr. Chandan Goswami:** "Modified polysaccharide based hydrogels for cost-effective bone tissue engineering (As Co-PI, from ICMR).
2. **Dr. Debasmita P. Alone:**
 - a. Proteostasis impairment in the progression of Pseudoexfoliation Syndrome and Glaucoma (PI), SERB, 75.68 Lakhs, 2019-2022.
6. **Dr. Palok Aich**
 - a. 2019 Global Travel Award, University of Saskatchewan, Canada \$2000
 - b. 2018 College of Medicine Research Award, University of Saskatchewan, Canada \$19320
7. **Dr. Praful Singru:** Anticipation in genes: Molecular, physiological and behavioral correlates of response of circa-annual clocks



to seasons in night- migratory song birds. Department of Biotechnology (DBT), New Delhi, India.

8. Dr. R. Srinivasan:

- a. SERB-DST: EMR/2016/000487 - Assembly of Bacterial Cell Division Protein, FtsZ into Ring-like Structures: Cell Biological, Biochemical, Biophysical and Ultra-structural Characterization of Novel Mutants trapped in a Helical Intermediate Stage of Z-ring Assembly ~ 78 lakhs
- b. DBT: BT/PR15183/BRB/10/1443/2015 - Assembly and Constriction of the Bacterial Cytokinetic Ring formed by the Tubulin homologue, FtsZ ~ 75 Lakhs.
- c. DBT: BT/INF/22/SP33046/2019 - Bioactive Bhubaneswar Biophysical Characterization Facility
9. **Dr. Rudresh Acharya:** Mechanistic insights into functioning of polysaccharide lyases (PLs) belonging to class 5 (PL-5) from pathogenic bacteria such as *Ralstonia solanaceae*, *Pseudomonas aeruginosa*: DBT ~ 60 Lakhs; 2017-2020 (ongoing) BT/PR15324/BRB/10/1482/2016.

10. Dr. Subhasis Chattopadhyay:

- a. Identification and characterization of differentially expressed host proteins for both S 27 and DRDE-06 strains of Chikungunya virus in mouse model: Implications in understanding its epidemic potential as Co-PI funded by Science & Engineering Research Board (SERB), India. [PI- Dr. S. Chattopadhyay, Institute of Life Sciences Bhubaneswar], 2016-19.

- b. Immune regulatory role of TRPV in T cell activation and suppressive response" as PI funded by CSIR, India. [Co-PI- Dr. G. Goswami, SBS, NISER Bhubaneswar], 2016-19.

COLLOQUIUM & SEMINAR ORGANIZED IN SBS

1. **Dr. Rached Jaafar** (M/s. NANOSURF AG, Switzerland) Title: AFM Applications for life sciences: ANA and Fluid FM 04-Apr-2019
2. **Prof. Aswin Sai Narain Seshasayee** (NCBS, TIFR) Title: Evolution of transcriptional regulatory networks in *E. coli* 19-Aug-2019
3. **Prof. Pradip Sinha**, BSBE IIT Kanpur Title: "Modelling cancers in *Drosophila* to uncover novel mechanisms and therapeutics strategies" September 13, 2019.
4. **Prof. Hari S. Misra** (BARC, Mumbai) Title: DNA damage response in radioresistant bacterium: Beyond Lex/RecA mediated canonical SOS response. Sep 20, 2019
5. **Dr. Sunil Laxman** (InStem, Bengaluru) Title: Metabolic constraints determining cell states in space, and over time. Oct 22, 2019
6. **Dr. Nibedita Lenka**, NCCS, Pune Title:- "To be or not to be, the Deubiquitinase and Cell fate modulation" Jan 1, 2020
7. **Dr. Andrija Finka** (University of Zadar, Croatia) Title: Molecular mechanisms of acquired thermotolerance in plants 31-Jan-2020
8. **Dr. K. Venkatesan Iyer** (Max Planck Institute of Molecular Cell Biology and Genetics) Title: Cell Junctions: A mechano-signaling hub to regulate physical properties of epithelial tissues 13-Mar-2020.



Conferences, Workshops and Symposiums Organized

1. **Dr. Asima Bhattacharyya** has contributed as a Co-convenor in organization of a workshop on Methodology in Clinical Cancer Research, during 18-20 July, 2019 at NISER.
2. **Dr. Debasmita P Alone** has contributed as a Coordinator in the Second Vigyan Pratibha Teacher's Training Workshop conducted on 18th-20th October, 2019, at NISER.
3. **Dr. Debasmita P Alone** has contributed as a Coordinator in the Third Vigyan Pratibha Teacher's Training Workshop conducted on 18th-20th December, 2019, at NISER.
4. **Dr. Kishore CS Panigrahi** has organized a National Arabidopsis Meeting (29th - 31st December 2019) which will be held at Hotel Empires, Puri.
5. **Dr. Manjusha Dixit** has organized a Hands-on workshop on methodology in clinical cancer research" at School of Biological Sciences, NISER, Bhubaneswar during July 18-20, 2019.
6. **Dr. R. Srinivasan** has organized Soft Matter Young Investigator Meet 2019, 12th - 14th May, Hotel Pine Wood, Shillong.
7. **Dr. Subhasis Chattopadhyay** has Organized Zonal XXXV Inter DAE Sports & Cultural meet, Table Tennis event held at NISER, Bhubaneswar on Nov 29th to Dec 1st 2019.
8. **Dr. Tirumala K Chowdary** has Coordinated and conducted NCERT-National Talent Search awardees nurturance program conducted by NISER, 9-13th December, 2019.



SCHOOL OF CHEMICAL SCIENCES

Methodology development for NMR spectroscopy

Dr. Arindam Ghosh, Reader-F

Our research group is currently involved in two different projects.

- A. Methodology development: Our group is working on bringing out new and improved experiments and processing techniques for NMR spectroscopy of small as well as large molecules. Currently we are working on methods to reduce spectral congestion, to improve spectral quality and fast measurement of data.
- B. Chemical Exchange Saturation Transfer (CEST): Our group is not only collaborating with different synthetic groups within and outside of NISER for finding out novel CEST agents, it also tries to improve experimental techniques to enhance the CEST efficiency of existing CEST agents.

Publications

- Seven Coordinate Co(II) and Six Coordinate Ni(II) Complexes of Aromatic Macrocyclic Triamide Ligand as ParaCEST Agents for MRI, Rabindra N. Pradhan, Subhayan Chakraborty, Pratibha Bharti, Janesh Kumar, Arindam Ghosh*, and Akhilesh K. Singh*, Dalton Transactions, 48, 8899 (2019)
- (Z)-Selective anti-Markovnikov or Markovnikov thio-yne-click reactions of an internal alkyne by amide hydrogen bond control, Milan Pramanik, Khokan Choudhuri, Subhayan Chakraborty, Arindam Ghosh and Prasenjit Mal*, Chem Comm, 56, 2991 (2020)

Conferences and Seminars Attended

- (i) Functional Smart and Supramolecular Materials (FSSM-2020), Kharagpur, 29-30 January, 2020
- (ii) 26th NMRS meeting and International conference on NMR – from Molecules to Human behaviour and beyond, 18-21 February, 2020

Group/Students' achievements:

- (i) Ph.D. scholar Mr. Subhayan Chakraborty has been awarded "Best Poster Award" for our posters in FSSM-2020 and NMRS-2020 international symposia.
- (ii) Ms. Vyshnavi Vellenakanti has moved to MIT, USA for Ph.D. in 2019 after completing her MSc project in the group. Ms. Vyshnavi Vellenakanti has moved to MIT, USA for Ph.D. in 2019 after completing her MSc project in the group.
- (iii) Present master student Mr. Indranil Ghosh has got offers for Ph.D. from Princeton Univ and Univ of Chicago in USA and TIFR, Mumbai in India among others.

Contracted and Expanded Carbaporphyrinoids

Prof. A Srinivasan, Professor

Our research interests are: (1) synthesis of contracted, normal and expanded derivatives of carbaporphyrinoids and explore its coordination chemistry as well as receptor properties; (2) synthesis of normal and expanded arene as well as pyridyl ring incorporated calixpyrrole, calixphyrins &



their respective 3-D analogues and these macrocycles are further exploited for sensing experiments and (3) Metal assisted macrocyclic synthesis.

Publications

- ❑ Structurally isomerized bis-biphenyl moieties embedded in hexaphyrin (3.1.1.3.1.1) and octaphyrin (1.1.1.0.1.1.1.0). S. Chitranshi, M. Das, B. Adinarayana, W.-Y. Cha, D. Kim and A. Srinivasan. *Org. Lett.* 2020, 22, 1081-1085.
- ❑ Bis-4,4'-biphenyl Ring Embedded Octaphyrin with Three Distinct Conformational Structures. S. Chitranshi, B. Adinarayana, M. Das, W.-Y. Cha, D. Kim and A. Srinivasan. *Chem. Eur. J.* 2019, 25, 12911-12915. (Hot paper).
- ❑ Protonation-Triggered Huckel and Mobius Aromatic Transformations in Nonaromatic Core-Modified [30]Hexaphyrin(2.1.1.2.1.1) and Annulated [28]Hexaphyrin(2.1.1.0.1.1). Syamasrit Dash, Arindam Ghosh, A. Srinivasan, C. H. Suresh and T. K. Chandrashekar. *Org. Lett.* 2019, 21, 9637-9641.
- ❑ Two non-identical twins in one unit cell: characterization of 34π aromatic core-modified octaphyrins, their structural isomers and anion bound complexes. Arindam Ghosh, Syamasrit Dash, A. Srinivasan, C. H. Suresh and T. K. Chandrashekar. *Chem. Sci.* 2019, 10, 5911-5919.
- ❑ Core-modified 48π and 42π decaphyrins: syntheses, properties and structures. Arindam Ghosh, Syamasrit Dash, A. Srinivasan, C. H. Suresh, S. Peruncheralathan and T. K. Chandrashekar. *Org. Chem. Front.* 2019, 6, 3746-3753.

Invited Talks

- (1) Invited talk; Title: Porphyrinoids with Polycyclic Aromatic units; Gandhigram Rural University, Tamilnadu, 24th to 25th February 2020.
- (2) Invited talk; Title: Carbaporphyrinoids; BHU-Varanasi, 17th October 2019.
- (3) Invited Talk; Title: Metals in Medicine and Therapy; BHU Varanasi, 18th October 2019.

Sponsored Projects

Status: On-going

Contracted & Expanded Porphyrin Analogues with Polycyclic Aromatic Units: Synthesis and Applications. Budget: Rs. 49.97 Lakhs; Project Code: EMR/2017/2932; Funding Agency: SERB, New Delhi.

Organometallic Chemistry and Catalysis

Dr. Bidraha Bagh, Assistant Professor

Catalysis plays an essential role in life, science and society; over 80% of all industrial processes involve one or more catalysed reactions and it is the key to more sustainable chemistry. The development of new approaches in transition metal catalysis is essential for a plethora of applications. This includes the efficient conversion of base chemicals via selective processes into high-value products and innovative materials. Significant breakthroughs are required for the sustainable exploitation of renewable and earth-abundant resources. Nature incorporates earth-abundant first row transition metals in combination with reactive ligands for essential transformations, while current homogeneous catalysis aimed at the functionalization of alkenes and related substrates is based on scarce, expensive novel



metal complexes. Many novel metals and their complexes are toxic in nature. However, most of the first-row transition metals are considered as environmentally friendly. The emerging field of 'cooperative catalysis', which revolves around the functional interplay between ligand sphere and metal centre for the activation and conversion of substrates, is a promising approach. The challenging question that we are trying to address is how to design systems that incorporate earth abundant first row transition metals and cooperative ligands and apply them for small molecule activation and catalysis.

Publications

- Behera, R. R.; Ghosh, R.; Panda, S.; Khamari, S.; Bagh, B.* Hydrosilylation of Esters Catalyzed by Bisphosphine Manganese(II) Complex: Selective Transformation of Esters to Alcohols. *Org. Lett.* 2020, 22, 3642–3648.

Sponsored Projects

Ongoing SERB project (06.03.2019 – 05.03.2022)

Dr. Bhargava B.L., Associate Professor

Molecular simulations provide insights into the structure and dynamics of a system at atomic level helping to understand the system from a microscopic perspective. Using molecular simulations, it is possible to carry out controlled (virtual) experiments at extreme conditions without safety issues involved in carrying out the actual experiments. We use ab initio methods and empirical potential based molecular dynamics and Monte Carlo techniques to study condensed phases of materials. We explore structural and dynamical properties of materials that are of potential use. For systems exhibiting aggregation behavior beyond the length scales accessible to the atomistic simulations, coarse grained MD simulations are used. Biological

systems such as proteins and lipids are also studied using molecular dynamics.

Publications

- Computational studies of fibrillation induced selective cytotoxicity of cross- amyloid – Phenol soluble modulin 3. Mitradi Das, Sandeep Dash and B. L. Bhargava, *Chemical Physics* 535 (2020) 110777

Conferences and Seminars Attended

Modern Approaches in Chemistry and Biology, February 2020, JNCASR Banaglore.

Organometallic Chemistry and Catalysis

Dr. Chidambaram Gunanathan, Associate Professor

Isolation and characterization of intermediates in catalytic processes are challenging owing to their inevitable low stability. However, overcoming this barrier and succeeding in this challenging task can turn out to be highly beneficial in further fine tuning and optimization of catalytic experiments, and for the fundamental understanding of reaction mechanisms.

By employing pincer complexes as catalyst inert bond activations are established, which are further utilized for the development of catalytic processes. Simple and atom-economical direct deuteration of various organic compounds using D₂O as a direct deuterium source is developed. Further, following the borrowing hydrogen concept and using alcohols as alkylating and olefinating reagents successful alkylation and olefination reactions are developed. We have discovered a new coupling reaction: catalytic cross-coupling of secondary alcohols. Remarkably, water and liberated molecular hydrogen are the only byproducts in these transformations.



Using half-sandwich ruthenium complexes as catalysts, efficient chemoselective hydroelementation reactions such as hydroboration of carboxylic acids, olefins, nitriles and imines, pyridines, carbonyl compounds, and hydrosilylation of aldehydes were reported. The hitherto unknown intermediate involved in these hydroelementation reactions turned out to be an efficient catalyst for the selective -deuteration of amines and amino acids and in direct synthesis of borosiloxanes from boranes, silanes and water.

Publications

- ❑ Pradhan, D. R.; Pattanaik, S.; Kishore, J.; Gunanathan, C. Cobalt-Catalyzed Acceptorless Dehydrogenation of Alcohols to Carboxylate Salts and Hydrogen. *Org. Lett.* 2020, 22, 1852-1857.
- ❑ Thiyagarajan, S.; Krishnakumar, V.; Gunanathan, C. KOTBuCatalyzed Michael Addition Reactions Under Mild and SolventFree Conditions. *Chem. Asian J.* 2020, 15, 518-523 (Invited Article).
- ❑ Thiyagarajan, S.; Gunanathan, C. Ruthenium-Catalyzed Selective Hydrogenation of Epoxides to Secondary Alcohols. *Org. Lett.* 2019, 21, 9774-9778.
- ❑ Thiyagarajan, S.; Gunanathan, C. Ruthenium-Catalyzed Direct Cross-Coupling of Secondary Alcohols to α -Disubstituted Ketones. *Synlett*, 2019, 30, 2027-2034 (Invited Synfacts article).
- ❑ Gawali, S. S.; Pandia, B. K; Pal, S. Gunanathan, C. Manganese(I)-Catalyzed Cross- Coupling of Ketones and Secondary Alcohols with Primary Alcohols *ACS Omega*. 2019, 6, 10741-10754 (Invited article).
- ❑ Pattanaik, S.; Gunanathan, C. Cobalt-Catalyzed Selective Synthesis of Disiloxanes and Hydrodisiloxanes. *ACS Catal.* 2019, 9, 5552-5561.
- ❑ Gawali, S. S.; Pandia, B. K; Gunanathan, C. Manganese (I)-Catalyzed α -Alkenylation of Ketones Using Primary Alcohols. *Org. Lett.* 2019, 21, 3842-3847.
- ❑ Kishore, J.; Thiyagarajan, S.; Gunanathan, C. Ruthenium (II)-catalysed direct synthesis of ketazines using secondary alcohols. *Chem. Commun.* 2019, 55, 4542-4545.
- ❑ Thiyagarajan, S.; Gunanathan, C. Catalytic Cross-Coupling of Secondary Alcohols. *J. Am. Chem. Soc.*, 2019, 141, 3822-3827. Emerged as top 20 Most Read Articles in JACS for March 2019. Highlighted in an invited Synfacts article.
- ❑ Chatterjee, B.; Gunanathan, C. Catalytic Dearomative Hydroboration of Heteroaromatic Compounds. *J. Chem. Sci.* 2019, 131, 118 (Invited Review article in "Special Issue on 150 years of the Periodic Table").

Conferences and Seminars Attended

International Conference on Organometallics and Catalysis II (ICOC-II, 2020), Goa, 7-10 March 2020.

Invited Talks

- (1) Green Catalytic Transformations. Young Talent in Chemical Sciences (YTCS 2019), Institute of Chemical Technology & RSC, Bhubaneswar, 22 November 2019.
- (2) Green Catalytic Transformations. International Conference on Chemistry for Human Development (ICCHD-2020), University of Kolkata, HIT, 09-11 January 2020.
- (3) Green Catalytic Transformations and



Hydroelementation Reactions: Genesis of Innovative Trends in Chemistry and Environment (GITCE 2020), Department of Chemistry, D.G.Vaishnav College, Chennai, 6th February 2020.

- (4) Green Catalysis Facilitated by Amine-Amide Metal-Ligand Cooperation. 3rd National Conference in Chemistry (NCONC-2020). Department of Chemistry, Indian Institute of Technology Gandhinagar (IITGN), 12-13th February 2020.
- (5) Green Catalysis Facilitated by Amine-Amide Metal-Ligand Cooperation 1st International Conference on Frontiers in Chemical Sciences (ICFCS-2020), Department of Chemistry, Karunya Institute of Technology and Sciences, Coimbatore, March 4-5th, 2020.

Sponsored Projects

Catalytic Activation and Direct Coupling of Ammonia with Arenes and Alkenes by Pincer Complexes (Sept 2017 to August 2020), Science & Engineering Research Board (SERB), New Delhi.

Organic synthesis and bioorganic chemistry

Dr. Chandra Shekhar Purohit,
Associate Professor

My research work is focused on molecular capsule and bioorganic chemistry. Molecular capsules are of great interest due to their possible applications in various fields. For example, their ability to carry guest molecules, and release under mild changes in conditions, is an important feature in drug delivery. Molecular capsules when used as reaction vessels, can accelerate the reaction speed as compared to the bulk solvent environment, and can trap the unstable molecules or reactive intermediates at

room temperature. Self-assembled molecular capsules can also be used for molecular recognition and as sensing materials. Molecular capsule formed by non-covalent interaction(s) such as hydrogen bonding, is highly desirable as these bonds can easily be broken by subtle change in environment. This will help in drug delivery at targeted sites.

Another aspect of my research is to make challenging molecular architecture those are challenging to prepare another aspect of my research is to make challenging molecular architecture those are challenging to prepare.

Publications

- DNA and RNA binding studies on a novel bromo-bridged dimeric copper (II) complex stabilized from a Schiff base ligand. J. Coord. Chem. 2019, 3625 – 3644
- Base mediated green synthesis of enantiopure 2-C-spiro-glycosyl-3-nitrochromenes. Organic & Biomolecular Chemistry, 2019, 17, 74-82

Conferences and Seminars Attended

OCS 2019 at Lucknow

Invited Talks

- 1) "Recent Trends in Material Science" at GM University, Sambalpur.
- 2) "National Conference on Recent Advances in Materials: Green Future" at Centurion University of Technology and Management, Odisha, Bhubaneswar.
- 3) PCNM-2020 at Centurion University of Technology and Management, Balangir campus.

Spectroscopy and Computational



Chemistry

Dr. Himansu Sekhar Biswal, Associate Professor

Himansu S. Biswal obtained his Ph.D. from Tata Institute of Fundamental Research (TIFR), Mumbai, India, where he worked with Professor Sanjay Wategaonkar studying the sulfur centered hydrogen bonds with supersonic-jet spectroscopy. He was a postdoctoral fellow with Professor Michel Mons at CEA, Saclay, France, where he investigated structure and ultrafast excited state dynamics of peptides. Then he moved to Prof. Jennifer P. Ogilvie's research group at University of Michigan, USA to work on 2D-electronic spectroscopy. In 2012, he joined in the school of Chemical Sciences, National Institute of Science Education and Research (NISER). Currently the group is working on 3 major problems

- 1) Unusual non-covalent interactions in biomolecules.
- 2) Implications of amino acid based ionic liquids in catalytic activity, stability, dissolution, and storage of DNA, RNA and proteins.
- 3) Excited state proton transfer and photodynamic therapy mediated through sulfur and selenium centered hydrogen bonds.

The group uses both experimental techniques such as frequency and time resolved fluorescence spectroscopy, gas phase laser spectroscopy, NMR etc. and theoretical methods such as electronic structure calculation, molecular dynamics, docking etc. to investigate the mentioned problems at the molecular level.

Conferences and Seminars Attended

- 1) 1st International Conference on Noncovalent Interaction (ICNI-2019) Lisbon, PORTUGAL
- 2) Spectroscopy and Dynamics of Molecules and Clusters (SDMC-2020), Jaipur, INDIA.

Sponsored Projects

"Electronic and Vibrational Spectroscopic Investigations of Thioamides as Potential Surrogates of Amides in Peptides." Funding Agency: DST-SERB, Duration: 2017 – 2020, (Project File No: CRG/2018/000892; Grant amount: ₹53,22,140/-)

Inorganic and Material Chemistry

Dr. Jogendra Nath Behera, Associate Professor

1. Porous Magnetic Materials: My group is focusing on synthesizing materials that are both porous as well as magnetic because of their potential applications in separation of air and absorption of oxygen from air in a non-cryogenic process.
2. Supercapacitors for layered composite Materials: Layered composite materials of metal chalcogenides with reduced graphene oxide are being prepared and their supercapacitor capacity is being tested, as these materials show potential applications in storage devices.
3. Organic-Inorganic hybrid materials: Organic-inorganic hybrid open-framework bismuth sulfates with the layered and three-dimensional structures have been synthesized and characterized. The arrangement of bismuth atom in one of the compounds suggests the presence of stereo active lone pair of electrons. All compounds show good fluorescence properties



exhibiting blue luminescence.

4. Electrocatalyst for Water Splitting: Designing New Catalysts based on earth abundant non-precious elements such as Ni, Co, Fe, Mn, Cu, S, Se, Te, N and P which show high catalytic activity for oxygen evolution reaction (OER) and hydrogen evolution reaction (HER) - the two half-cell reactions for water splitting.

Awards and Honours: Contribution to the Powder Diffraction File in Release 2020 (ICDD).

Understanding the behavior of some interesting nanostructured materials by using steady state and time-resolved fluorescence spectroscopy

Dr. Moloy Sarkar, Associate Professor

We are mainly focused in understanding the mechanism of important photo-processes such as electron transfer, energy transfer etc between water soluble quantum dots/metal nano particles and organic dye molecules/aggregates. To achieve that selected fluorescent metal nano clusters and quantum dots are synthesized in aqueous medium and characterized by spectroscopic and microscopic techniques and the said photophysical processes are investigated by examining the spectral and temporal behaviour of the systems using steady state and time-resolved absorption and fluorescence techniques. The outcomes of these studies are expected to be useful in both energy-related and biological applications. We also try to understand the microscopic behaviour of complex fluids such as room temperature ionic liquids and deep eutectic solvents as proper understanding on these specialized media will be helpful for these

systems to be used in avenues such as catalysis, lithium ion batteries etc. Several spectroscopic techniques such as NMR, EPR fluorescence correlation spectroscopy time-resolved fluorescence anisotropy are used during the investigations. Since ionic liquids (ILs) are also being used in many biological applications, in recent times we are also trying to understand the ILs-biomolecules interactions at both ensemble-averaged and single molecule level.

Publications

- Highly efficient energy transfer from water soluble Zinc-Silver-Indium Sulphide quantum dot to organic J aggregates., Banerjee, N. Preeyanka, H. Dey, S. Seth, A. Rahaman and M. Sarkar.*Phys. Chem. Chem. Phys., 2020 (2020, DOI:10.1039/D0CP01845G).
- Highly efficient energy transfer from fluorescent gold nanoclusters to organic J-aggregates. S. Banerjee, N. Preeyanka, H. Dey, S. Seth, A. Rahaman and M. Sarkar.*J. Phys. Chem. C. 2020, 124, 5009-5020.
- How Does Addition of Lithium Salt Influence the Structure and Dynamics of Choline Chloride-Based Deep Eutectic Solvents? , S. Barik, M. Chakraborty and M. Sarkar.* J. Phys. Chem. B. 2020, 124, 2864-2878.
- Interaction of lysozyme with monocationic and dicationic liquids: Towards finding a suitable medium for biomacromolecules. M. M. Islam, S. Barik, N. Preeyanka and M. Sarkar.*J. Phys. Chem. B. 2020, 124, 961-973.
- Understanding the behavior of monocationic and dicationic room-temperature ionic liquids through resonance energy-transfer studies. M. Chakraborty, T. Ahmed and M. Sarkar.*Langmuir, 2019, 35, 16172-16184.



Conferences and Seminars Attended/Invited Talks

- (1) In International Conference in Recent Trends in Chemical Sciences, Pt. Ravishankarshukla University, Raipur, India, in November 2019.
- (2) In International conference on Smart Materials for Sustainable Technology (SMST-2020), February 2020 At IIT GOA.

Sponsored Projects

Understanding the photophysics of molecular (organic) aggregates...nanoscale materials for optoelectronic applications" from SERB (Ongoing Project)

Awards and Honours: Received affiliate membership from Royal Society of Chemistry, UK.

Synthesis and Biochemical Studies of modified DNA, RNA and peptide analogues

Dr. Nagendra K. Sharma, Associate Professor

Nucleic acids and proteins are natural biopolymers. The nucleic acid (DNA/RNA) are genetic materials of organisms. The protein-protein/protein nucleic acid interactions regulate numerous biochemical reactions and provide opportunities for the development of therapeutic drugs. The native nucleosides/nucleotides and peptides molecules have limitations such as stability, cell permeability and site selectivity to employ directly as drugs. The development of gene based therapeutic drugs are emerging technology to minimize the off target effects of other similar small molecule drug candidate. My research group involve in the synthesis and biochemical of structurally modified nucleic acid (DNA/RNA) and peptides analogues for the development of potential therapeutic drug

candidate. Recently we have synthesized and studies their biochemical studies of various new dNTP/ddNTP/DNA/RNA/nucleosides/unnatural amino acids/peptides. The synthesis of these molecules are challenging. Pleasantly we have established a research group in my laboratory for syntheses of those analogues along with other bioactive natural/synthetic molecules with help of PhD-Scholar, Research Associates (RAs) and M.Sc. students. Importantly, some of them have shown remarkable bioactivities and consider as the drug candidates. For example, troponyl-nucleic acid/-peptides and ampyronyl peptides. We have planned to target those interactions with small nucleosides/ oligonucleotides/ peptides to find affordable drug candidates for gene specific diseases including antiviral drugs.

Publications

- Bollu, A. Sharma, N. K.*., ChemBioChem 2019, 20, 1-10.
- Bollu, A. Sharma, N. K.* Syntheses and Conformational Analysis of New Aminopyrazolonyl Amino Acid (APA)/Peptides, Eur. J. Org. Chem. 2019, 1286-1292.
- Bollu, A. Sharma, N. K.* Cleavable Amide Bond: Mechanistic Insight of Cleavable 4-Aminopyrazolyloxy Acetamide at low pH, J. Org. Chem. 2019, 84, 5596-5602.
- Mohanlal, S. Sharma, N. K.* Syntheses of 3-Aryl-Alaninyl Derivatives by sp³ C-H Activation with Pd(OAc)₂ Catalyst/Pivalic Acid in DCE and Their Structural Studies in Solid State, Chem. Select, 2019, 4, 7058-7066
- Palaia, B. B., Soren, R.; and Sharma, N. K.* BODIPY Analogues: Synthesis and Photophysical studies of difluoro Boron complexes from 2-Aminotropone Scaffolds



through N,O-Chelation. *Org. Biomol. Chem.* 2019, 17, 6497-6505.

- Gade, C. R., Sharma* N. K. Synthesis and biochemical evaluation of Aminopropanolyl-Thymine tri-Phosphate (ap-TTP). *Nucleosides Nucleotides Nucleic Acids.* 2020;39, 730743

Conferences and Seminars Attended / Invited Talks

- (1) School of Applied Sciences, Kalinga Institute of Industrial Technology (KIIT), Bhubaneswar.
- (2) Invited Lecture, (May 15-17) SupraBio2019, Barcelona, Spain.
- (3) Conference N-COS-2020 (March 02-03), University of Berhampur, Odisha

Sponsored Projects

Genome Engineering Technologies with project reference BT/PR26143/GET/119/112/2017; Department of Biotechnology (DBT), Govt. Of India, New Delhi, Title: CRISPR-RNA-Cas9 System: Syntheses and Biochemical Evaluations of Nucleobase Modified tropolonyl-Ribose Nucleoside in CRISPR-RNA (Duration: 03 years); Amount: 84.0 Lakh.

Organic Synthesis

Dr. P. C. Ravikumar, Associate Professor

Research in our group revolves around transition metal catalysed activation of inert bonds such as carbon-carbon, carbon-nitrogen and carbon-hydrogen & carbon-oxygen bonds and its application for the synthesis of a variety of biologically active heterocycles and pharmaceuticals.

Publications

- Bedadyuti Vedvyas Pati, Asit Ghosh, P. C. Ravikumar, Rhodium-Catalyzed Room Temperature C-C Activation of Cyclopropanol for One-Step Access to Diverse 1,6-Diketones, *Org. Lett.*, 2020, 22, 2854.
- Shyam Kumar Banjare, Pragati Biswal, P. C. Ravikumar, Cobalt-Catalyzed One-Step Access to Pyroquilon and C-7 Alkenylation of Indoline with Activated Alkenes Using Weakly Coordinating Functional Group, *J. Org. Chem.*, 2020, 85, 5330.
- Pragati Biswal, Bedadyuti Vedvyas Pati, Rajesh Chebolu, Asit Ghosh, P. C. Ravikumar, Hydroxylamine OSulfonic Acid (HOSA) as a RedoxNeutral Directing Group: Rhodium-Catalyzed, Additive Free, OnePot Synthesis of Isoquinolines from Arylketones, *Eur. J. Org. Chem.*, 2020, 1006. (Selected as Very Important Paper). Highlighted in *Synfacts* 2020;16 (07): 0776.
- Tanmayee Nanda, and P. C. Ravikumar, A Palladium-Catalyzed Cascade C-C Activation of Cyclopropenone and Carbonylative Amination: Easy Access to Highly Functionalized Maleimide Derivatives, *Org. Lett.*, 2020, 22, 1368.
- Prateep Singh Sagara, Prem Felix Siril, and Ponneri Chandrababu Ravikumar, N-Amino-7-Azaindole as N, N'- Bidentate Directing Group: Ruthenium-Catalyzed Oxidative Annulation of N-(7-Azaindole) Benzamides with Alkynes via C-H Bond Activation, *J. Org. Chem.*, 2019, 84, 12314.
- Shyam Kumar Banjare, Tanmayee Nanda, and P. C. Ravikumar, Cobalt-Catalyzed Regioselective Direct C 4 Alkenylation of 3 Acetylundole with Michael Acceptors Using a



Weakly Coordinating Functional Group Org. Lett., 2019, 21, 8138.

- Shyam Kumar Banjare, Rajesh Chebolu, and P. C. Ravikumar, Cobalt Catalyzed Hydroarylation of Michael Acceptors with Indolines Directed by a Weakly Coordinating Functional Group, Org. Lett., 2019, 21, 4049.

Invited Talks

ACS Spring National Conference 2020

Sponsored Projects

Ongoing SERB Project: Development of first row transition metal catalyzed C-H activation approach for the enantioselective synthesis of complex tri- and tetracyclic alkaloid natural product and their hybrid structures.

Weak Interactions to Control C-S Bond Formation

Dr. Prasenjit Mal, Associate Professor

On the way to weakening of strong chemical bonds via weak interactions (soft fore) is significant in both making new chemical systems with functions or to understand the complex functions of living systems. Currently, we are working on utilization of soft forces or cooperative multiple weak interactions towards making of C-X (X = N, S, O, etc.) bonds. Therefore, several lowenergy and lowlevel interactions or weak interactions are explored to control certain reactivity of chemical systems. Thus, we have developed our research mainly to develop selective C-N and C-S bond formation reactions under metal free and mild condition with an anticipation that the reactivity of those systems could be controlled by soft forces.

Publications

- M. Pramanik, K. Choudhuri, A. Mathuri and P. Mal, Dithioacetalization or thioetherification of benzyl alcohols using 9-mesityl-10-methylacridinium perchlorate photocatalyst, Chem. Commun., 2020, 10.1039/D1030CC02352C.
- M. Pramanik, K. Choudhuri, S. Chakraborty, A. Ghosh and P. Mal, (Z)-Selective anti-Markovnikov or Markovnikov thiol-yne-click reactions of an internal alkyne by amide hydrogen bond control, Chem. Commun., 2020, 56, 2991-2994.
- Mandal, A. Choudhury, S. Sau, P. K. Iyer and P. Mal, Exploring Ambipolar Semiconductor Nature of Binary and Ternary Charge-Transfer Cocrystals of Triphenylene, Pyrene, and TCNQ, J. Phys. Chem. C, 2020, 124, 6544-6553.
- Mandal, A. Choudhury, R. Kumar, P. K. Iyer and P. Mal, Exploring the semiconductor properties of a charge transfer cocrystal of 1-aminopyrene and TCNQ, CrystEngComm, 2020, 22, 720-727.
- K. Choudhuri, M. Pramanik and P. Mal, Direct C-S Bond Functionalization of Benzyl Mercaptan, Eur. J. Org. Chem., 2020, 3906-3913.
- Bal, S. Maiti and P. Mal, Strategies to Control Hypervalent Iodine - Primary Amine Reactions, Chem. Asian J., 2020, 15, 624-635.
- S. Sau, A. Bose and P. Mal, C-H Mono-Nitration of Indolines using tert-Butyl Nitrite, Asian J. Org. Chem., 2019, 8, 1854-1857.
- M. Pramanik, K. Choudhuri and P. Mal, N-Iodosuccinimide as Bifunctional Reagent in (E)-Selective C(sp²)-H Sulfonylation of Styrenes, Asian J. Org. Chem., 2019, 8, 144-150.



- Parida, K. Choudhuri and P. Mal, Unsymmetrical Disulfides Synthesis via Sulfenium Ion, *Chem. Asian J.*, 2019, 14, 2579-2583.
 - Mandal, P. Swain, B. Nath, S. Sau and P. Mal, Unipolar to Ambipolar Semiconductivity Switching in Charge Transfer Cocrystals of 2,7-di-tert-Butylpyrene, *CrystEngComm*, 2019, 21, 981-989.
 - Mandal, K. Rissanen and P. Mal, Unravelling substitution effects on charge transfer characteristics in cocrystals of pyrene based donors and 3,5-dinitrobenzoic acid, *CrystEngComm*, 2019, 21, 4401-4408.
 - Mandal, A. Choudhury, P. K. Iyer and P. Mal, Charge Transfer Versus Arene-Perfluoroarene Interactions in Modulation of Optical and Conductivity Properties in Cocrystals of 2,7-Di-tert-butylpyrene, *J. Phys. Chem. C*, 2019, 123, 18198-18206.
 - S. Maiti, M. T. Alam, A. Bal and P. Mal, Nitrenium Ions from Aminelodine (III) Combinations, *Adv. Synth. Catal.* 2019, 361, 4401-4425.
 - K. Choudhuri, M. Pramanik and P. Mal, 3-Iodanes as Visible Light Photocatalyst in Thioacetalization of Aldehydes, *Eur. J. Org. Chem.*, 2019, 4822-4826.
 - K. Choudhuri, S. Maiti and P. Mal, Iodine (III) Enabled Dehydrogenative Aryl C-S Coupling by in situ Generated Sulfenium Ion, *Adv. Synth. Catal.* 2019, 361, 1092-1101.
 - Bose, S. Sau and P. Mal, Intramolecular C(sp³)-H Imination towards Benzimidazoles Using Tetrabutylammonium Iodide and tBuOOH, *Eur. J. Org. Chem.*, 2019, 4105-4109.
 - Bose and P. Mal, Mechanochemistry of supramolecules, *Beilstein J. Org. Chem.*, 2019, 15, 881-900.
 - Bose, S. Maiti, S. Sau and P. Mal, An intramolecular C(sp³)-H imination using PhI-mCPBA, *Chem. Commun.*, 2019, 55, 2066-2069.
 - Bose, S. Maiti and P. Mal, CHAPTER 9: Soft Forces in Organic Synthesis by C-N Coupling Reactions. In *Noncovalent Interactions in Catalysis*, K. T. Mahmudov, M. N. Kopylovich, M. F. C. Guedes da Silva and A. J. L. Pombeiro, Eds. The Royal Society of Chemistry, 2019; pp 188-208.
 - S. K. Bera, M. T. Alam and P. Mal, C-N Coupling via Antiaromatic Endocyclic Nitrenium Ions, *J. Org. Chem.*, 2019, 84, 12009-12020.
 - Bal, S. Maiti and P. Mal, Steric and Electronic Effect on C2-H Arylation of Sulfonamides, *ChemistrySelect*, 2019, 4, 7010-7014.
- Invited Talks**
- (1) Weak Interactions to Control C-Hetero Bond Formation Reaction Department of Chemistry, North Eastern Hill University; Shillong; May 31, 2019
 - (2) Weak Interactions to Control C-Hetero Bond Formation Reactions Department of Chemistry, NIT Meghalaya; Shillong; May 30, 2019
- Nanostructured Materials for energy conversion and storage**
Dr. Sudip Barman, Associate Professor
- Synthesis of nanostructured materials for energy conversion and storage systems: The artificial photosynthesis (photo-catalytic hydrogen evolution via water splitting) is most promising and convenient approach to convert solar energy into chemically store energy. New nanocatalysts



based on different metal and transition metals composite are developed for electrochemical water splitting hydrogen production. Electric double layer / pseudo capacitors and Battery are electrochemical energy storage devices. We developed new carbon based nanostructured composite materials and 1D, 2D Metal oxides, Sulphides for electric double layer capacitors and battery applications.

Publications

- Manas Kumar Kundu, Ranjit Mishra, Tanmay Bhowmik, Sarat Kanrar, Sudip Barman, International Journal of Hydrogen Energy, 2020, 45 (11), 6036-6046

Molecular Spectroscopy

Dr. Subhadip Ghosh, Associate Professor

Photoinduced electron transfer (PET) from Nmethylaniline (NMA) to a photoexcited CdTe quantum dot (QD*) is studied in toluene. The PET mechanism at low to moderate quencher (NMA) concentrations (<0.08 M) remains mostly collisional with some contributions from QDNMA complex formation. However, at high quencher concentrations (>0.10 M), QDs form larger numbers of static complexes with NMA molecules leading to a steep positive deviation in the steadystate Stern–Volmer curves. An isothermal titration calorimetry (ITC) study confirms the formation of QDNMA complexes ($K \sim 150$ M $^{-1}$) at high quencher concentrations. Fitting our experimental data using a stochastic kinetic model indicates that the number of NMA molecules attached per QD at highest NMA concentration (~ 0.16 M) used in this study decreases from ~ 0.76 to ~ 0.47 with reducing the QD size from ~ 5.2 nm to ~ 3.2 nm. However, the PET rate increases with decreasing QD size, which is commensurate with the observation that

the chemical driving force (ΔG) increases with decreasing the QD particle size. We have analyzed the PET kinetics mainly by using SternVolmer fittings. However, in some cases Tachiya's stochastic kinetic model is used for stoichiometric analysis, which seems to be useful only at high quencher concentrations. The measured PET rate coefficients in all the cases are found to be at least an order of magnitude lower when compared to the diffusioncontrolled rate of the reaction medium.

Bimolecular photoinduced electron transfer (PET) from excited state CdTe quantum dot (QD*) to an electron deficient molecule 2,4dinitrotoluene (DNT) is studied in toluene. We observed two types of QDDNT complex formations; (i) nonemissive complex, in which DNT is embedded deep inside the surface polymer layer of QD and (ii) emissive complex, in which DNT molecules are attached to QDs but approach to the QD core is shielded by polymer layer. Because of its nonemissive nature, the lifetime of QD is not affected by dark complex formation, though the steadystate emission is greatly quenched. However, emissive complex formation causes both, lifetime and steadystate emission quenching. In our fitting model, consideration of Poisson distribution of the attached quencher (DNT) molecules at QD surface enables a comprehensive fitting to our time resolved data. QDDNT complex formation was confirmed by an isothermal titration calorimetry (ITC) study. Fitting to the time resolved data using a stochastic kinetic model shows moderate increase (0.05 ns $^{-1}$ to 0.072 ns $^{-1}$) of intrinsic quenching rate with increasing the QD particle size (from ~ 3.2 nm to ~ 5.2 nm). Our fitting also reveals that the number of DNT molecules attached to a single QD increases from ~ 0.1 – 0.2 to ~ 1.2 – 1.7 , as the DNT concentration is increased from ~ 1 mM to 17.5 mM



. Complex formation at higher quencher concentration assures that the observed PET kinetics is a thermodynamically controlled process where solvent diffusion has no role on it.

Publications

- Kiran Bharadwaj, Himanshu Choudhary, Soumitra Hazra, Subhadip Ghosh* Study of Interfacial Charge Transfer from an Electron Rich Organic Molecule to CdTe Quantum Dot by using Stern-Volmer and Stochastic Kinetic Models. *ChemPhysChem* 2019, 21, 415-422.
- Kiran Bharadwaj, Himanshu Choudhary, Soumitra Hazra, Subhadip Ghosh Role of Emissive and Non-Emissive Complex formations in Photoinduced Electron Transfer Reaction of CdTe Quantum Dots. *ChemAsianJ* 2019, 14, 4207-4216.

Conferences and Seminars Attended/Invited Talks

- (1) 2nd Quantum Symposium taking place May 22-24, 2019 in Berlin-Adlershof, Germany.
- (2) Recent Trends in advanced functional material, Jan 13-14, 2020, Midnapore collage

Sponsored Projects

- (1) DAE funded project, cost ~ 3.5 cr
- (2) CSIR funded project (2017-2020) Cost ~ 20 lakhs

Bioinorganic Chemistry

Dr. Sanjib Kar, Associate Professor

Transition metal complexes are important in catalysis, materials synthesis, photochemistry, and biological systems. Display diverse chemical, optical and magnetic properties. In that context we are exploring the synthesis, structural characterization, spectroscopic properties

(Raman, IR, and NMR), electrochemistry, magnetic properties and chemical reactions of novel transition metal complexes.

The enzyme family cytochrome P-450 (cytochrome P-450s are oxidation enzymes, which bear a thiolate group as an axial ligand and catalyze the oxidation of organic substances by oxygen activation) catalyzes the incorporation of one oxygen atom from O₂ into a variety of organic substrates. We prepare chemical models (metal porphyrin/corrole) of cytochrome P-450 for catalytic oxygenation of olefins and hydrocarbons.

The synthesis, structural and spectral characterization of novel metallo-corrole/porphyrin complexes, generation of their aggregates in the form of nanomaterials and application of those nanoparticles in the fabrication of semiconductor device.

Synthesis and application of novel metalloporphyrin/ corrole (redox innocent metal) based nano-particles in bio-imaging.

Publications

- Mondal, S., Naik, P.K., Adha, J.K. and Sanjib Kar* Synthesis, characterization, and reactivities of high valent metal-corrole (M=Cr, Mn, and Fe) complexes. *Coordination Chemistry Reviews*, 2019, 400, p.213043.
- Kasturi Sahu, Sruti Mondal, Bratati Patra, Tanmoy Pain, Sajal Kumar Patra, Carsten Dosche *, and Sanjib Kar* Regioselective Thiocyanation of Corroles and the synthesis of Gold nanoparticle-Corrole assemblies, *Nanoscale Adv.*, 2020, 2, 166-170
- Sruti Mondal, Antara Garai, Pratyush Kumar Naik, Jogesh Kumar Adha and Sanjib Kar* Synthesis and characterization of Antimony



(V)-oxo corrole complexes, *Inorganica Chimica Acta*, 2020, 501, 119300 (Invited Article).

- Sruti Mondal, Kasturi Sahu, Bratati Patra, Subhrakant Jena, Himansu Biswal*, Sanjib Kar* A new synthesis of porphyrin via a putative trans-manganese(IV)-dihydroxide intermediate, *Dalton Trans.*, 2020, 49, 1424-1432
- Bratati Patra, Sruti Mondal, Sanjib Kar* Corroles (Invited book chapter) *Encyclopedia of Inorganic and Bioinorganic Chemistry*, edited by Robert A Scott, and Tim Storr, Chichester, UK: John Wiley and Sons, 2020, 1-24.
<https://doi.org/10.1002/9781119951438.eibc272>.
- Bratati Patra, Sruti Mondal, Sanjib Kar* Cr Complexes (+6, +5, and +4 formal oxidation states) (Invited book chapter); In *comprehensive Coordination Chemistry III*, edited by Daniel J. Mindiola Eds.: Pergamon Press: Oxford, 2020; MS 40010, in press (accepted manuscript).

Invited Talks

- (1) Delivered an Invited lecture in the International Conference on "Modern Trends In Inorganic Chemistry-XVIII" at the IIT Guwahati from 11-14th December, 2019.
- (2) Delivered an Invited Flash Talk followed by Poster presentation in the "International Conference on Organometallics and Catalysis (ICOC-2020)" at the Goa from 7-10th March, 2020

Sponsored Projects

High valent Metallo-Corroles: Synthesis, characterization and applications to catalysis
Period: 2017-2020 Funding Agency: SERB-India
Amount ₹54,09,820/-.

Main group Organometallics, Inorganic synthesis and Catalysis

Dr. Sharanappa Nembenna,
Associate Professor

Our research group is currently focusing on cheaper, Earth-abundant, less toxic, and biocompatible main group elements such as zinc, magnesium, calcium, and aluminum-based catalysts for various organic transformations. Moreover, we developed a new -diketiminato analogue, conjugated bis-guanidinate (CBG) ligand containing C, H, and N elements. In this context, recently synthesized structurally characterized zinc, magnesium, and aluminum hydride complexes bearing a CBG ligand. Further, we investigated the catalytic applications of those complexes in the hydroboration of various organic substrates, such as alkynes, alkenes carbonyl compounds, and nitriles.

Publications

- Aluminum-Catalyzed Selective Hydroboration of Nitriles and Alkynes: A Multifunctional Catalyst N. Sarkar, S. Bera and S. Nembenna* *J. Org. Chem.* 2020, 85(7), 4999-5009.
- Mono- and Bimetallic Aluminum Alkyl, Alkoxide, Halide and Hydride Complexes of a Bulky Conjugated Bis-Guanidinate (CBG) Ligand and Aluminum Alkyls as Pre-catalysts for Carbonyl Hydroboration T. Peddaraao, N. Sarkar, and S. Nembenna* *Inorg. Chem.* 2020, 59(7), 4693-4702.



- Synthesis of Novel 4-Substituted Coumarins, Docking Studies, and DHODH Inhibitory Activity D. Patagar, R. Kusanur*, N, D. Sitwala, ; M. D. Ghate, S. Shanmugasundar; S. Nembenna, P. A. Gediya, Journal of Heterocyclic Chemistry 2019, 56(10), 2761-2771.

Conferences and Seminars Attended

Leibniz Lecture and workshop August 26th 2019
IIT-Madras

Invited Talks

Aluminum-Catalyzed Reduction of Unsaturated Organic Substrates at IIT-Madras, Leibniz Lecture and workshop August 26th 2019.

Synthetic Organic Chemistry

Dr. S. Peruncheralathan, Associate Professor

Organic synthesis is a main theme of our research. Synthetic organic molecules have various applications in various fields ranging from biomedical to material sciences. Our research group makes those molecules using simple, mild, and greener synthetic protocols. We demonstrated some of these molecules in organic materials for AIEE properties, and other derivatives used as antiangiogenic properties. Further we devised a protocol to synthesize enantiomerically enriched molecules containing all-carbon quaternary centres.

Publications

- Core-modified 48 π and 42 π decaphyrins: syntheses, properties and structures, A. Ghosh, S. Dash, A. Srinivasan, C. H. Suresh, S. Peruncheralathan, and T. K. Chandrashekar Org. Chem. Front. 2019, 6, 3746-3753

Conferences and Seminars Attended

- (1) Participated in the International conference "Emerging Trends in Chemistry" during July 12-15, 2019 at the Discipline of Chemistry at IIT Indore.
- (2) Participated in "Organic Chemistry Symposium' during September 13-14, 2019 (OCS-2019) at Hyatt Regency, Lucknow
- (3) Participate in the XX NOST-Organic Chemistry Conference during December 4-7, 2019 at The Ananta, Udaipur.

Invited Talks

- (1) Delivered an invited lecture in 56th Annual Convention of Chemists during November 14-16, 2019 at the School of Studies in Chemistry, Pt. Ravishankar Shukla Raipur.
- (2) Invited talks delivered at Erode Arts College, Erode during December 13 – 16, 2019.
- (3) Delivered an invited talk in "New Frontiers in Chemistry-from Fundamentals to Applications-III (NFCFA 2019)" during Dec 20-22, 2019 at the Department of Chemistry, BITS Pilani K. K. Birla Goa campus.
- (4) Delivered an invited lecture in "National Organic Synthesis Conference" N-COS-2020, during March, 2 – 3, 2020 at the Department of Chemistry, Berhampur University.

Molecular Reaction Dynamics

Dr. Upakarasamy Lourderaj, Associate Professor

We are interested in the computational studies of the processes that happen during a chemical reaction. We use classical trajectories simulations as a tool to study the dynamics of



chemical reactions. The simulation results are compared with experiments. Broadly, we work on the following topics:

- Mechanisms and dynamics of chemical reactions
- Chemical reactions at interfaces
- Development of methods and algorithms for ab initio direct dynamics simulation

Publications

- Theoretical investigation of the isomerization pathways of diazenes: torsion vs. inversion, Aarti Sindhu, Renuka Pradhan, Upakarasamy Lourderaj and Manikandan Paranjothy, Phys. Chem. Chem. Phys. 2019, 21, 15678.
- Can reactions follow. Non-traditional second-order saddle pathways avoiding transition states? Renuka Pradhan and Upakarasamy Lourderaj, Phys. Chem. Chem. Phys. 2019, 21, 12837.
- Machine Learning in Chemical Dynamics, Rupayan Biswas, Richa Rashmi, and Upakarasamy Lourderaj, Resonance, 2020, 25, 59.

Conferences and Seminars Attended

- (1) iCOMET 2019, Hefei China. (September 2019)
- (2) Machine Learning for Science, IIIT Hyderabad (November 2019)
- (3) DAE Computational Chemistry Symposium (November 2019)
- (4) NSRAC 2020, Pondicherry University (February 2020)
- (5) SDMC 2020, Kumbhalgarh (February 2020)
- (6) ICFCs 2020, Karunya University (March 2020)

Invited Talks

- (1) Mechanisms and Dynamics of Chemical Reactions, APSA College, Tirupattur, Tamil Nadu (October 2019)
- (2) Computational Studies of the Dynamics of Chemical Reactions
- (3) Harbin Institute of Technology, China (September 2019)
- (4) Unusual Reaction Mechanisms: A Tale of Two Molecules IIT Bhubaneswar (February 2020)

Sponsored Projects

Computational Studies on the mechanisms and dynamics of substitution reactions, SERB 2018-21

Hybrid Organic Inorganic Materials

Dr. Krishnan Venkatasubbaiah, Associate Professor

The chemistry in my group will be interdisciplinary which includes inorganic, polymer and organic. My research focuses on the development of new functional materials which have potential applications in catalysis and making sensors, OLED's and NLO materials.

Publications

- K. Dhanunjayarao, S. Shreenibasa, N. Prakash, S. Joseph Ponniah, Krishnan Venkatasubbaiah* Organometallics 2019, 38, 870-878.
- R. V. R. N. Chinta, B. P. R. Aradhyula, A. C. Murali, Krishnan Venkatasubbaiah* J. Organomet. Chem. 2019, 891, 20-27.
- M. Ramesh, P. Biswal, M. S. Subramani, S. Samser, Krishnan Venkatasubbaiah* J. Org. Chem. 2019, 84, 10472-10480.
- V. Mukundam, S. Shreenibasa, K. Anupa, R. Das, Krishnan Venkatasubbaiah*, J. Mater.



Chem. C. 2019, 7, 12725 – 12737.

- P. Dudhe, Krishnan Venkatasubbaiah, B. Pathak, V. Chelvam, Org. Biomol. Chem. 2020, 18, 1582–1587.
- B. P. R. Aradhyula, R. V. R. N. Chinta, K. Dhanunjayarao, Krishnan Venkatasubbaiah*, RSCAdvances, 2020, 10, 13149–13154.
- V. Mukundam, S. Shreenibasa, K. Anupa, A. C. Murali, P. Nayak, R. Das, Krishnan Venkatasubbaiah* Dalton Trans. 2020, 49, 7737–7746 (selected as one of the HOT articles)

Sponsored Projects

Imidazole containing polymers for the selective detection of fluoride ion and synthesis of boron-complexes, (EMR/2017/000620); Sanctioned amount: Rs. 5888845.00 Funding Agency: SERB-DST.

Additional information, if any

Convener, Local Chapter of the region, Bhubaneswar.



SCHOOL OF MATHEMATICAL SCIENCES

Order theoretic Functional Analysis

Dr. Anil Kumar Karn, Associate Professor

Research work done during this period may be divided broadly into three parts. The first part goes into the study of M -ideals of an order smooth ∞ -normed space and its quantized version CM -ideal of a matrix order smooth ∞ -normed space. We also studied the quantization of $A_0(K)$ -spaces. These works were done jointly with my Ph. D. student Anindya Ghatak which resulted in three papers and were part of his Ph. D. thesis. In the second part we studied absolute compatibility in operator algebras and characterized in the case of $\mathbb{M}_n$. We also studied absolute compatibility preserving maps. These works were done jointly with Nabin Kumar Jana and Antonio M. Peralta and resulted in another two papers. In the third part we studied and characterized isometries between absolute order unit spaces and complete isometries between absolute matrix order unit spaces. This was in collaboration with my another Ph. D. student Amit Kumar and resulted in the sixth paper in the period.

Modular forms

Dr. Brundaban Sahu, Associate Professor

We study differential operators and arithmetic of Fourier coefficients of modular forms. Using theta series, we study number of representations of a natural by certain quadratic forms.

Blocking sets in projective spaces

Dr. Binod Kumar Sahoo, Associate Professor

We are able to characterize the minimum size blocking sets of external/ tangent/ secant lines of $PG(3, q)$ with respect to an elliptic quadric in it.

Cryptography and Boolean function

Dr. Deepak Kumar Dalai, Reader-F

- Algebraic cryptanalysis
- Cryptanalysis of stream ciphers
- Studying and designing cryptographically significant Boolean functions

Hardy inequality and Stein Weiss inequality

Dr. Sanjay Parui, Reader-F

My research work was about to study Hardy, Stein Weiss inequality in the setting of Dunkl operators. Presently I am working on Boundedness property of Lacunary maximal function for Dunkl operator.

Number Theory, Modular forms

Dr. Jaban Meher, Reader-F

In this year, I mainly worked on the mod p theories of Hermitian Jacobi forms and Hermitian modular forms. We have proved congruences among Hermitian Jacobi forms and Hermitian modular forms.

Zero divisor graphs, Power graph of finite groups

Dr. Kamal Lochan Patra, Reader-F

- Zero divisor graphs: We study the Laplacian eigenvalues of the zero divisor graph of the ring $\mathbb{Z}_n$.
- Power graph of finite groups: We study vertex connectivity and minimum degree of the power graph of different finite groups.

Partial Differential Equations

Dr. Manas Ranjan Sahoo, Reader-F

- Currently we I am working on a conservation



law with point source term. I am basically interested to construct explicit solution and study the structure of the solution (large time behaviour and shock structure).

- Also we are working on a general equation whose particular case is the zero pressure gas dynamics equation. We are interested to construct a shadow wave solution for this general system with BV initial data. This is an ongoing work with Mr. Abhrojyoti Sen and Anupam Pal Choudhury.

Enumerative Geometry and Gromov-Witten Invariants

Dr. Ritwik Mukherjee, Reader-F

I work on enumerating singular curves in a suitably ample Linear System. I have also worked on enumerating stable maps with singularities using the theory of Gromov-Witten Invariants.

Geometric Similarity invariants of Cowen-Douglas Operators

Dr. Dinesh Kumar Keshari, Reader-F

In 1978, M. J. Cowen and R.G. Douglas introduce a class of operators (known as Cowen-Douglas class of operators) and associates a Hermitian holomorphic vector bundle to such an operator in a very influential paper. They give a complete set of unitary invariants in terms of involving the curvature and its covariant partial derivatives. At the same time, they ask: can one use geometric ideas to characterize completely the similarity invariants of Cowen Douglas operators? We give a partial answer to this question. In this paper, we show that the curvature and the second fundamental form completely characterize the similarity invariants for a norm dense class of Cowen-Douglas operators.

Probability Theory

Dr. Nabin Kumar Jana, Reader-F

Quantum computation is knocking the door of modern era in which probability theory is the key. In that completely positive maps plays vital role. Currently studied the ordered structure of a C^* -algebra to explore the possibility to give an alternative approach for quantum stochastic process through ordered structure.

Braided quantum groups

Dr. Sutanu Roy, Reader-F

- Constructed new examples of braided quantum groups: braided free Orthogonal Quantum Groups and braided quantum $E(2)$ groups.
- Developed a general theory of braided quantum groups.
- Found analytic solution of $(1+1)$ -dimensional Landau equation with viscosity.

Generalized Araki-Woods Factors

Dr. Panchugopal Bikram, Reader-F

I work on Operator algebra, von Neumann algebras. Recently I am working on q -deformed Araki-Woods von Neumann algebra, ergodic theory etc.

Transcendental Number Theory

Dr. K. Senthil Kumar, Assistant Professor

Most of my recent works and problems are connected to the transcendence and algebraic independence of images of one parameter subgroups of algebraic groups. Recently, I have improved a result of Tubbs and Chudnovsky regarding fields of transcendence degree at least two over the field of rational numbers.



Fractional BV Spaces and conservation Laws

Dr. Anupam Pal Choudhury,
Assistant Professor

The current project focuses on a systematic study of hyperbolic conservation laws in the space of functions of fractional bounded variations. As part of this project, we are studying strictly hyperbolic triangular systems with a decoupled nonlinear conservation law and a coupled linear transport equation with a discontinuous velocity. Such systems are known to create measure solutions for the initial value problem. Adding a uniform strictly hyperbolic assumption on such systems we are trying to obtain bounded solutions in fractional BV spaces under optimal fractional regularity of the initial data.

Algebraic Geometry: Linear Series

Dr. Krishanu Dan, Assistant Professor

- Seshadri constant of a line bundle over a smooth, projective variety contains local data about the behaviour of curves on the variety. This is a topics of immense interest, and related to several other conjectures. I'm interested in Seshadri constant over higher dimensional varieties, about which not much is known.
- Coherent system is a generalization of classical Brill-Noether theory, and is already proved to be highly effective in studying Brill-Noether theory over curves. But it was not studied much over higher dimensional varieties. I'm interested in coherent system over surfaces, and its relation with Brill-Noether theory.

Publications (2019-20)

Dr. Anil Kumar Karn

- $\$M\$$ -ideals and split faces of the quasi state space of a non-unital ordered Banach space, Anindya Ghatak and Anil Kumar Karn; *Positivity*, 23(2) (2019), 413-429. (DOI: 10.1007/s11117-018-0614-1); (<https://arxiv.org/abs/1704.07628>). (<https://rdcu.be/7RZx>).
- $\$CM\$$ -ideals and $\$L^{[1]}\$$ -matricial split faces, Anindya Ghatak and Anil K. Karn; *Acta Sci. Math. (Szeged)*, 85(3-4) (2019), 659-679.
- Quantization of $\$A_{[0]}(K)\$$ -Spaces, Anindya Ghatak and Anil Kumar Karn; *Operator and Matrices*, 14(2) (2020), 381-399. (<https://arxiv.org/abs/1802.03481>)
- Contractive linear preservers of absolutely compatible pairs between C^* -algebras, Nabin K. Jana, Anil K. Karn and Antonio M. Peralta; *Revista de la Real Academia de Ciencias Exactas, Físicas y Naturales. Serie A. Matemáticas (RCSM)*, 113(3) (2019) 2731-2741. (<https://arxiv.org/abs/1810.10886>). DOI: 10.1007/s13398-019-00653-0 (<https://rdcu.be/bogLn>)
- Absolutely compatible pairs in a von Neumann algebra, N. K. Jana, A. K. Karn and A. M. Peralta, *Electronic Journal of Linear Algebra*, 35 (2019), 599-618. (<https://arxiv.org/abs/1801.01216>)
- Isometries of Absolute order unit spaces, Anil Kumar Karn and Amit Kumar; (Published online in *Positivity*) (DOI: 10.1007/s11117-019-00731-y) (23 December, 2019). (<https://arxiv.org/abs/1903.05302>)

Dr. Brundaban Sahu

- Differential operators on Jacobi forms and special values of certain Dirichlet series (with



Abhash Kumar Jha) Automorphic Forms and Related Topics, 91-99, Contemp. Math., Vol-732, American Mathematical Society, Providence, RI, 2019

- On the number of representations by certain quadratic forms in 8 variables (with B. Ramakrishnan and Anup Kumar Singh) Automorphic Forms and Related Topics, 215-224, Contemp. Math., Vol-732, American Mathematical Society, Providence, RI, 2019
- Rankin-Cohen brackets on Jacobi forms of several variables and special values of certain Dirichlet series (with Abhash Kumar Jha) Int. J. Number Theory (15), 2019, no-5, 925-933
- Rankin-Cohen type operators for Hilbert-Jacobi forms (with Moni Kumari), To appear in Modular Forms and Related Topics in Number Theory, Springer Proceedings in Mathematics and Statistics.
- On the number of representations of a natural number by certain quaternary quadratic forms (with B. Ramakrishnan and Anup Kumar Singh), Modular Forms and Related Topics in Number Theory, Springer Proceedings in Mathematics and Statistics.

Dr. Binod Kumar Sahoo

- B. K. Sahoo and Bikramaditya Sahu, Blocking sets of certain line sets to a hyperbolic quadric in $PG(3, q)$, Advances in Geometry 19 (2019), 477-486.
- S. Chattopadhyay, K. L. Patra and B. K. Sahoo, Vertex connectivity of the power graph of a finite cyclic group, Discrete Applied Mathematics 266 (2019), 259-271.
- B. De Bruyn, B. K. Sahoo and Bikramaditya Sahu, Blocking sets of tangent lines to a

hyperbolic quadric in $PG(3, 3)$, Discrete Applied Mathematics 266 (2019), 121-129.

- S. Chattopadhyay, K. L. Patra and B. K. Sahoo, Laplacian eigenvalues of the zero divisor graph of the ring Z_n , Linear Algebra and its Applications 584 (2020), 267-286.
- S. Chattopadhyay, K. L. Patra and B. K. Sahoo, Vertex connectivity of the power graph of a finite cyclic group II, Journal of Algebra and its Applications 19, No. 02 (2020), Article Id: 2050040, 25 pp.
- S. Chattopadhyay, K. L. Patra and B. K. Sahoo, Erratum: Vertex connectivity of the power graph of a finite cyclic group II, Journal of Algebra and its Applications 19, No. 02 (2020), Article Id: 2092001, 2 pp.
- R. P. Panda, K. L. Patra and B. K. Sahoo, On the minimum degree of the power graph of a finite cyclic group, Journal of Algebra and its Applications, Article Id: 2150044, 18 pp, to appear.

Dr. Deepak Kumar Dalai

- Deepak Kumar Dalai, Subhamoy Maitra, Santu Pal, Dibyendu Roy: Distinguisher and non-randomness of Grain-v1 for 112, 114 and 116 initialisation rounds with multiple-bit difference in lvs. IET Information Security 13(6): 603-613 (2019)
- Deepak Kumar Dalai, Santu Pal: Recovering Internal States of Grain-v1. Lecture Notes in Computer Science, volume 11879, pages 325-337, Springer, 2019
- Deepak Kumar Dalai, Santu Pal: Wip: Degree Evaluation of Grain-v1. Lecture Notes in Computer Science, volume 11952, pages 239-251, Springer, 2019



- Deepak Kumar Dalai: A Basic Theory of Lightweight Hierarchical Key Predistribution Scheme. Lecture Notes in Computer Science, volume 11980, pages 325–340, Springer, 2019.

Dr. Sanjay Parui

- S Parui, Anoop V.P. The Hardy inequality and fractional Hardy inequality for the Dunkl Laplacian, Israel Journal of Mathematics (2020) 1–32
- S Parui, Anoop V.P Hardy inequality and trace Hardy inequality for Dunkl gradient, Collectanea Mathematica, 70 (2019), no. 3, 367–398
- S Parui, M. Bhowmik, S Pusti, Ingham-type theorems for the Dunkl Fourier transforms, Complex Variables and Elliptic Equations, (2020)(accepted) 13 pages.

Dr. Jaban Meher

- (With B. Kumar and S. Pujahari) Some remarks on the coefficients of symmetric power L-functions, Automorphic forms and related topics, 155–164, Contemporary Mathematics, Vol. 732, American Mathematical Society, 2019.
- (With S. K. Singh) Congruences in Hermitian Jacobi and Hermitian modular forms, Forum Mathematicum, 32 (2020), 501–523.

Dr. Kamal Lochan Patra

- S. Chattopadhyay, K. L. Patra and B. K. Sahoo, Vertex connectivity of the power graph of a finite cyclic group, Discrete Applied Mathematics, 266 (2019), 259 – 271.
- S. Chattopadhyay, K. L. Patra and B. K. Sahoo,

Vertex connectivity of the power graph of a finite cyclic group II, Journal of Algebra and its Applications 19, No. 02 (2020), Article Id: 2050040, 25 pp.

- S. Chattopadhyay, K. L. Patra and B. K. Sahoo, Erratum: Vertex connectivity of the power graph of a finite cyclic group II, Journal of Algebra and its Applications 19, No. 02 (2020), Article Id: 2092001, 2 pp.
- S. Chattopadhyay, K. L. Patra and B. K. Sahoo, Laplacian eigenvalues of the zero divisor graph of the ring $\mathbb{Z}_n$, Linear Algebra and its Applications 584 (2020), 267–286.
- R. P. Panda, K. L. Patra and B. K. Sahoo, On the minimum degree of the power graph of a finite cyclic group, Journal of Algebra and its Applications, Article Id: 2150044, 18 pp, to appear.

Dr. Manas Ranjan Sahoo

- (With Abhishek Das and K.T. Joseph) Adhesion approximations of the zero-pressure gas dynamics system, Adv. Pure Appl. Math., to appear.
- (With Abhrojyoti Sen) Limiting behavior of scaled general Euler equations of compressible fluid flow. Z. Angew. Math. Phys. 71, 51 (2020).
- (With Abhrojyoti Sen) Limiting behavior of some strictly hyperbolic systems of conservation laws. Asymptot. Anal. 113 (2019), no. 4, 211–238.
- (With Satyanarayana Engu and Abhrojyoti Sen) On a complex sequence of vanishing moments, J. Ramanujan Math. Soc. 34 (2019), no. 2, 185–190.



Dr. Nabin Kumar Jana

- Contractive linear preservers of absolutely compatible pairs between C^* algebras, (2019), RACSAM, Vol. 113, pp 2731-2744, DOI:10.1007/s13398-019-00653-0 (with Anil K. Karn & Antonio M. Peralta)
- Absolutely compatible pairs in a von Neumann algebra, (2019), EJLA, Vol. 35, DOI: 10.13001/ela.2019.5165 (with Anil K. Karn & Antonio M. Peralta)

Dr. Sutanu Roy

- Deeptak Biswas, Amaresh Jaiswal, Kishan Deka, Sutanu Roy, Viscosity, nonconformal equation of state, and sound velocity in Landau hydrodynamics, Physical Review C 102, 014912
<https://doi.org/10.1103/PhysRevC.102.014912>

Dr. Panchugopal Bikram

- On the von Neumann algebras associated to Yang-Baxter Operators with Rahul K. R., R. Mohanta, K. Mukherjee and D. Saha, to appear Proc. Roy. Soc. Edinburgh Sect. A, 2020.
- On the commutants of generators of q -deformed Araki-Woods von Neumann algebras with Kunal Mukherjee, to appear Publ. Res. Inst. Math. Sci., 2020.
- On the classification and modular extendability of Eo-semigroups on factors with Daniel Markiewicz, to appear Mathematische Nachrichten, 2019.
- A Note on Coarse Bimodules with J. Bannon, and K. Mukherjee, Journal of Mathematical Analysis and Applications Vol. 475, Issue 2, 2019, 1404-1415.

Conferences and Seminars

Dr. Anil Kumar Karn

- International Conference 'Positivity 10' held at University of Pretoria, Pretoria, South Africa during July 8-12, 2019.
- International Conference 'Order Analysis and Related Problems in Mathematical Modeling' held at Tsey Gorge, Republic of North Ossetia-Alania, Russia during July 15-20, 2019.
- National Conference on Functional Analysis held at IIT Bombay, Mumbai during October 12-15, 2019.
- Mini-symposium held at IIT Hyderabad during January 1-2, 2020.

Dr. Brundaban Sahu

- Sphere Packing (October 31-November 6, 2020), ICTS, Bengaluru
- Workshop on additive combinatorics (February 24- March 06, 2020), ICTS, Bengaluru

Dr. Binod Kumar Sahoo

- 9th Slovenian International Conference on Graph Theory (June 23-29, 2019), at Bled, Slovenia.
- National Seminar on Graph Theory and its Applications (February 27-28, 2020), Department of Mathematics, Sambalpur University, Odisha, India.

Dr. Deepak Kumar Dalai

- The 24th European Symposium on Research in Computer Security (ESORICS 2019), 23-27 September 2019 at Luxembourg.



Dr. Sanjay Parui

- 4th conference Probability and Analysis, 20-24 May 2019 in Będlewo, Poland.

Dr. Jaban Meher

- IISER Bhopal Math Symposium (6-7 March, 2020), IISER Bhopal, India.
- International conference on Number Theory (23-26 January, 2020), Kerala School of Mathematics, Kozhikode, India.

Dr. Kamal Lochan Patra

- 9th Slovenian International Conference on Graph Theory (June 23-29, 2019), at Bled, Slovenia
- National Seminar on Graph Theory and its Applications (February 27-28, 2020), Department of Mathematics, Sambalpur University, Odisha, India.

Dr. Ritwik Mukherjee

- ICTS Bangalore, January 2020

Dr. Dinesh Kumar Keshari

- Hilber Modules in Analytic Functions Space Workshop, Tsinghua Sanya International Mathematics Forum (TSIM), No. 100 Tsinghua Road, Tianya District, Sanya, Hainan, China.
- Conference on Noncommutative geometry and its applications, National Institute of Science Education and Research (NISER), P.O. Jatni, Khurda 752050, Odisha, India,

Dr. Nabin Kumar Jana

- IFCAM School on Graph and Random processes during 16-20 December, 2019 in IISER Pune.

Dr. Sutanu Roy

- Conference on Functional Analysis (CFA@IITB 2019), Indian Institute of Technology Bombay, India, October 18, 2019.

Dr. K. Senthil Kumar

- School (and Workshop) on Diophantine Geometry and Special Varieties, Trento, Italy, Sep 16-21, 2019.
- International Conference in Number Theory and Workshop on Multiple zeta values, KSOM, Jan 18-26, 2020.

Dr. Anupam Pal Choudhury

- Workshop on Applications of Differential Equations (WADE 2020), 12-14 February 2020, Bharathiar University, Coimbatore.

Dr. Krishanu Dan

- ICTS Discussion Meeting on "Moduli of bundles and related structures", February 10-14, 2020 at ICTS, Bengaluru, India.

Invited Talks

Dr. Anil Kumar Karn, Associate Professor

- Talk entitled "Orthogonality and absolute compatibility in operator algebras" delivered in the International Conference 'Positivity 10' held at University of Pretoria, Pretoria, South Africa during July 8-12, 2019.
- Talk entitled "Absolute compatibility in operator algebras" delivered in the International Conference 'Order Analysis and Related Problems in Mathematical Modeling' held at Tsey Gorge, Republic of North Ossetia-Alania, Russia during July 15-20, 2019.



- Talk entitled "A model for non-commutative model for vector lattices" in the National Conference on Functional Analysis held at IIT Bombay, Mumbai during October 12-15, 2019.
- Talk entitled "An elliptic behaviour in operator algebras" in the Mini-symposium held at IIT Hyderabad during January 1-2, 2020.

Dr. Brundaban Sahu, Associate Professor

- Rankin-Cohen brackets on modular forms and certain Dirichlet series', (November 19, 2019) IIT, Guwahati
- On the number of representations of a natural number by certain quadratic forms', (January 4, 2020), HRI, Prayagraj.
- Supercongruences of Apéry-like numbers, 06 March 2020, ICTS, Bengaluru

Dr. Binod Kumar Sahoo, Associate Professor

- Vertex connectivity of the power graph of a finite cyclic group, 9th Slovenian International Conference on Graph Theory (June 23-29, 2019), at Bled, Slovenia.
- Minimal cut-sets in power graphs associated with maximal cyclic subgroups, National Seminar on Graph Theory and its Applications (February 27-28, 2020), Department of Mathematics, Sambalpur University, Odisha, India.

Dr. Deepak Kumar Dalai, Reader-F

- On Cayley graphs of Boolean functions, NATIONAL SEMINAR ON GRAPH THEORY AND ITS APPLICATIONS (NSGTA-2020) during 27-28, February, 2020 at Mathematics Department, Sambalpur University,

Dr. Sanjay Parui, Reader-F

- 4th conference Probability and Analysis, 20-24 May 2019 in Będlewo, Poland

Dr. Jaban Meher, Reader-F

- Certain congruences among Hermitian Jacobi forms, IISER Bhopal Math Symposium, IISER Bhopal, India, (6-7 March, 2020).
- Certain congruences among Hermitian Jacobi forms, International Conference on Number Theory, Kerala School of Mathematics, Kozhikode, India, (23--26 January, 2020).
- Theory of newforms of half-integral weight, Harish Chandra Research Institute, Prayagraj, India, (4 January, 2020).
- Some of the works of Ramanujan, Institute of Mathematics and Applications, Bhubaneswar, India, (22 December, 2019).
- Prime numbers and some questions, NCERT-NTS awardees nurturance program, NISER, Bhubaneswar, India, (9-13 December, 2019).

Dr. Kamal Lochan Patra, Reader-F

- Laplacian eigenvalues of the zero divisor graph of the ring $\mathbb{Z}_n$, 9th Slovenian International Conference on Graph Theory (June 23-29, 2019), at Bled, Slovenia.
- Different Middle parts of trees, National Seminar on Graph Theory and its Applications (February 27-28, 2020), Department of Mathematics, Sambalpur University, Odisha, India.

Dr. Ritwik Mukherjee, Reader-F

- Center for Quantum Geometry of Moduli Spaces (Aarhus, Denmark), gave a talk, titled "Enumeration of curves with upto 8 singular points", in July 2019.

Dr. Dinesh Kumar Keshari, Reader-F

- Similarity invariants of a subclass of Cowen-Douglas class of operators, Hilbert Modules in



Analytic Function Space Workshop, TSIM, Sanya, China.

- Similarity invariants of Cowen-Douglas class of operators, National Institute of Science Education and Research (NISER), P.O. Jatni, Khurda 752050, Odisha, India.

Dr. Nabin Kumar Jana, Reader-F

- Large deviation and its application to interacting particle system, IFCAM School, 16-20 December, 2019 at IISER Pune.

Dr. Sutanu Roy, Reader-F

In conferences:

- Quantum $E(2)$ groups for complex deformation parameters in Conference on Functional Analysis (CFA@IITB 2019), IIT Bombay on October 18, 2019

In Seminars:

- Braided compact quantum groups: motivation and examples, Department of Mathematics and statistics, IISER Kolkata, July 22, 2019.
- Braided quantum groups in C^* -algebraic framework, School of Mathematics, TIFR Mumbai, May 24, 2019.

Dr. K. Senthil Kumar, Assistant Professor

- Algebraic independence of the values of Weierstrass ϕ , ζ and σ functions, KSOM, Jan 23-26, 2020.
- Shuffle product, iterated integrals and Multiple zeta values, KSOM, Jan 18-22, 2020.
- Delivered a series of lectures on Galois Theory, AFS III, NISER, July 01-27, 2019.
- Delivered a series of lectures on Galois theory, Summer outreach Program in Mathematics, (17-29 June 2019), NISER, Bhubaneswar.

Dr. Anupam Pal Choudhury, Assistant Professor

- CALDERON PROBLEM- UNIQUENESS AND STABILITY (WADE 2020)

Sponsored Projects

Dr. Brundaban Sahu, Associate Professor

- MATRICS (MTR/2017/000228)

Dr. Binod Kumar Sahoo, Associate Professor

- Project No. MTR/2017/000372, SERB, DST, Govt. of India, Amount: Rs. 6,60,000/-, Duration: 2018-2021

Dr. Sanjay Parui, Reader-F

- Lacunary Maximal functions for Dunkl Operators MTR/2019/001119

Dr. Manas Ranjan Sahoo, Reader-F

- Inspire Faculty award by Department of Science and technology (DST), India ongoing from 2015.
- MATRICS by Science and Engineering Research Board (SERB), Department of Science and Technology (DST), India Ongoing from February 2019.

Dr. Ritwik Mukherjee, Reader-F

- MATRICS Grant

Dr. Dinesh Kumar Keshari, Reader-F

- Unitary, similarity invariants and curvature inequalities for operators in the Cowen-Douglas class (MTR/2019/000319).
- Funding Agency: Department of Science and Technology, Govt. of India,

Dr. Sutanu Roy, Reader-F

- Inspire faculty award by Department of Department of Science and Technology (DST), India ongoing from 2016 (Session-I).



- Early Career Research Award (ECRA) by Science and Engineering Research Board (SERB), Department of Department of Science and Technology (DST), India ongoing from 2017.

Dr. Panchugopal Bikram, Reader-F

- ECR
- Cefipra

Conferences and Seminars organized by the faculty in the School during 2019-20

Dr. Brundaban Sahu, Associate Professor

- Lectures series on Transcendence on Commutative algebraic group (December 9–15, 2019), NISER

Dr. Jaban Meher, Reader-F

- Lectures on transcendence on commutative algebraic groups (9--15 December, 2019), NISER, Bhubaneswar, India (organized with B. Sahu and K. Senthil Kumar)

Dr. Ritwik Mukherjee, Reader-F

- Organized an NCM workshop at NISER in Dec 2019 on Seshadri Constants (jointly with Indranil Biswas of TIFR and Krishna Hanumanthu of CMI)

Dr. Nabin Kumar Jana, Reader-F

- Advanced Instructional School on Stochastic Processes - Level I & II from June 17th to July 12th Funded by NCM, Mumbai and IASc, Bengaluru.

Dr. Sutanu Roy, Reader-F

- Noncommutative Geometry and its applications (NCGA@NISER) during January 6-10, 2020 at NISER Bhubaneswar (Convenor).

Dr. K. Senthil Kumar, Assistant Professor

- Lectures on Transcendence on Commutative Algebraic Groups, December 09-15, 2019, NISER, Bhubaneswar.

Additional information, if any

Dr. Anil Kumar Karn, Associate Professor

- Delivered a series of three talks of 1.5 hours each on "Kakutani theorem" in the workshop on 'Advanced Functional Analysis' in IIT Hyderabad.

Dr. K. Senthil Kumar, Assistant Professor

- Algebraic independence of values of Weierstrass zeta and elliptic functions. With an appendix by Robert Tubbs (Revision submitted).
- Linear dependence of quasi-periods over the rationals (Revision submitted).

Dr. Anupam Pal Choudhury, Assistant Professor

- Joined the School of Mathematical Sciences (NISER) on 18th December 2019. The articles published during the mentioned period were submitted from IIT Indore and hence has not been mentioned here.

Departmental Seminars

Speaker: Chiranjit Ray

Affiliation: IIT G

Title: Arithmetic properties of certain partition functions and modular form

Speaker: S. P. Murugan

Affiliation: C.M.I

Title: Existence of E₀-semigroups; the multiparameter case.

Speaker: TSSRK Rao

Affiliation: ISI, Bangalore

Title: APPROXIMATE BIRKHOFF-JAMES ORTHOGONALITY

Speaker: Amit kumar

Affiliation: NISER



Title: Isometries of absolute order unit spaces

Speaker: Atibur Rahaman

Affiliation: NISER Bhubaneswar

Title: Braided Quantum $E(2)$ Groups and Contraction

Speaker: Soumendu Sundar Mukherjee

Affiliation: Indian Statistical Institute Kolkata

Title: On offline changepoint estimation for network data

Speaker: Sk Asfaq Hossain

Affiliation: ISI Kolkata

Title: Quantum Symmetry on Potts Model

Speaker: Suratno Basu

Affiliation: IMSc Chennai

Title: Degeneration of intermediate Jacobians and the Torelli type theorems

Speaker: Chitrabhanu Chaudhuri

Affiliation: IISER Pune

Title: Topological results on Moduli of Curves

Speaker: Dr. Jagannath Bhanja

Affiliation: Indian Institute of Technology Roorkee

Title: Direct and inverse problems for certain sumsets in additive number theory

Speaker: Abhay Soman

Affiliation: ISI Bangalore

Title: On triviality of the reduced Whitehead group

Speaker: Santosh Nadimpalli

Affiliation: Radboud University, Nijmegen

Title: Whittaker models for cuspidal representations of p -adic unitary groups

Speaker: Arpan Kabiraj

Affiliation: Chennai Mathematical Institute

Title: Poisson algebras associated to unoriented curves on surfaces

Speaker: Parangama Sarkar

Affiliation: Chennai Mathematical Institute

Title: Mixed Multiplicities and Rees' theorem for filtrations

Speaker: Dr. Shibananda Biswas

Affiliation: Indian Institute of Science Education and Research Kolkata

Title: Reducing submodules of Hilbert modules with an invariant kernel

Speaker: Dr Arpita Patra

Affiliation: Department of Computer Science & Automation, Indian Institute of Science Bangalore, Bengaluru 560012, India

Title: Secure Multi-party Computation over the Internet

Speaker: Dr. Venkata Raghu Tej Pantangi

Affiliation: Southern University of Science and Technology, China

Title: Critical groups of graphs

Speaker: Rekha Biswal

Affiliation: Max Planck Institute for Mathematics, Bonn

Title: Macdonald polynomials and level two Demazure modules for affine sl_{n+1}



SCHOOL OF PHYSICAL SCIENCES

Brief of Research Activity

Prof. Sudhakar Panda,
Senior Professor, Director

- A generalized scalar thermal operator representation in real time formalism has been constructed.
- Aspects of quantum entanglement in de Sitter space has been investigated in the context of string theory

Prof. Bedangadas Mohanty: Professor

Experimental High Energy Physics and Dark Matter Group

ALICE

The main physics goal of A Large Ion Collider Experiment (ALICE) at the Large Hadron Collider (LHC) is the study of strongly interacting matter at extreme conditions of temperature and energy densities, where a deconfined phase of QCD matter called quark-gluon plasma (QGP) forms. NISER group is mainly involved in analyses related to the measurements of hadronic resonances production in different collision systems and energies. The short lived resonances can be used to probe both the initial and final state of the evolution of heavy-ion collisions due to their spin and lifetime, respectively.

In non-central heavy-ion collisions a large initial angular momentum is expected to be created which can lead to the spin alignment of vector mesons due to the spin-orbital interaction of quantum chromodynamics. Spin alignment of vector meson is studied by measuring the zeroth element of the spin density matrix, ρ_{00} . The ρ_{00} is the probability of finding a vector meson in spin state 0, out of 3 possible spin states (-1, 0 and 1). In

absence of spin alignment $\rho_{00} = 1/3$ and any deviation from $1/3$ indicates the spin alignment of vector mesons. We have reported for the first time a significant spin alignment for vector mesons (K^*0 and ϕ) in heavy-ion collisions. Whereas, in control experiments such as measurements of vector mesons spin alignment in p+p collisions, spin alignment measurements for $K0$ s in heavy-ion collisions, measurements with respect to random event plane lead to $\rho_{00} = 1/3$. These results support the presence of large angular momentum in heavy-ion collisions and subsequent polarization of quarks. NISER group is solely involved in this study. A paper draft on results from the spin alignment of K^*0 and vector meson in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV is submitted to Physical Review Letter.

Due to their short lifetime, resonances can also be used as a unique probe to understand the effect of hadronic phase on produced particles in heavy-ion collisions. Even after chemical freeze-out, reconstructed resonance yields deviate from the values expected from thermal models due to the processes like re-scattering and regeneration in the hadronic phase of heavy-ion collisions. Effect of hadronic phase can be understood by measuring the momentum distribution of resonances and their yield ratios to stable hadrons. The ALICE detector has measured several resonances with different masses, quark content and lifetime in pp, p-Pb, Pb-Pb and Xe-Xe collisions at LHC energies. A significant suppression is observed for K^*0/K yield ratio in central heavy-ion collisions whereas Φ/K ratio remains flat across all centrality classes. These results give the evidence of the dominance of rescattering effect over regeneration in the hadronic phase of heavy-ion



collisions. Recently, results of high multiplicity pp collisions have also shown the suppression of K^0/K yield ratio in low pT. The charged particle multiplicity in high multiplicity pp collisions at LHC energies are similar to those observed in peripheral Pb–Pb collisions. It hints towards the possible presence of a hadronic phase with non-zero lifetime in small collision systems. NISER group has primarily contributed to the measurements of K^0 and resonances in pp, p–Pb, Pb–Pb and Xe–Xe collisions at various center of mass energies. These studies lead to one paper published in Physics Letter B, five papers submitted to journals and one paper is under ALICE Internal Review Committee.

STAR

STAR experiment at Relativistic Heavy-Ion Collider (RHIC) facility primarily aims to understand the properties of strongly interacting matter formed, study of the dynamics, mechanism of particle production and exploring the Quantum ChromoDynamics (QCD) phase diagram in heavy-ion collisions. One of the main physics interests of our group in STAR is the study of fluctuations of conserved quantities, such as baryon number (B), strangeness (S) and electric charge (Q). These measurements provide insight into the nature of phase transitions of matter created in high-energy nuclear collisions. The higher moments of multiplicity distributions of net-proton (proxy for net-baryon), net-kaon (proxy for net-strangeness) and net-charge are expected to show large fluctuations near the QCD critical point. A beam energy scan program (BES-I & II) is ongoing to perform such studies. We have performed measurement of cumulants of net-particle distributions from two newly taken Au+Au collision datasets at $\sqrt{s_{NN}} = 27$ GeV (year 2018) and 54.4 GeV (year 2017). The high statistics data leads to the precision measurements which

help us in the study of QCD phase diagram and search for the QCD critical point. A paper draft which includes the results from this study is under preparation.

We have also measured the higher order fluctuations of event-by-event deuteron number distribution in Au+Au collisions in the STAR experiment at RHIC to shed light into the production mechanism of nuclei. Light nuclei are formed and survive the evolution of matter, despite the fact that typical energy scales in high energy heavy-ion collisions exceed the binding energy of these objects by orders of magnitude. The nature of fluctuations being different in two widely used theoretical models (thermal and coalescence model) to explain light-nuclei production mechanism in heavy-ion collisions, study of higher order fluctuations of deuteron number gives us the unique scope to probe finer into the bulk of the medium formed in heavy-ion collisions.

We have also participated in the data taking shifts for the STAR detector for the currently ongoing BES II phase.

CBM

The physics program of the Compressed Baryonic Matter (CBM) experiment at FAIR is focused on the measurement of properties of nuclear matter at high net-baryonic density. This is an upcoming heavy-ion experiment which offers the possibility to find signatures of discontinuous transition from QGP to hadronic phase and the QCD critical point where the first order phase transition ends. The physics program at CBM compliments the STAR BES program. We are involved in the physics simulation of conserved charge fluctuations in Au–Au collisions at SIS100 energies. NISER group is also contributing in the detector hardware activities of the MuCh subsystem in the CBM experiment. Two contributions related to the detector



hardware activities at NISER will appear in the CBM progress report 2019.

SuperCDMS

SuperCDMS is a direct dark matter search experiment that uses cryogenic solid state detectors to look for nuclear recoil signals from dark matter. In SuperCDMS, NISER has been involved in calibration, background studies, search for lightly ionising Particles (LIPS) and detector monte carlo (DMC) simulations.

1. **LIPs** have been successfully incorporated into the GEANT4 simulation package. The energy deposition probability distribution for LIPs in germanium detectors has been obtained using GEANT4. A journal article about this work is under preparation.
2. Intensity limit for LIPs in the CDMS detectors has also been calculated which will be reported as a journal calculation soon.
3. NISER is also involved in the calculation of Si-32 background which is very crucial for dark matter experiments employing Si detectors.

MINER

The Mitchell Institute Neutrino Experiment at Reactor (MINER) is a coherent neutrino scattering experiment which aims to map the so called 'neutrino floor' which is very crucial for low mass dark matter experiments performed at lower recoil energy thresholds. Other interesting physics which MINER intends to do is the measurement of the neutrino magnetic moment; evidence for new mediator bosons; sterile neutrino etc. NISER is involved in a big way in this project. NISER has procured a Cryogen-free dilution refrigeration that will initially be shipped to Texas A & M University where the experiment will take place. NISER is also contributing to the thermal neutron shielding of the experiment by

providing boron rubbers produced in India. MINER has begun its engineering data taking runs. NISER is heavily involved in the data analysis and is remotely taking data and monitoring the experiment.

DINO

NISER is engaged in the backgrounds and calibration efforts in the first phase of DINO, a dark matter search experiment in Jaduguda Underground Science Laboratory (JUSL), India. Neutrons are one of the most important backgrounds in this search as they interact with the detector materials in the same way as WIMPs. In underground laboratories, neutrons can be generated mainly by spontaneous fission of Uranium and radiogenic processes, such as by U/Th (α, n) reactions on the rock materials and by cosmogenic processes, such as interaction of cosmic ray muons with rock and shielding materials. The flux of cosmogenic and radiogenic neutrons expected at JUSL has been estimated. An estimate of the sensitivity of a Csl crystal based dark matter search experiment at JUSL has also been done. A journal article describing the work is ready and will be submitted to a journal soon.

Phenomenology

In parallel to the experimental data analysis our group is also involved in the various analysis using QCD based models like PYTHIA, transport models like AMPT, UrQMD and thermal model like THERMUS, THERMINATOR and Hadron Resonance Gas (HRG) model. The model studies are mainly performed to compliment the experimental results.

The main focus of our group in the STAR experiment is to explore the QCD phase diagram. The assumption of thermalization is often utilized in most of the theoretical calculations to study



the phase diagram of the strongly interacting QCD matter. Fluctuations of conserved quantities, such as baryon number (B), strangeness (S) and electric charge (Q), provide insights into the bulk properties of matter created in high-energy nuclear collisions. Higher-order moments of event-by-event conserved charge distributions, which carry subtle details of distribution, could serve as novel probes for thermalization of such systems. We have performed a systematic test of thermalization by comparing the results from a minimal statistical model of hadrons and resonances in thermal equilibrium to the different diagonal (up to 3rd order) and off-diagonal (up to 2nd order) cumulants of net-proton, net-kaon and net-charge distributions measured by the STAR experiment. The hadron resonance gas model is found to explain the experimental data of yields and fluctuations with common temperature (T) and baryonic chemical potential (μ_B). The consistency of thermal freeze-out conditions (T and μ_B) for each order of moments suggest that not only the region near the peak of distribution is thermalized but some parts of the tails also approach thermal equilibrium. A paper draft based on these results is under preparation.

A study on the thermodynamics of a gas of hadrons with attractive and repulsive interactions within an S-matrix formalism is performed. We have two publication based on these results.

ALICE has recorded the Xe-Xe data at $\sqrt{s_{NN}} = 5.44$ TeV which will help in understanding the system size dependence of particle production dynamics. We have performed a study of charged particle multiplicity, average transverse momentum and azimuthal anisotropy in Xe-Xe collisions using the AMPT model and have one publication.

Hardware activities

1. Neutron detectors for rare event experiments

Using a technique known as Time-of-flight, the energy spectrum of an Am-Be source has been measured using liquid scintillator detectors. The measurement will be improved by taking more data and increasing the statistics.

2. Advanced gas detectors:

a) Resistive Plate Chamber (RPC) for use in the 3rd and 4th stations of the MuCh subsystem in the CBM experiment

The MuCh subsystem at the CBM experiment in FAIR requires detector rate handling capability of ~ 10 kHz/cm² in the 3rd station and ~ 4 kHz/cm² in the 4th station respectively. We have performed experiments with RPCs made of low resistivity glass (bulk resistivity $\sim 10^{10}$ ohm.cm) and double gap RPCs. We are able to achieve a rate capability of 5 kHz/cm² with an efficiency of 55%. Double gap geometry has been shown to improve the efficiency.

b) Micro Pattern Gaseous Detectors (MPGD) for high energy physics experiments and societal applications

MPGDs are gaseous detectors that are used or being proposed in many high energy physics experiments around the world. They have remarkable position resolution, reasonable time resolution and show excellent radiation hardness. Thick-GEM (THGEM) or Thick-Gas Electron Multiplier is one such detector. A THGEM has been fabricated with the involvement of a Master's student. The detector is to be tested with radiation soon. All the components of this detector have been manufactured in India. The frames for the foils were 3D printed at NISER and even the PCB board was chemically etched at NISER as part of the student's master's project.



3. Semi-conductor detectors for dark matter experiments

State of the art silicon and germanium detectors are used in dark matter experiments such as the SuperCDMS. Using NISER's cryogen free dilution refrigerator system currently operational at Texas A & M, two detectors (a) Silicon hybrid and (b) Silicon HV have been tested. The silicon hybrid detector is a novel design that shows nuclear and electron recoil discrimination without having to operate at different bias voltages unlike the standard silicon detectors in use. The silicon HV detector on the other hand is so sensitive that it can measure single electron-hole pair events. This is a remarkable achievement in a large size detector (~100 g). Both detectors are excellent candidates for next generation dark matter experiments.

Dr. Sanjay Kumar Swain,
Associate Professor

My research has few parts:

a) $B_s^0 \rightarrow \mu^+ \mu^-$ Data analysis: The physics study of B-mesons were very crucial (among the collider experiments) during 1995-2010. Specifically measurement of CP violation in B-meson decays (through measurement of CKM angles and sides). This eventually earned Nobel Prize to Kobayashi and Maskawa (along with Y Nambu) in 2008. The two experiments: Belle at KEK, Japan and BaBar at SLAC performed different measurements during this period. Although earlier CLEO experiment made several B-physics measurement. One of the most important measurements in the area of B-physics (considered as golden channel) is finding the decay of $B_s^0 \rightarrow \mu^+ \mu^-$. The search for this decay mode using collider data started during CLEO (Experiment at Cornell University) in 1985. It went on for 30 years without much success on this

decay mode. This is significant in a sense, theoretically it is clean (no hadronic uncertainty) and experimentally the final state involves two oppositely charged muons to be detected (although the branching fraction is $\sim 10^{-9}$). This decay is sensitive to physics beyond the standard model. This analysis is one of the top priority (probably amongst top 5) analyses in the CMS. My student and I have been actively participating and contributing to this analysis. This analysis resulted many papers published in CMS such as in PRL, JHEP, Nature Journal.

b) Other B-physics analysis and building B-physics analysis group in India: Apart from the $B_s^0 \rightarrow \mu^+ \mu^-$ the other promising analysis are the angular analysis of B-mesons through their FCNC rare decay channels, such as $B \rightarrow K^* 0^-$, etc. Currently the group has 3- 4 faculties from India who have prior expertise in B-analysis and several students taking up multiple analysis projects. Also the group is participating effective lifetime analysis for different B-meson decays.

c) SUSY analysis: We know that standard model is not the ultimate theory of elementary particle physics at all energy scales. It's only tested up to electroweak scale (~200 GeV). Standard model has many drawbacks such as it cannot explain the known non-zero neutrino masses, presence of dark matter, stability of Higgs mass, hierarchy problem and many more. One theory that is generally preferred and accepted among scientists is SUSY (super symmetric theory), which fills the gap of standard model. As per SUSY, there is another set of particles (than standard model particles) that must exist in nature. But those particles are never seen in any past collider experiments. It was/is expected that LHC would be able to see those particle as LHC can go to higher energy scale. My group



participates in search for SUSY using the data collected with the CMS experiment at LHC.

- d) CMS Phase-II tracker upgrade: One of the most ambitious projects I have undertaken is to build 2000 modules of silicon tracking detector that is going to be installed for CMS phase-II upgrade (2024-2025). During Phase-II of the run, the LHC luminosity is planned to go up to $2-5 \times 10^{34} \text{ /cm}^2\text{sec}$. With this configuration, the pile up is expected to be around 150-200 compared to current average value of 20-30. The L1 trigger rate will be around 750 kHz compared to current 100 kHz. The increase in channel number will be significant (10 million channels now, to 200 million channels). This new tracker will have close to 8000 modules for the barrel region out of which 25% will be build by NISER. The component will be machined in different parts of the world and will be sent to NISER for fabrication and test of the complete Si-detector module. Since last two years the R&D work has already started and the simple version of module with glass plates (in stead of silicon sensors) has been built with the required precision. This project is planned to be finished in collaboration with IIT Madras, IIT BBS, IOP, SINP, and Delhi University with NISER as the main production and testing center. Below shows the pictorial view of one module after and before assembly (on the upper part) and the side view (lower part of the picture).

- e) Participation in Neutrino project (NOvA): My previous short experience in MINOS data analysis motivated me to go for similar neutrino experiment and participate in physics data analysis, as there are still large interesting undiscovered questions in neutrino physics. This is complementary to

the searches we do in CMS experiment. I found the two most important unresolved questions in neutrino physics are: (a) mass hierarchy and (b) search for sterile neutrino species. Decades of neutrino experimental programs have not been able to resolve these due to low statistics. I started the NOvA experiment year ago with ~113 lakhs support from DST and is participating precisely these two sectors, which are not resolved (there are many other unresolved questions in neutrino sector as well). I have two PhD students funded by DST projects: one working in mass hierarchy and other one in sterile neutrino search.

Dr. Subhankar Bedanta,
Associate Professor

The group led by Dr. Subhankar Bedanta works broadly on the static and dynamic properties of magnetic thin films. A summary of research activities of the past one year has been given below.

Study of skyrmions in magnetic thin films: The main focus in this area is to study nucleation, stabilization and propagation of skyrmions in various heavy metal/ferromagnet and heavy metal/ferrimagnet heterostructures. We plan to minimize the size of the skyrmions and the skyrmion Hall effect (SHE) in such heterostructures for possible application in skyrmionic devices. By performing micromagnetic simulations, using OOMMF and MuMax, the group has successfully studied the formation and stability of skyrmions for different values of anisotropy (K) and interfacial Dzyaloshinskii-Moriya interaction (iDMI). At present, the group is focused on skyrmion manipulation by electrical current in various device geometries of ferromagnetic, ferrimagnetic and antiferromagnetic systems.



Flexible Spintronics: Our group also working on the effect of variable strain (due to bending, peeling, stretching, etc.) on the magnetization reversal, domain and relaxation dynamics of flexible thin films. Magnetic anisotropy of magnetic thin film was found to increase under application of tensile strain while the domains remain unaffected under stress. Additionally, insertion of another layer of organic material (C60) on magnetic films deposition on a flexible substrate shows a remarkable decrease in the size of magnetic domains in comparison with its parent film.

Organic spintronics: The group also focuses to study spin transfer mechanism across ferromagnetic/organic semiconductor interface. The group has successfully demonstrated that non-magnetic fullerene (C60) can attain an induced magnetic moment as high as $\sim 3 \mu_B$ in a Fe/C60 bilayer system. The magnetic interface has been quantitatively evaluated by polarized neutron reflectivity experiments performed at FRM II (Muenich, Germany) and Rutherford Appleton Laboratory (Oxford, UK). The group has also investigated interface magnetism at non-magnetic Cu and C60 heterostructure via x-ray magnetic circular dichroism measurements performed at the synchrotron lab ALBA, Spain. At present, they are exploring antiferromagnetic/organic semiconductor interfaces.

Spin pumping in ferromagnetic/heavy metal heterostructures: The group has been working extensively on spin dynamics of Heusler alloy/heavy metal and manganite/heavy metal bilayers. The studies were carried out mainly using ferromagnetic resonance (FMR) spectroscopy based inverse spin Hall effect (ISHE) measurement set up developed in-house. From our study, the spin pumping voltage of $\text{La}_{0.67}\text{Sr}_{0.33}\text{MnO}_3/\text{Pt}$ bilayer, due to ISHE, was

found to be comparable with the standard FM/HM system like Py/Pt. In another study, the group has studied spin dynamics by replacing the heavy metal with a topological insulator having surface metallic states. Recently the group is exploring various antiferromagnetic (AFM) thin films to study the spin dynamics for possible applications AFM spintronics.

Synthetic antiferromagnets: Synthetic antiferromagnets (SAF) is another area of interest of the group due to its rich physics and potential applications in data storage, magnetic sensors, etc. We have successfully deposited samples of SAFs having multilayer stacks of ferromagnet and heavy metal separated by metallic spacer layer using multi deposition sputtering system. The aim is to optimize the thickness of spacer layer to achieve antiferromagnetic interlayer exchange coupling.

Intrinsic 2D ferromagnetism and FM/2D material heterostructures: One of the main aims of this project is to study intrinsic 2D ferromagnetism in trichalcogenide single crystal after exfoliation. In such single crystals, layers are stacked together via van der Waals interaction and we plan to study magnetic properties of such exfoliated layers. Another aim of this project is to fabricate ferromagnetic (e.g. Fe, Ni, Co)/2D material (e.g. MoS_2 , WS_2) heterostructures for fundamental studies like extraordinary Hall effect (EHE), magnetic proximity effect, magnetization dynamics and to explore their possible application in magnetic field sensing.

Static and dynamic properties of soft/hard ferromagnetic (FM) or ferromagnetic/antiferromagnetic (AFM) bilayers: Soft/hard ferromagnetic bilayers have been studied extensively by the group due to its high energy product (BH) max value compared to the component layers. In such bilayers, interface



properties can be tuned to improve the energy product. We have studied the static and dynamic magnetic properties of soft (Co, Ni₈₁Fe₁₉)/hard (Co₄₀Fe₄₀B₂₀, Fe) magnetic bilayers with improved (BH) max compared to their component layers. The role of interface in tuning dynamic properties like Gilbert damping constant, has also been brought out. Additionally, the group has studied exchange bias in FM/AFM type Fe/Ir₂₀Mn₈₀ bilayers to explore the role of FM/AFM interface and 'bulk' part of the AFM in its overall magnetic behavior.

Dr. Subhasis Basak, Reader-F

Presently the group is working on the following.

- Bottom baryon spectroscopy with staggered lighter quarks (u/d, s, c) and NRQCD bottom quarks has been attempted for the first time. The difficulty in constructing local heavy baryon operator using staggered quarks have been overcome by redefining di-quark part of the operator. The associated spectrum and hyperfine mass splittings obtained matches with PDG values (where available) within 1σ .
- Heavy tetraquarks Z_b (10610) and Z_b^{*} (10650) with minimal quark content of bbud have been reproduced with the same formalism built for the heavy baryon spectroscopy. GEVP analysis and potential model calculations are carried out to establish the nature of the tetraquark viz. 4-quark deeply bound tetraquark state or BB^{*} bound state.
- Random Matrix spectrum of minimally doubled fermions is carried out to establish its Eigen spectra and understand the nonperturbative parity restoration, which is violated at the action level in minimally doubled fermions.

Dr. Chetan Gowdigere, Reader-F

Contemporary Topics in String and Field Theory

- Study of Monopole Operators in Three Dimensional Chern-Simons-Matter Theories
- Applying Conformal Bootstrap Techniques to Study Universality Classes in Statistical Mechanics
- Study of Fermion Zero Modes above Black Hole Solutions in Supergravity Theories

Dr. Yogesh Srivastava, Reader-F

In past one year, the group (including PhD students Deepali Mishra, Pooja Jethwani and Swayamsidha Mishra) and collaborators Amitabh Virmani and Sudipta Mukherji has worked on new solution generating techniques in supergravity and problems in quantum field theory (and string theory) on cosmological backgrounds.

With Deepali Mishra and Amitabh Virmani, He has found a generalization of Garfinkle-Vachaspati solution generating technique which has found many uses in String theory. This generalized-garfinkle-Vachaspati technique was developed in the context of minimal six dimensional supergravity and was subsequently generalized to include dilaton are working on generalizing this technique to different supergravity theories. These techniques are quite useful in constructing black hole microstates in String theory and were applied to construct supersymmetric microstates of D1-D5 system. He has been on recently constructed class of fuzzballs called superstrata and studying new features of these solutions.

A technique relating how scalar fields in different FRW spacetimes can be related was worked and applied to FRW spacetimes. They are currently working on AdS-Milne spacetime and correlation functions in these.

With Pooja Jethwani, He is also working on BMS symmetries in String theory.



Dr. Joydeep Bhattacharjee, Reader-F

Computational Materials Science from first principles and model Hamiltonian.

Direction of research: magnetism, catalysis, transport, topological protection of states etc. in the lightest low-dimensional systems - graphene, hexagonal boron nitride, germanene etc. and their hybrids and functional forms.

Introduction: With the aim of proposing new materials and methodologies towards solving some of the contemporary problems faced by humanity, such as, securing clean green energy resources and environment, our group focuses on computationally understanding electronic, optical and magnetic properties, and their interplay in primarily low-dimensional systems from first principles as well as model Hamiltonian. We compute and analyse electronic structure of the ground and excited states in layered structures made of the lightest of the elements known to self-assemble into extended structures in normal temperature and pressure, namely, boron, carbon, nitrogen and oxygen, within the frameworks of density functional theory with refinements to include self-energy corrections and correlations through mean-field approximation of Hubbard model.

Dr. Prasanjit Samal, Associate Professor

Understanding the quantum mechanical behavior of atoms, molecules, and solids from density functional electronic structure theory and ab-initio molecular dynamics (AIMD) calculation is our present research activity. We apply the DFT and AIMD technique on various material applications. The main goal of my present research activities is to predict theoretically the accurate experimental results by reducing the computation cost. We developed several accurate methods which

include semilocal, hybrid, and higher-order accurate wave functional techniques. Our developed methods is already been implemented in basis set codes and started using by several research groups.

The main research activity from my group can be outlined as follows:

Theme of Research @ QSG group: NISER

1. Development and Applications of (Time-dependent) Density Functional Theory (TD) DFT

Aim: The accuracy of the electronic structure simulation within density functional depends on the accuracy of the approximations which includes all the many body effects. The main focus of our group recent activity to push the limit of the approximation and perform assessment, and benchmarking of those methods within TD-DFT for the properties related to optical spectra of nanomaterials; Extended systems: optical electronic and magnetic properties of solids, surfaces, nanostructures. (Photovoltaics), Hybrid organic-oxide solar cells (Graetzel cells), light harvesting complexes and catalysis.

2. Excited state properties of materials

Aim: Several developments to improve the accuracy of the excited state properties which includes opto-electronic, charge-transfer excitation, spin-flip, Rydberg excitation, and band gaps are also proposed and continue work in this directions are also ongoing.

3. Development & applications of many-body theory

Aim: Green's functions, RPA, GW, BSE, NEGF, Hybrid Green's functions methods, combined DFT-MBPT, GW calculations of the optical response of extended and low dimensional systems. Construction of exchange-correlation kernels for TDDFT based on MBPT. Orbital-dependent functionals based on variational total



energy functionals. Molecular electronics, electronic and thermal transport.

4. Development of Wave-function Theory

Aim: The strong-interaction limit of Hartree-Fock theory, Coupled Cluster (CC), CCSD, Multireference Methods (MRCI & MRCC), wave-function and DFT based symmetry adapted perturbation theory, CPMD, QMC.

5. Molecular dynamics simulation of materials

Aim: To predict water and solid-state properties with the high accurate ab-initio methods is also our current research interest. We combine first principle molecular dynamics (MD) simulation with the high-performance computational facility to achieve the so called accuracy of the liquids and solids. We also study condensed systems under pressure and extreme conditions.

6. Machine learned density functional theory

Aim: One present research activity also focus on the develop computer and data based machine-learning approximations for assessing and improving the accuracy of density functional approaches for solids, surfaces and interfaces.

7. Quantum information and spintronic

Aim: Development of materials for qubit and quantum computer are also our present research interest. Density functional formalism for designing the defect-based qubit systems is also our prime goal.

Dr. A. V. Anil Kumar, Reader-F

The group led by Dr. Kumar aims to understand the complexity in understanding the interaction between charged colloidal particles in solutions in order to unravel some basic physics. Their research activity is described below.

The interactions between charged colloidal particles in solution can be complex and varied.

One particularly interesting case is when the particles attract one another at small separations, but repel at larger separations. These competing interactions lead to very rich phase behaviour in these systems like formation of cluster fluids. Our investigations on a highly size-asymmetric binary colloidal mixtures shows that counter ion distributions around the colloidal particles are nonlinear and this leads to highly non-additive interactions between the two components. In such an asymmetric mixture, even though likely charged, larger colloidal particles form a cluster fluid which is in very good agreement with experimental findings. Similar effects may be observed in the case highly charge-asymmetric mixtures also. We are investigating the effect of this charge/size polydispersity in colloidal mixtures on phase behaviour and dynamical properties using classical molecular simulation methods such as Monte Carlo and molecular dynamics. (This work is being carried out in collaboration with Prof. J. Horbach at German Aerospace Center (DLR), Köln, Germany).

Dr. Sumedha, Reader-F

Statistical Mechanics and interdisciplinary applications

- (1) They are interested in understanding the signature of multicritical points in three dimensions using conformal bootstrap methods.
- (2) They have been looking at the effect of disorder on the phase diagram of various models.
- (3) They are interested in understanding the role of crowding and confinements on biopolymers.
- (4) They try to model subcellular processes using stochastic equations.



Dr. Colin Benjamin, Associate Professor

The research activity of the group concerns three broad fields-

(a) Theoretical Nanoscience- The focus here is on aspects of non-local edge mode transport in the quantum spin Hall state, thermoelectric effects in graphene and topological insulators, quantum transport in Josephson junctions and probes for identifying the pairing symmetry of exotic superconductors.

Students worked or working on theoretical nanoscience in this period:

- (i) Subhajit Pal, from December 2015- continuing.
- (ii) Tusaradri Mohapatra, from December, 2017- continuing.
- (b) Quantum information theory- The focus here is on quantum walks and exploring topological phases in quantum walks and quantum thermodynamics. Students worked or working on QuANTum InformATIOn theory in this period:
 - (i) Abhisek Panda (Aug. 2019-June 2020) submitted his Master's thesis on "On quantum walks and quantum games" in June 2020.
 - (ii) Pratyush K. Sahoo (Aug. 2019-June 2020) a student of IISER, Kolkata submitted his Master's thesis on "Quantum stochastic walks and its application in understanding photosynthetic complexes, graphs and quantum neural networks" in June 2020.
 - (iii) B. Varun Govind (Jan. 2020-June 2020) submitted his 6th semester project report on "Generating Highly Entangled States Using Discrete-Time Quantum walks".
 - (iv) Ayush Singh (Jan. 2020-June 2020) submitted his 6th semester project report on "On Cyclic Quantum Heat Engines".

(c) Game theory-The focus here is on finding equilibrium solutions like Nash equilibrium and Pareto optimality of classical and quantum games in the thermodynamic limit.

Students worked or working on Game theory in this period:

- (i) N. Dudhe, (Jan. 2020-June 2020) submitted her 6th semester project report on "Quantum Pigou games".

Dr. Pratap Kumar Sahoo, Associate professor

The group led by Dr. Sahoo carries out experimental investigation of nano-materials and ion matter interaction. The main two research areas are mentioned below.

Tunnel devices are very important for technological application. The basic phenomena can be understood in terms of the physics behind the electron and phonon-tunnel device, which depends on the device geometry. The group is involved to fabricate novel structure with low cost techniques for tunnel devices. Recently they have synthesized crystalline-amorphous-crystalline (c-a-c) stature which can be used as phonon-tunnel junction devices. Similar structures like c-a-c with p-n-p electronics devices also of great interest which can be fabricated using low energy ion beam facility.

Single Nanorod based n-n-p transistor: Tandem p-n junctions have been synthesized in ZnO nanorods (NRs) by implantation of 50 and 350 keV O⁺ ions. We have demonstrated the single nanorod based p-n, p-n-p and p-n-p-n type tandem junction after successive ion implantation using suitable ion energy and ions. These Nanorods are also highly luminescence, which can be used as photodiodes and photo transistors.

New Phase synthesis using ion beams: In general, study of stable phases of Ni-Bi system



would be quite interesting for superconducting, ferromagnetic and often their coexistence at certain conditions. We have synthesized NiBi and NiBi₃ phases using ion energy range from 1 MeV to 120 MeV and optimize the parameter for highest mixing rates where the stable phase can exit. We show the swift heavy ion (120 MeV Au ions) induced electronic energy loss plays an important role to enhance the interface mixing of Ni-Bi stable phases as a function of ion fluence. Also, a molten-like surface morphology has been realized due to latent thermal spike along the ion track upon swift heavy ion irradiation. The enhanced mixing and evolution of molten like surface morphology after ion irradiation has been explained on the basis of the inelastic thermal spike model calculations. These calculations were extended for the higher energies to understand the threshold energy of molten phase which may transfer the materials to a stable phase to realize the suitable properties for technological applications.

Also optical excitation by coupling a foreign atom by ion implantation to propagate surface plasmons and its anisotropic optical response due to the strong transverse and longitudinal plasmons coupling is a hot recent research area. Ion beams are also indispensable tools to dope materials with optically active ions. Ion irradiation can also lead to nanoscale changes in the structure and shape of materials such as colloids, Si nanostructures and lithographic masks. The thermal spike that is generated along the ion track leads to anisotropic deformation, with the material expanding perpendicular to the ion beam. Continuum modeling is used to determine the fundamental mechanisms behind these ion-solid interactions. The first attempt in this regard is to fabricate the nanostructures using various lithographic techniques, thin film deposition and energetic low and swift heavy ion beam

implantation and study the strong interaction of light with nano structured materials which lead to the design of plasmonic devices with optimized properties.

Dr. Kartikeswar Senapati, Reader-F

Superconducting spintronics

The field of spintronics (spin-controlled electronics) has evolved a new branch of research in the past decade, where superconducting material play an important role, in addition to primarily magnetic functionality of usual spintronics devices. On a broader scale, this branch of research, known as "Superconducting spintronics", has the potential to address several key aspects solid state quantum computation.

Along this direction, our work primarily focuses on two aspects:

- (i) spin-triplet superconducting devices, where electronic transport behaviour of low temperature Josephson junctions are studied with a variety of synthetic magnetic barriers with the goal to make functional spin-triplet SQUIDS.
- (ii) Thermal and quantum Phase-slip behaviour in nanowires are studied in proximity of ferromagnetic layers with the goal of understanding and using high speed Josephson junction like response due to phase-slip phenomena in nanowires.

Dr. Ashok Kumar Mohapatra,
Associate Professor

Currently, the group is working on 2 major projects.

- Study of coherent Rydberg excitation in a thermal and ultra-cold atomic vapor.

The long term objective of the project is to realize strong photon-photon interactions using the



non-linearity mediated by Rydberg blockade interaction. Rydberg blockade is the phenomenon where more than one atom within the blockade volume can not be excited to the Rydberg state using a monochromatic laser beam due to strong Rydberg-Rydberg interaction. Recently the group has demonstrated the blockade interaction in thermal atomic vapour which has a potential application in quantum information processing and quantum computation. The group has developed the set up for ultra-cold atoms to study blockade interaction as well as interaction facilitated enhanced Rydberg excitation.

Recently, the group investigated the four-photon excitation to the Rydberg state theoretically where the residual Doppler shift in thermal vapour can be overcome using suitable beam geometry. The theoretical results promise the observation of Rydberg blockade mediated optical nonlinearity for single photon which can be used for quantum computation and quantum technology. Also, the four-photon excitation in cold atoms will reduce the decoherence and hence increase the fidelity of the quantum gates based on Rydberg blockade.

○ Study of Mirrorless optical parametric oscillator (MOPO) using four wave mixing (FWM) enhanced by ground state coherence in thermal atomic vapour.

Ground state coherence in atomic vapour can enhance the optical non-linearity and one of the striking examples are EIT induced enhancement of cross-phase modulation (XPM) and four wave mixing (FWM) etc. The group has recently demonstrated MOPO, where the new fields are generated spontaneously through FWM process in the presence of strong pump and control fields. In this case the driving fields are counter-propagating to each other leading to the

feedback due to efficient FWM in the system. The generated fields have a lasing threshold which has been studied in the same system in the last decade. However, the system has also possess large XPM of the generated fields due to the presence of strong driving fields resulting in all-optical wave-guiding of the generated fields. The correlated wave-guided modes like Gaussian, Laguerre-Gaussian and Hermite-Gaussian modes are observed depending on the experimental parameters. Also the system display a bistability in the MOPO threshold which is demonstrated by the group the associated non-equilibrium phase transition is investigated in detail.

In the recent experiments, the group is involved in developing precision magnetometry based on Zeeman state coherence and four wave mixing process. The observed experimental results has applications in accurate measurement of radio frequency magnetic field with state of the art precision and which would ultimately helps in detection of dark matter.

Dr. Ritwick Das, Associate Professor

The research group led by Dr. Das focuses on Nonlinear Photonics which mainly include generation of high-power radiations at wavelengths different from the conventional Laser sources and are tunable across a band of wavelengths or frequencies. The underlying physical processes include Second-Harmonic-Generation (SHG), Third-Harmonic-Generation (THG), Optical-Parametric-Generation/Oscillation (OPG/OPO), Four-Wave-Mixing (FWM) etc. in the bulk as well as waveguiding geometries. The field of Nano-Photonics and Plasmonics is another area where we are laying significant emphasis. We are theoretically and experimentally investigating the surface optical properties/surface states of periodic and



aperiodic photonic lattices in order to ascertain topological phases in such systems. By carrying out such investigations, we aim to reduce the design as well as fabrication tolerances in modern-generation photonic/optical systems for applications in spectroscopy/ sensing/ communications. Our laboratory possesses variety of fiber lasers which includes single-frequency, continuous-wave 40.0 W Yb-fiber laser and 20.0 W green fiber laser. Also, we have added high-pulse energy Yb-fiber laser (>30 microjoule) with ultrashort (< 300 femtosecond) pulse-width to be used for various nonlinear optical studies.

Dr. Prolay Kumar Mal, Reader-F
(Ramanujan Fellow 2013-18)

The Standard Model (SM) of Particle Physics is the theoretical framework explaining the dynamics of the subatomic particles viz., quarks, leptons and gauge bosons, and their interactions. The discovery of the SM Higgs boson by the LHC experiments (ATLAS and CMS) has finally culminated the long-standing puzzle of electroweak symmetry breaking (at least within the context of the SM). However, in spite of its great accuracy in explaining the wide range of experimental data over the past few decades, it has several shortcomings (e.g., no dark matter candidate, mass hierarchy problem, etc.) and it is believed to be a low-energy limit of a more fundamental theory.

Dr. Mal's primary research focuses on the understanding of the basic mechanism responsible for the electroweak symmetry-breaking and to probe new physics beyond the standard Model (BSM) of Particle physics. He works with the CMS detectors at the Large Hadron Collider (LHC) involving the top quark and Higgs boson. Presently, he and his group members are looking into the rare signatures of top pair production in association with photons

and Z boson with LHC Run II dataset at $\sqrt{s}=13$ TeV. In the context of SM Higgs and beyond, his group members are intensely involved in the Run II analysis with diphoton signature. His students and group members are also pursuing precision measurements on some of the top quark properties (decay width and W-helicity).

In addition, he is leading the NISER-CMS group in terms of CMS detector upgrade program scheduled in next few years. During this period the LHC is scheduled to undergo several luminosity upgrade programs where the number of interactions per proton-proton bunch crossing would heavily be increased. In such an environment, any physics analyses would require event filtering based on the tracking detector. Dr. Mal is actively involved in the CMS upgrade program for developing suitable track triggering mechanism, as well as in building the tracking detector for High-Luminosity LHC (HL-LHC). During HL-LHC, the CMS Outer Tracker (OT) would completely be replaced with a brand new Silicon pixel/strip detectors. Detailed designing and feasibility studies for the same have been documented in the CMS OT Technical Design Report II. NISER-CMS group has taken the responsibility to build 2000 modules consisting of Silicon strip detectors. The responsibility involves assembly of such detector modules, electrical testing and temperature cycling, and integration of the modules into ladder structure. Presently, the NISER-CMS facility is setup with most of the major equipments required for this assembly works. The ladder integrated strip detectors are expected to be delivered/shipped to CERN by 2023, while successful prototyping of modules are to be completed by 2020. Dr. Mal is the contact person from NISER-CMS group for the successful execution and timely delivery of these detectors to CERN. Furthermore, he and his group members are working on the performance



studies for the present CMS tracker, studies with different HEP event generators, development of monitoring tools for CMS L1 trigger system, etc. He has regularly been participating in CMS detector operations and data-taking.

Dr. V Ravi Chandra, Reader-F

In the year 2019-20 we have worked on the following research problems:

1. We have studied the interplay of Dzyaloshinskii-Moriya interaction and spin-ice like anisotropy in pyrochlore Heisenberg magnets with a view to characterising the topological magnons in these systems. Using programs developed to calculate the spin wave spectrum for general Bravais lattices we have studied magnonic spectra for both the ferromagnetic and antiferromagnetic Hamiltonians. We are currently analysing the nature of edge states in the 111 and 100 directions of the lattice in detail. This work is being carried out in collaboration with Mr. V.V. Jyothis (PhD student, NISER) and Mr. Bibhabasu Patra (Project Fellow, NISER) and preliminary results have been presented at a conference and a manuscript describing this work is currently in preparation.
2. We have investigated, using extensive exact diagonalisation simulations, the many body localisation (MBL) transition in disordered fermionic chains from the point of view of disorder averaged local density of states. By analysing a site disordered fermionic chain with nearest neighbour hopping and repulsive interactions for $L=14, 16, 18$ and 20 sites we found that the local density of states at zero frequency over the whole spectrum and the frequency dependence of the local density of states at both the edges and the middle of the spectrum clearly becomes vanishingly small for increasing disorder

strength. This behaviour of vanishing LDOS broadly tracks the delocalised to localised transition analysed using level spacing statistics. Ours is one of the few studies to attempt to characterise the behaviour of the local density of states over the whole spectrum as the system goes into an MBL phase. This work is in collaboration with Mr Atanu Jana (PhD student, NISER) and Prof. Arti Garg (SINP, Kolkata) and a manuscript is in final stages of preparation.

Dr. Nishikanta Khandai, Reader-F

- a. Understanding the distribution of neutral hydrogen in Galaxies with the ALFALFA and SDSS surveys.
- b. The effect of quasar feedback on the environment of clusters and groups of galaxies
- c. On using the pair-velocities of galaxies to constrain cosmology.
- d. Understanding the metal absorption lines in quasar spectra.

Courses Taught

- a. Fall 2019 - P474 Introduction to Cosmology
- b. Spring 2020 - P206 Quantum Mechanics I

Student supervision

- a. Pushpak Pandey - MSc Project (24 credits)
- b. Priyabrata Jena - MSc Project (24 credits)

Dr. Anamitra Mukherjee, Reader-F

- (a) The collaborations started with Prof. Tanusri-Saha-Dasgupta at SNBCBS, Kolkata and Prof. Arun Paramekanti at University of Toronto for studying the physics of strongly correlated Nickel oxide systems has led to a paper that is published in Physical Review Letters. Current collaboration is continuing in understanding



the microscopic mechanism behind stabilizing polar distortion in transition metal ferrates and uncovering the competition between polar and breathing mode distortions in negative charge transfer oxides. One paper in this long term project is complete and is being prepared for submission.

- (b) With his student Gour Jana, he has completed the work on the project of studying the Hubbard model with next nearest hopping. In this work, he has shown that their approach of Monte Carlo-Mean Field theory can capture Fermi liquid to NonFermi liquid crossover, magnetic phases and spin liquid behavior in this model and can be used to study the impact of temperature of these. The paper is under review in Physical Review B.
- (c) With his student Gour Jana, they are now looking to study super conducting instability in the above-mentioned model and in the ionic Hubbard model. This work also has a collaborative component with Prof. Elbio Dagotto, University of Tennessee.
- (d) He has started co-guiding another PhD student Sayan Jana of IOP, jointly with Dr. Arijit Saha, faculty member of IOP. They have looked at the impact of strong correlation physics of topological phases in the 2 dimensional Lieb lattice. They have shown how a band topological insulator becomes a topological Mott insulator using slave rotor mean field theory. They have also shown how the edge states evolve under Page 2 of 3 increasing correlation effects. The work for this project is complete, the paper is under review in Physical Review B.
- (e) In collaboration with Arjit Saha, Sayan Jana IOP and Dr. Priyanka Mohan, TIFR, they have shown how light with certain kinds of polarization can melt a Mott insulating state in

strongly correlated systems. The paper is being written up. (f) With Dr. Sanjukta Paul, postdoc at NISER, Anamitra is developing a way to apply Monte-Carlo mean field theory in rotation invariant multiband models for correlated materials.

Dr. Ajaya Kumar Nayak, Reader-F

Recently, Dr. Nayak's group is working on the topological aspects of magnetism in different intermetallic compounds. The plan is to directly implement the phenomena arising from the topological magnetic structures in spintronic devices. In particular, the group is working on Magnetic Skyrmions/Antiskyrmions and Anomalous/Topological Hall effect, etc. In the following the summary of research works based on these three research topics are discussed.

Magnetic skyrmions/ antiskyrmions/ antiskyrmioniums:

The art of easy manipulation of noncollinear magnetic structures has led to a drastic shift of focus on research involving next generation spintronic devices. In this direction, chiral magnetic solitons like skyrmions are subjects of extreme research due their capabilities to be implemented in low power consumption data storage devices. In the quest for finding new skyrmion based materials the group has discovered a new Mn-Ni-Ga based system that is supposed to show antiskyrmions beyond room temperature. The group measured the topological Hall Effect and ac-susceptibility to demonstrate the presence of antiskyrmion phase. By tuning the Mn/Ga concentration the antiskyrmion phase was stabilized over a large temperature regime, thereby moving close to the realization of skyrmion based racetrack memory. In another work the group utilize magnetic entropy change measurements, to characterize the antiskyrmion phase in bulk Mn-Pt-Sn



antiskyrmion materials. It was shown that the antiskyrmion phase comes with a positive magnetic entropy change in contrast to the conventional negative entropy change in a second order magnetic phase transition. In addition, the presence of anomalies in the ac-susceptibility measurements supports the findings. In another work, we utilize micromagnetic simulations to propose a unique method where magnetic antiskyrmioniums can be stabilize from the ferromagnetic as well as antiskyrmionic ground states in ferromagnetic materials with D2d symmetry. Our dynamics study shows that the antiskyrmioniums can be moved with a large velocity in comparison to antiskyrmions. The anisotropic magnetization distribution in antiskyrmionum provides a distinct current driven dynamic in comparison to skyrmioniums. These antiskyrmionium can be stabilized and switched reversibly from a single antiskyrmion and driven efficiently in an anisotropy gradient. The work provides a new direction to the realization of antiskyrmionium based racetrack devices using D2d symmetry based materials.

Anomalous/Topological Hall effects and magnetocaloric materials:

Non-vanishing momentum space Berry curvature is one of the main contributors to the anomalous Hall Effect (AHE) which in general scales with the magnetization in ferromagnetic materials. The study of AHE in epitaxially grown Co_2TiSn films reveals that the contribution from the Berry curvature is significant. The deviation between the theoretically predicted value and the experimental values is found to be coming from the side jump and skew scattering mechanisms. The theoretical calculations point that the intrinsic contribution to the anomalous Hall Effect originates from partially gaped nodal

lines due to the symmetry reduction induced by the lack of time reversal symmetry in Co_2TiSn . In another work related to magnetic entropy change in Ni-Co-Mn-Sb-based Heusler shape-memory alloys reveals the presence of a large magnetocaloric and elastocaloric effects. A large adiabatic temperature change of 11 K was obtained in the Ni-Co-Mn-Sb system by using direct adiabatic temperature-change measurements in pulsed magnetic fields. It is also demonstrated that the magnetic cooling can be achieved in a wide temperature range spanning from 120 to 270 K by varying the chemical composition.

Dr. Victor Roy, Reader-F

The present research of the group led by Dr. Victor Roy is focused on studying various theoretical aspects of the quark-matter produced in high energy heavy-ion collisions experiments at RHIC and LHC. One such study involves the investigation regarding the unexpected success of relativistic viscous hydrodynamics for small systems e.g., proton-proton collisions at LHC energies. Along with a Ph.D. student Mr. Ashutosh Dash the study of a non-equilibrium system approaching equilibrium hydrodynamics regime by using relativistic Boltzmann transport equation shows the existence of attractor solutions for 2+1d Gubser flow has led to a publication in Physics Letters B.

In another collaborative study with Prof. Sabyasachi Ghosh's group at IIT Bhilai has resulted in a publication in Phys. Rev. D. In that study they investigate the anisotropic transport coefficients resulting from the interaction of the hadronic matter with a magnetic field produced in the high-energy heavy-ion collisions. They also show the dependence of shear, bulk viscosity, particle diffusion coefficients, and electrical conductivity of a hadron resonance gas on the magnetic field, temperature, and baryon chemical potential.



In a separate project with Mr. Ashutosh Dash, they recently included the shear and bulk viscosity to an ideal $2(\text{space}) + 1(\text{time})$ dimensional relativistic hydrodynamic code that they have developed the last year at NISER. The group is currently involved in a study to locate the QCD critical point on the phase diagram spanned by temperature and baryon chemical potential by using this newly developed code. One paper has been communicated on this topic.

Dr. Amaresh Kumar Jaiswal, Reader-F

The current research of our group is focused on attractors and applicability of relativistic hydrodynamics in high-energy heavy ion collisions. We are interested in formulation of relativistic hydrodynamic equations, which takes into account the spin of fermions in the plasma. Polarization of observed hadrons will carry the signature of this effect that we are trying to incorporate in our formulation. We are also interested in finding the analytical solution of hydrodynamic equations for highly symmetric systems. Recently we have started working on propagation of heavy quarks, such as charm and bottom, and their bound states through the medium.

Dr. Tuhin Ghosh, Reader-F

The group led by Dr. Tuhin Ghosh focuses on certain aspects of Galactic Astrophysics and Cosmology. The activities of this group are described below.

- a. PASIPHAЕ Project – Tuhin Ghosh and team has officially joined the PASIPHAЕ collaboration in March 2019. The aim of this experiment is to measure the polarization of millions of stars at areas of the sky away from the Galactic plane with unprecedented accuracy. The ultimate goal of the experiment is to reconstruct a tomographic map of the

Galactic magnetic field by combining the stellar distances provided by ESA's GAIA mission. The team is working on the pipeline code for the PASIPHAЕ instrument called WALOP South to correct for geometrical and artificially produced instrumental polarization effects.

- b. Dust modelling using HI emission – Debabrata Adak (Ph.D. student at IUCAA) and Tuhin Ghosh have developed and extend a modelling framework to simulate polarized dust emission based on Ghosh et al. 2017 paper, making use of both the Planck data and Effelberg-Born HI surveys over the northern Galactic cap. The seven-parameter dust model, incorporates three layers of HI gas in multiphase medium as a proxy for variable dust intensity and a phenomenological model of Galactic magnetic field, is able to reproduce the 1- and 2-point statistics of observed dust polarization seen by Planck satellite at 353 GHz over northern Galactic cap. This work has important application in assessing the accuracy of component separation method used for CMB B-mode search.
- c. Statistical characterization of dust polarization – Andrea Bracco (Postdoc at ENS Paris) and Tuhin Ghosh extend the Planck 2018 analysis to low Galactic latitude to investigate the correlation between the T-E-B auto- and cross-power spectra with the gas column density from the diffuse interstellar medium (ISM) to molecular clouds. For the first time, this work shows significant variations in T-E-B dust polarization power spectra across the sky with gas column density and multipoles (angular scales). These results are key for accurate foreground separation for next generation CMB experiments targetting for B-mode signal.



- d. Hamiltonian Markov Chain method – Debabrata Adak (Ph.D. student at IUCAA), Shabbir Shaikh (Ph.D. student at IUCAA) and Tuhin Ghosh are developing a new and powerful tool to make bayesian inference of dust-HI correlation using diffuse interstellar medium. The team employ Hamiltonian Monte Carlo (HMC) sampling method to sample the large dimensional parameter space. In their application to HMC, they simultaneously fit $f_{\text{sky}} \times 12 \times N_{\text{side}}^2 + 1$ parameters to a given Planck frequency, where f_{sky} ranges from 0.1 to 0.2 and $N_{\text{side}}=32$. The HMC method is successfully applied to the simulated Planck maps to estimate the dust emissivities. The next step is to apply HMC method to the real Planck data and obtain reliable estimate of dust emissivities and cosmic infrared background anisotropies map.
- e. Stacking of pairs of Luminous Red Galaxies (LRGs) – Tuhin Ghosh and Baibhav Singari (M.Sc. student at NISER) have been searching for warm/hot filamentary structure between a pair of LRGs using the publicly available Planck data. In their analysis, the raw Planck maps are stacked up at the location of LRG pairs separating within a radial and tangential distance of $6h^{-1}$ Mpc. The angular position of each LRG pair is rotated and scaled so that they lie on a common reference frame. They found statistically significant signal coming from warm/hot filamentary structures connecting two LRGs. Through this study, they also quantify the level of foreground contamination in the detected signal.

Dr. Najmul Haque, Assistant Professor

High energy heavy ion physics (Theory)

1. Properties of meson in a warm magnetised medium

2. Curvature of QCD phase transition line from NNLO HTLpt thermodynamics
3. Heavy Quark Diffusion in Perturbative QCD at Next-next-to-Leading Order
4. Quark and Gluon propagator in a hot magnetised medium
5. Thermodynamics of deconfined hot and dense magnetised nuclear medium

Dr. Kush Saha, Assistant Professor

The group of Dr. Kush Saha has a broad range of interests in condensed matter physics with specific focus on physics of ultracold atomic gases loaded in optical lattices, topological phases of matter and Dirac semimetals. Below he sketches some of those topics-

Unsaturated thermopower in two dimensional Dirac semimetals

Recently, there has been an upsurge in the study of thermopower in Dirac systems, both in the presence and absence of a quantizing magnetic field (Hwang et al., PRB 2009; Skinner et al., PNAS 2018). This is because the thermopower is a sensitive and powerful tool to probe transport properties, involving different scattering mechanisms in materials. Two-dimensional (2D) graphene and related 2D Dirac materials are shown to have anomalous and universal thermoelectric properties due to the Weyl/Dirac dispersion of the emergent quasiparticles (Zhu et al., PRL 2010, Bergman et al., PRL 2010).

Despite much work on the transport properties in Dirac materials, the thermoelectric properties in relatively new 2D anisotropic Dirac materials, having a quadratic dispersion in one direction and a linear dispersion along the orthogonal direction, such as VO₂/TiO₃ (Banerjee et al., PRL 2009; Pardo et al., PRL 2009), organic salts, and deformed graphene (Montambaux et al., PRB 2009), have not been explored in details. This is in



part because there are lack of natural materials with such anisotropic dispersion and in part because the anisotropy leads to complexities in finding the analytical expressions for relevant thermoelectric coefficients involving different scattering mechanism, as compared to the in-plane and out-of-plane anisotropy in double-Weyl materials (Chen et al., PRB 2016). Due to the anisotropic dispersion, these 2D Dirac materials exhibit unconventional electric and magnetic properties as opposed to the isotropic Weyl/Dirac system. Since transport coefficients such as thermal conductivity and thermoelectric coefficients are determined by the band structure and scattering mechanism, it is natural to ask how this anisotropy can be leveraged in the thermal properties of these 2D systems, both in the presence and absence of quantized magnetic field. Specifically, does this anisotropy give rise to interesting field, temperature and doping dependence of the thermoelectric coefficients?

To address these, we have recently studied the thermal transport in such an anisotropic 2D Dirac system, both in absence and in presence of an external magnetic field. We have shown that the thermopower in the absence of magnetic field exhibits a complex dependence on the chemical potential and temperature, in contrast to its isotropic counterpart. We have also found that the presence of an external magnetic field leads to novel field-dependent thermal properties, leading to unsaturated thermopower. This field dependence differs notably not only from its isotropic counterpart, but also from the 3D Weyl systems (Skinner and Fu, 2018). This have been attributed to the fact that the field dependence of the Landau spectrum for such anisotropic Dirac systems differs from that of the 2D and 3D isotropic Dirac systems. As expected, the transport properties of the 2D and 3D anisotropic cases are different due to the change in

dimensionality. This feature have found to be reflected in the chemical potential and magnetic field dependence of the thermopower.

Mirror anomaly in Dirac semimetals

Dirac semimetals are a new class of materials with non-trivial electronic band topology. Despite a decade of rapid progress, the field of Dirac semimetals (DSMs) continues to evolve as a promising avenue for studying several unusual phenomena such as magnetoresistance, giant diamagnetism, quantum oscillations, etc (Hasan et al., RMP, 2011). Moreover, they can host non-trivial states of matter such as topological insulators and Weyl metals in the presence and/or absence of certain symmetries such as time-reversal (TR) symmetry, inversion symmetry (IS), and crystalline uniaxial rotational symmetry. The response of these topological states to external fields can be understood in terms of quantum anomalies, a concept that stems from particle physics. Chiral anomaly turns out to be one of the most well known anomalies, which is manifested in the longitudinal magnetoresistance, planar Hall Effect, Fermi arc surface states in these Dirac systems.

In addition to the chiral anomaly, there exists parity anomaly which refers to the violation of time-reversal and parity symmetry in 2+1 dimensional relativistic Dirac fermions. Interestingly, the observable signature of such anomaly can be realized in condensed matter systems whose low-energy Hamiltonians are described by two dimensional Dirac fermions. For example, the Hall response of two dimensional gapped graphene depends on the magnitude and sign of the gap parameter, leading to singular step-like Hall Effect. Similar to the observable signature of parity anomaly, the three dimensional DSMs have been found to show a step-like anomalous Hall conductivity (AHC) (A.



Burkov, PRL 2018) as a function of polar angle of the applied magnetic field perpendicular to the mirror symmetric plane. This anomaly is termed as mirror anomaly.

Recently, we have shown that this feature is not generic to all DSMs (Nandy et al., PRB 2019). In type-I Dirac semimetals, where Dirac points generally appear in pairs on the rotation axis, the step-like AHC is smoothen out with the polar angle across the mirror symmetric plane. On the other hand, in type-II DSMs, the AHC shows step-like behavior as a function of the polar angle. Therefore, the Hall measurement can be thought of as a key observable to infer the presence or absence of mirror anomaly in type-II DSMs as well as to distinguish different classes of DSMs. However, such measurements are always limited by impurities, and it can have contributions from orbital effect. This in turn may lead to the deviation from the step-like behavior. Hence, it is desirable to find easily accessible diagnostic tools to discriminate DSMs with or without mirror symmetry (i.e., presence or absence of mirror anomaly) as well as their types.

Such tools may help us understanding the responses of DSMs exhibiting different underlying symmetries and their potential applications in electronic devices.

In view of the above, we have theoretically investigated (Karmakar et al., arXiv 2020) the optical activity of three dimensional Dirac semimetals (DSMs) using circular dichroism (CD). We have shown that DSMs in the presence of a magnetic field in any one of the mirror-symmetric planes of the materials exhibit a notable dichroic behavior. In particular, for different orientations of the light field with respect to the mirror-symmetric plane, the CD in type-II DSMs can detect the presence of mirror anomaly by showing sharply distinct patterns at the mirror-symmetric angle. Interestingly, we have found

that the CD can also distinguish type-II DSMs having only one Dirac point at a time-reversal invariant momentum from type-I DSMs with a pair of Dirac points on the rotation axis of the crystals.

Higher harmonic generation

Even after several decades of intense research, the field of matter-light interaction continues to be an emerging field of research both theoretically and experimentally as it allows to decode microscopic mechanism for several physical systems such as gaseous, solid-state, and photonic systems (Ghimire et al., Nature Phys. 2019). The non-perturbative nature of the matter-light interaction makes the field more promising for its potential for exhibiting unprecedented and rich physics. For example, the generation of higher harmonics in gaseous systems (Ferry et al., J. Phys. B 1988, Huillier et al., PRA 1991, etc), leading to plateaus in energy distribution of emitted light, has stimulated research for several decades and has now become a key candidate for attosecond science. Recently, the higher harmonic generation (HHG) has been experimentally observed and theoretically studied in solid state systems (Ghimire et al., Nature Phys. 2010, You et al., Nature Phys. 2017). While gas phase HHG is limited to complex experimental set-ups and millijoule class laser pump, the solid state HHG turns out to be easily achievable and non-destructive. Thus it emerges as a potential platform for ultrafast and short wavelength coherent light sources.

While most of the studies on HHG in gas and solid-state systems either assume weak interaction or those are based on single particle picture, only a few recent studies has addressed HHG in strongly correlated electronic systems such as Mott insulators (Silva et al., Nat. Photon 2018, Murakami et al., PRL 2018). Using fermionic



Hubbard model, it has been shown that the HHG can be used to resolve ultrafast many-body dynamics in a Mott insulator. In the strong-field, the mechanism that leads to the HHG in Mott insulators turns out to be the recombination of field-excited doublon-holon pairs with the ground states. In contrast, in the low-field limit, the itinerant doublon-holon excitations play the role in generating higher harmonics. The typical notion of doublon-holon excitations in Fermionic Mott insulators cannot be extended to bosonic systems. For example, bosons in optical lattice are known to exhibit a class of excitations (Sachdev et al., PRB 2002) depending on the strength of the applied electric field. It is therefore natural to ask if similar higher harmonics can be obtained in bosonic systems under light pulse. If yes, what governs such generation of higher harmonics, or in other words, how various types of excitations contribute to HHG?

In view of that, very recently we have studied HHG in one dimensional Bose-Hubbard model in different regimes of atom-atom interactions giving rise to the superfluid and Mott phases in the presence of a synthetic electric field. We have found that the dynamics of atoms in the superfluid regime is transparent to the electric field. In contrast, the Mott insulating phase exhibits strikingly different responses. By varying strength of the field, we have revealed that the field-driven transitions involve an increasing order of harmonics in the Mott insulating regime. The superfluid regime remains unaffected as we increase strength of the light field. We have demonstrated that the generation of higher harmonics in the Mott insulating regime can be attributed to the formation of resonant dipole states- a pair of quasiparticle and quasihole on nearest neighbor sites when the field strength is comparable with the interaction U . On the contrary, in the strong field limit, the HHG is attributed to the non-resonant states where

quasiparticle-quasihole pair resides on different sites.

Although there are several interesting facts obtained in bosonic HHG, it lacks quantitative explanation of the reason behind the offset of odd harmonics in the HHG spectrum. This may be attributed to the absence of bath induced dephasing terms due to dissipation in the Hamiltonian. Thus it is desirable to investigate the effect of dissipation on bosonic HHG to see if it can explain this offset and can lead to additional structure in the HHG spectrum.

Dr. Ashis Kumar Nandy, Assistant Professor
(Ramanujan Fellowship-2019)

Within a theoretical framework, Dr. Nandy's group is broadly interested on magnetization dynamics in a multiscale environment comprising first principles calculations within density functional theory and/or model Hamiltonian approach, to identify the physics at play, followed by micromagnetic theory, Monte-Carlo and/or large-scale Atomistic Spin Dynamics simulations to elucidate the static and dynamic properties.

Such multiscale approach is useful in describing various aspects of condensed matter physics which include chiral spin structures in both real space e.g. skyrmion, domain-wall and momentum space e.g. topological insulators with non-trivial surface states, Rashba-Dresselhaus systems, transverse transport phenomena via the spin Hall effect and/or the Edelstein effect, ultrashort light induced magnetization dynamics to name a few.

We have been working on these following areas:

Non-trivial topology in spin space:
Skyrmion & anti-skyrmion

The recent information revolutions demand a steadily increasing data storage capacity with



bits to be stored and processed on decreasing spatial and temporal scales. (Anti-)Skyrmions carrying nontrivial topology are particle-like solitons with spin states that appear in non-centrosymmetric bulk crystals and in ultrathin magnetic films deposited on heavy metal substrates. Recently, magnetic skyrmions are of intense interest: from a fundamental perspective, they allow the unique interplay between topology, chiral magnetism and unconventional transport properties at the nanoscale to be investigated. Moreover, its small size, electric/magnetic field-controlled nucleation, detection and motion, preferably under ambient conditions, offer technological promises such as information storage based on more efficient skyrmion racetrack memory or logic technologies.

Spin-orbitronics

One of the primary requirements in this area is the conversion between charge and spin transports for basic spintronics operations. The spin-dependent electron scattering due to the fundamental spin-orbit coupling produces a spin current from usual electrical current and vice versa. Recently, we have seen a resurgence of interest in understanding such transport phenomena due to the new possibilities for manipulating magnetization on nanoscale. For example, if the spin current is injected into a magnetic material, the resulting torque has the potential to switch its magnetization even strikingly for an antiferromagnet; the resultant torque in ultrathin magnetic films can move a chiral domain walls or skyrmions, much more efficiently than any other known mechanism. We are interested in exploring the spin-charge conversions phenomena via the spin Hall Effect and/or the companion Edelstein effect and their inverse effects with in ab initio theory.

Ultrafast magnetization dynamics

This area comprises fundamental aspects of magnetization dynamics preceded by ultrafast laser excitation in magnetically ordered materials as well as extending novel concepts of spintronics and magnetic recording towards ultrafast time-scale.

Such excitation of a material brings the material's electrons into a strongly out-of-equilibrium state that is within an ultrashort timescale engaged entangled dynamics between spin, orbital, and lattice degrees of freedom. The experimental capability of measuring ultrafast relaxation dynamics has led to the discovery of many unexpected phenomena: ultrafast demagnetization, change of magnetic anisotropy, generation of coherent magnetic precession etc. The theoretical frameworks which we are interested can describe such dynamical nonequilibrium phenomenon involving charge, spin, orbital, and lattice degrees of freedom interacting with such intensive, short radiation pulses.

Our team is involved in developing and understanding theoretical models in above mentioned areas to cultivate new ideas which motivate experimentalist to set up new experiments or elucidate experimental observations.

Dr. Sayantani Bhattacharyya, Reader-F

In past one year, She is working with two Ph.D. students Parthajit Biswas, Anirban Dinda and two Integrated Ph.D she is am working on new perturbative techniques ('large dimension' expansion) to generate dynamical black hole solutions and they are comparing it with other existing techniques. Last year we had two publications in Journal of High Energy Physics and one arXiv preprint, which got published this



year. In these projects we also collaborate with Yogesh Dandekar, post doctoral fellow in ICTS. The another parallel project that she was working on along with Anirban, Shuvayu, Nilay Kundu (faculty in IITK) and Jyotirmoy Bhattacharya (faculty in IITKgp) is about generalizing the concept of entropy current to higher derivative theories of gravity. However, this project has not lead to any publication so far. Dr. Pratim Roy, post-doctoral fellow in our group, is independently working on the holographic aspects of complexity. Last year he has one publication.

Publications (Journals):

ALICE

1. Measurement of electrons from semileptonic heavy-flavour hadron decays at midrapidity in pp and Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV. S. Acharya et al. [ALICE Collaboration], Phys. Lett. B 804 (2020) 135377.
2. Longitudinal and azimuthal evolution of two-particle transverse momentum correlations in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV. S. Acharya et al. [ALICE Collaboration], Phys. Lett. B 804 (2020) 135375.
3. Measurements of inclusive jet spectra in pp and central Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV. S. Acharya et al. [ALICE Collaboration], Phys. Rev. C 101, 034911 (2020).
4. Scattering studies with low-energy kaon-proton femtoscopy in proton-proton collisions at the LHC. S. Acharya et al. [ALICE Collaboration], Phys. Rev. Lett. 124 (2020) 092301.
5. Multiplicity dependence of (multi-)strange hadron production in proton-proton collisions at $\sqrt{s} = 13$ TeV. S. Acharya et al. [ALICE Collaboration], Eur. Phys. J. C 80, 167 (2020).
6. Studies of J/ψ production at forward rapidity in Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV. S. Acharya et al. [ALICE Collaboration], JHEP 02 (2020) 041.
7. Measurement of electrons from heavy-flavour hadron decays as a function of multiplicity in p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV. S. Acharya et al. [ALICE Collaboration], JHEP 02 (2020) 077.
8. Exploration of jet substructure using iterative declustering in pp and Pb-Pb collisions at LHC energies. S. Acharya et al. [ALICE Collaboration], Phys. Lett. B 802 (2020) 135227.
9. Evidence of rescattering effect in Pb-Pb collisions at the LHC through production of $K^*(892)^0$ and $\phi(1020)$ mesons. S. Acharya et al. [ALICE Collaboration], Phys. Lett. B 802 (2020) 135225.
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13. Measurement of charged jet cross section in pp collisions at $\sqrt{s} = 5.02$ TeV. S. Acharya et al. [ALICE Collaboration], Phys. Rev. D 100, 092004 (2019).
14. Measurement of the inclusive isolated photon production cross section in pp collisions at $\sqrt{s} = 7$ TeV. S. Acharya et al. [ALICE Collaboration], Eur. Phys. J. C (2019) 79: 896.



15. Measurement of Υ (1S) elliptic flow at forward rapidity in Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV. S. Acharya et al. [ALICE Collaboration], Phys. Rev. Lett. 123, 192301 (2019).
16. Charged-particle production as a function of multiplicity and transverse sphericity in pp collisions at $\sqrt{s} = 5.02$ and 13 TeV. S. Acharya et al. [ALICE Collaboration], Eur. Phys. J. C 79 (2019) no.10, 857.
17. Study of the Λ - Λ interaction with femtoscopy correlations in pp and p-Pb collisions at the LHC. S. Acharya et al. [ALICE Collaboration], Phys. Lett. B 797 (2019) 134822.
18. $3\Lambda^0$ and $3\Lambda^0$ lifetime measurement in Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV via two-body decay. S. Acharya et al. [ALICE Collaboration], Phys. Lett. B 797 (2019) 134905.
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26. Measurement of the production of charm jets tagged with D^0 mesons in pp collisions at $\sqrt{s} = 7$ TeV. S. Acharya et al. [ALICE Collaboration], JHEP 08 (2019) 133.
27. Production of muons from heavy-flavour hadron decays in pp collisions at $\sqrt{s} = 5.02$ TeV. S. Acharya et al. [ALICE Collaboration], JHEP 09 (2019) 8.
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STAR

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93. Quantum Nash equilibrium in the thermodynamic limit, Shubhayan Sarkar, Colin Benjamin, Quantum Information Processing 18:122 (2019).
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112. Performance of Tao-Mo Semilocal Functional with rVV10 Dispersion-Correction: Influence of Different Correlation, Abhilash Patra, Subrata Jana, Prasanjit Samal, J. Phys. Chem. A, 123, 49, 10582–10593 (2019). (IF 2.836)
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117. Semianalytical wavefunctions and Kohn-Sham exchange-correlation potentials for two-electron atomic systems in two-dimensions, Rabeet Singh, Ashish Kumar, Manoj K Harbola and Prasanjit Samal, Journal of Physics B: Atomic, Molecular and Optical Physics, Volume 53, Number 3 (IF 2.115)
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119. Efficient yet Accurate Dispersion-Corrected Semilocal Exchange-Correlation Functionals for Non-Covalent Interactions, Abhilash Patra, Subrata Jana, Lucian A. Constantin, and Prasanjit Samal, J. Chem. Phys. (accepted) (2020). (IF 2.997)

PrePrints

1. Shot Noise as a probe for the pairing symmetry of Iron pnictide superconductors, Colin Benjamin, Tusaradri Mohapatra, arXiv:1904.00201
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Conference/Workshop proceedings:

1. Amaresh Jaiswal, 'Attractors in higher-order viscous hydrodynamics for Bjorken flow', Proceedings of the DAE Symposium on Nuclear Physics 64, 37-38 (2019).
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3. Samapan Bhadury, Manu Kurian, Vinod Chandra and Amaresh Jaiswal, 'First order dissipative hydrodynamics from an effective fugacity model', Proceedings of the DAE Symposium on Nuclear Physics 64, 810-811 (2019).
4. Dr. Najmul Haque- Quark Matter 2019, Wuhan, China on 4th -10th Nov 2019
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6. Dr. Najmul Haque- WHEPP XVI, IIT Guwahati, 7th -10th Dec, 2019
7. Study of Voltage Controlled Magnetic Anisotropy in Ferromagnetic Bilayer System Abhilash Mishra, Esita Pandey, Purbasha Sharangi, Braj Bhusan Singh, Subhankar Bedanta
8. Inverse spin Hall effect in sputter deposited MoS₂/CoFeB bilayers Abhisek Mishra, V.Thiruvengadam, B.Singh, S.Bedanta
9. Shorthand demonstration of artificial neural network using antiskyrmionic structures Adyashakti Dash, Mona M.M. Bhukta, Brindaban Ojha, Braj Bhusan Singh, Subhankar Bedanta
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11. Effect of Strain on the Perpendicular Magnetic Anisotropy and Domains of Co/Pt Thin Films on Polyimide: Towards Flexible Spintronics, Esita Pandey, Braj Bhusan Singh, Purbasha Sharangi, Subhankar Bedanta
12. Effect of random anisotropy in skyrmion stabilization, Gajanan Pradhan, and Subhankar Bedanta
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14. Fabrication of magnetic nanostructures by nanosphere lithography, Mohammed Azharudheen, Braj Bhusan Singh, Subhankar Bedanta
15. Pulsed magnetic field driven domain wall dynamics in Pt/Co multilayers, Minaxi Sharma, Braj Bhusan Singh, Brindaban Ojha, Sabine Pütter and Subhankar Bedanta
16. Skyrmionic States in Synthetic Antiferromagnets, Mona Minakshee Manjaree Bhukta, Braj Bhusan Singh, Subhankar Bedanta
17. Ba₄NbIr₃O₁₂ spin liquid: the tuning of magnetic ordering by Ru-substitution, Palash K. Manna, Samikshya Sahu, and Subhankar Bedanta
18. Effect of Fullerene on magnetization relaxation and domain wall dynamics in a perpendicularly magnetized Co/C₆₀/Pt system, Purbasha Sharangi, Srijani Mallik, Subhankar Bedanta



19. Observation of antidamping and inverse spin Hall effect in $\text{La}_{0.67}\text{Sr}_{0.33}\text{MnO}_3/\text{Pt}$ bilayers, Pushpendra Gupta, Braj Bhusan Singh, Koustuv Roy, Anirban Sarkar, Markus Waschk, Thomas Brueckel, and Subhankar Bedanta
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22. Magnetization reversal, damping properties and magnetic anisotropy of L_{10} -ordered FeNi thin films, V. Thiruvengadam, B. B. Singh, T. Kojima, K. Takanashi, M. Mizuguchi, and S. Bedanta
23. "Spin alignment measurements of K^0 vector mesons with ALICE at the LHC", Mr. Sourav Kundu, Proceeding of ICHEP 2018: PoS ICHEP2018 (2019) 671.
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28. "Recent results on hadronic resonance production with ALICE at the LHC", Dukhishyam Mallick, Proceeding: DAE Symp.Nucl.Phys. 64 (2020) 706-707.
29. "Measurement of higher moments of net-proton distributions in $\text{Au}+\text{Au}$ collisions at $\sqrt{s_{\text{NN}}} = 54.4$ GeV at RHIC" by Mr. Ashish Pandav (for the STAR Collaboration) Proceeding of Quark Matter 2019, arXiv: 2003. 12503.
30. R.R. Sahoo, M.K. Shukla, S.S. Nayak, Ritwick Das, "Thermo-optic manifestations in congruently-grown LiTaO_3 based continuous-wave optical parametric oscillator," International Conference on Optics & Electro-optics (ICOL-2019)' at Instruments R&D Establishment (IRDE), Dehradun, 19-22 October 2019.
31. M.K. Shukla, R.R. Sahoo, Ritwick Das, "Stimulated polariton scattering in LiNbO_3 based optical parametric oscillator," International Conference on Optics & Electro-optics (ICOL-2019)' at Instruments R&D Establishment (IRDE), Dehradun, 19-22 October 2019.
32. Abhishek Mondal and Ritwick Das, "Group velocity matched optical parametric generation in the mid-infrared range, "International Conference on Optics & Electro-optics (ICOL-2019)' at Instruments R&D Establishment (IRDE), Dehradun, 19-22 October 2019.
33. Dr. Colin Benjamin- QCQT 2020 at Berhampur University from Mar. 8-9, 2020.

Conferences /Workshop/Meeting organized:

1. Dr. Yogesh Srivastava:- Conference on Recent Topics in String Theory 2019
2. Dr. Amaresh Jaiswal: - Workshop on Dynamics of QCD matter, 15-17 August 2019, NISER Jatni.



3. Dr. Nalmul Haque- Co-convener of "Workshop on Dynamics of QCD matter" which was held in NISER from 15th-17th August, 2019

4. Dr. Subhankar Bedanta- Convenor of the conference 'Bringing the Nanoworld Together (BTNT) 2019' held at NISER Bhubaneswar during Dec 5-6, 2019.

5. Prof. Bedangadas Mohanty, Dr. Amaresh Jaiswal, Dr. Najmul Haque, Dr. Victor Roy, Dr. Sudipan Dey- Workshop on Dynamics of QCD matter

The workshop was held from August 15-17, 2019 at NISER. This workshop was the first in the series of workshops that are aimed in near future at various institutes in India. The main aim of the workshop is to discuss and exchange the scientific information among heavy-ion community in India, both from the experiments and theory. The focus of the discussions was on the fundamental understanding of strongly-interacting matter at extreme conditions, as formed in ultra-relativistic nucleus-nucleus collisions, as well as on emergent QCD phenomena in high-multiplicity proton-proton and proton-nucleus collisions.

6. Dr. Ritwick Das- Topical meetings of Advances in Photonics (TMAP) at NISER, March-April 2019
7. Dr. Anamitra Mukherjee & Dr. Ashis Kumar Nandy- "Condensed Matter Meeting on Quantum Materials" during 01.05.2019 to 05.05.2019
8. Dr. Sumedha & Dr. A.V. Anil Kumar- "Conference on Recent Topics in Statistical Mechanics during 11.12.2019 to 13.12.2019
9. Dr. Tuhin Ghosh & Dr. Nishikanta Khandai-

"Conference on Geometric and Topological methods for cosmological data analysis during 20.07.2019 to 23.07.2019

Projects from non-DAE schemes:

1. Dr. Amaresh Jaiswal-Co-PI in SERB core grant CRG/2019/000807 (PI: Prof. Rajeev Bhalerao, IISER Pune) titled "Aspects of Relativistic Heavy-Ion Collisions and Quark-Gluon Plasma".

2. Dr. Amaresh Jaiswal-Co-PI in Indo-French project IFCPAR/CEFIPRA/6304-3 (PI: Ayan Mukhopadhyay, IIT Madras, Chennai) titled "Novel Non-Perturbative Approaches to Strongly Coupled QCD Matter.

3. Dr. Ajaya Kumar Nayak- Max Planck-India partner group project

Title: Room temperature magnetic skyrmions and the study of their current driven motion for potential applications in racetrack memory devices.

Source of funding: Max Planck Society, Germany

Budget: 20,000 euro per year (Total: 100000 euro in 5 years, 2017-2022).

4. Dr. Ajaya Kumar Nayak- Ramanujan Fellowship

Title: Designing Magnetic Anisotropy for Spintronics

Source of funding: DST/SERB

Budget: Rs. 7 lakhs per year (Total: 35 lakhs in 5 years, 2017- 2022). In addition, overhead of Rs. 3 lakhs in 5 years.

5. Dr. Ajaya Kumar Nayak- Early career research award



Title: Designing novel magnetic materials for exploring skyrmions at room temperature

Source of funding: DST

Budget: Rs. 39,13,056/ (2018-2021)

6. DST-Nanomission:

Title: In-situ low temperature imaging of magnetic nano-structures using Lorentz Transmission Electron Microscopy

Source of funding: DST

Budget: Rs. 86,55,200/ (2018-2021)

7. Dr. Nalmul Haque- Project title: QCD thermodynamics using non-perturbative Dyson-Schwinger Equation approach

Agency: SERB

Amount: 16,38,714 INR

8. Ferromagnetic-Semiconductor heterostructures for magnetic field sensing and optoelectronic applications (DST-Nanomission)

PI: S. Bedanta, Financial Support sanctioned: ~Rs 62.41 lakhs

(This project is being continued since 2017)

9. Creating magnetic interface in non-magnetic organic thin films for spintronic applications (DST- SERB)

PI: S. Bedanta, Financial Support sanctioned ~ Rs 60.75 lakhs

(This project is being continued since 2018)

10. Tuning the interfacial Dzyaloshinskii-Moriya interaction in ultrathin magnetic films: toward the stabilization of skyrmions in spintronic devices (Indo-French CEFIPRA project)

PI: S. Bedanta, Financial Support sanctioned ~ Rs 73.8 lakhs

(This project is being continued since 2018)

11. Project Title: Indian Institutions-Fermilab Collaboration in Neutrino Physics

PI- Sanjay K Swain

Duration of Funding: FY 2019-20 to FY 2023-24 (5 years)

Amount sanctioned to the Indian PI: 114.18 Lakhs INR

Project Reference Number: SR/MF/PS-01/2016-NISER/G

DST Funding to work in NOvA neutrino experiment at Fermilab, Chicago

12. DST SERB Project, July 2016-Jan 2020: "Non-local correlations in mesoscopic superconducting junctions".

PI: Colin Benjamin, Theoretical project with a budget of around 25 Lakhs which includes funds for recruiting a Research Associate.

13. SCIENCE & ENGINEERING RESEARCH BOARD, DST, Government of India, and MATRICS grant on "Nash equilibrium versus Pareto optimality in N-Player games", Grant No. MTR/2018/000070 from Mar. 2019-Mar. 2022

PI: Colin Benjamin

14. SCIENCE & ENGINEERING RESEARCH BOARD, DST, Government of India, CRG grant on "Josephson junctions with strained Dirac materials and their application in quantum information processing". Grant No. CRG/2019/006258 from Mar. 2020-Mar. 2023.

PI: Colin Benjamin

15. Ramanujan Fellowship, PI- Dr. Nishikanta Khandai



Talks (Invited and contributory)

1. Dr. Yogesh Srivastava gave a webinar on "Relativity and Black Holes" at Amity University.
2. Dr Amaresh Jaiswal- ". Attractors in relativistic fluid dynamics", 64th DAE-BRNS Symposium on Nuclear Physics, 26 December 2019, Lucknow University, India (Invited plenary).
3. Dr Amaresh Jaiswal- "Bottomonium elliptic flow from anisotropic escape", EMMI-RRTF meeting on Suppression and (re)generation of quarkonium in heavy-ion collisions at the LHC, 19 December 2019, GSI Darmstadt, Germany (Invited).
4. Dr Amaresh Jaiswal- "Analytical solutions and attractors of higher-order viscous hydrodynamics", Workshop on Theoretical Foundations of Relativistic Hydrodynamics, 28 November 2019, BIRS, Banff, Canada (Invited).
5. Dr Amaresh Jaiswal- "Relativistic dissipative hydrodynamics from kinetic theory", The Myriad Colorful Ways of Understanding Extreme QCD Matter, April 16, 2019, ICTS Bangalore, India (Invited).
6. Dr Amaresh Jaiswal- "Anisotropic escape mechanism and elliptic flow of bottomonia", 3rd Heavy Flavour Meet, March 19, 2019, IIT Indore, India (Invited).
7. Dr. Ajaya Kumar Nayak- Invited talk in "QMAT-2020" on "Quantum Condensed Matter Physics", S. N. Bose, Kolkata, 2020.
8. Dr. Ajaya Kumar Nayak- Invited talk in the "3rd Asia-Pacific workshop on Quantum Magnetism to be held in the newly found "Tsung-Dao Lee Institute" located in Shanghai, China, 2020.
9. Dr. Ajaya Kumar Nayak- Invited talk in "10th International Conference on Materials for Advanced Technologies (ICMAT)", 2019, Singapore.
10. Dr. Ajaya Kumar Nayak- Invited talk in "SpOT-LITE Workshop on Skyrmion" Singapore, 2019.
11. Dr. Ajaya Kumar Nayak- Invited talk in "Infosys Condensed Matter Physics seminar at TIFR", TIFR, India, 2019.
12. Topological magnons on the Pyrochlore lattice: role of competing anisotropies, Dr. V Ravi Chandra, (Young Investigator Meet on Quantum Condensed Matter Theory, Dec. 2019, SNBNCBS, Kolkata)
13. Correlations, entanglement and topological aspects of spin Hamiltonians, Dr. V Ravi Chandra, (Forum for quantum materials, May 2019, NISER)
14. Dr. Nalmul Haque- "Thermomagnetic effects in Heavy Ion Collisions", Workshop on the QCD Phase Structure at High Baryon Density Region, CCNU, Wuhan, China; 12th Nov 2019
15. Dr. Nalmul Haque- "Applications of thermal field theory in presence of magnetic field in HIC" WHEPPXVI, IIT Guwahati, 7th Dec, 2019
16. Dr. Nalmul Haque- "The application of thermal field theory to study hot and dense nuclear matter", IMSc Chennai on 17th Dec, 2019.
17. Dr. Subhankar Bedata- Invited talk at Delhi University in May 2019
Title: Nanomagnetism in dots and antidot lattices
18. Dr. Subhankar Bedanta- Invited talk at University Duisburg-Essen (Campus-Essen) in June 2019.
Title: Manipulating and/or creating magnetism by architecture and interface



19. Dr. Subhankar Bedata- Invited talk at IISER Berhampur in October 2019.
Title: Exploring Nanomagnetism via architecture and interface
20. Dr. Subhankar Bedata- Invited talk at Institute of Material Science, Tohoku University, Sendai, Japan in July 2019.
Title: Inverse spin Hall Effect in systems with heavy metals, topological insulators and antiferromagnets
21. Dr. Subhankar Bedata- Invited talk at Institute of Nanoscience and Technology (INST), Mohali in May 2019.
Title: Manipulating and/or creating magnetism by architecture and interface
22. Dr. Subhankar Bedata- Invited talk at University Paris-Saclay in November 2019.
Title: Inverse spin Hall Effect in systems with heavy metals, topological insulators and antiferromagnets
23. Dr. Subhankar Bedata- Invited talk at The Neotia University, Kolkata in July 2019.
Title: Exploring Nanomagnetism.
24. Dr. Subhankar Bedata- Invited talk at National Institute of Material Science (NIMS), Tsukuba, Japan in July 2019.
Title: Inverse spin Hall Effect in systems with heavy metals, topological insulators and antiferromagnets
25. Dr. Subhankar Bedata- Invited talk at Strasbourg University, Strasbourg, France in November 2019.
Title: Spinterface with Fullerene.
26. Dr. Subhankar Bedata- Invited talk at Utkal University, Bhubaneswar in November 2019.
Title: The excitations in nanomagnetism.
27. Dr. Subhankar Bedata- Invited seminar talk at S. N. Bose Center for Basic Science, Kolkata in February 2020.
Title: Exploring Nanomagnetism via architecture and interface engineering
28. Dr. Subhankar Bedata- Invited to give the BK Mohanty memorial lecture at Ravenshaw University in February 2020.
Title: Excitations in Nanomagnetism.
29. "Spin alignment of vector mesons measured in Pb-Pb collisions with ALICE" by Prof. Bedangadas Mohanty at CERN LHC Seminar, January 27, 2020.
30. "Spin alignment measurements of vector mesons in Pb-Pb collisions with ALICE at the LHC" by Mr. Sourav Kundu (for the ALICE Collaboration) at The 18th International Conference on Strangeness in Quark Matter (SQM 2019), Bari, Italy, June 10-15, 2019.
31. "Probing Thermal Nature of Matter formed at RHIC via Fluctuations" by Mr. Debasish Mallick at Quark Matter 2019 - the XXVIIIth International Conference on Ultra-relativistic Nucleus-Nucleus Collisions, Wuhan, China, November 4-9, 2019.
32. "Measurement of cumulants of conserved charge multiplicity distributions in Au+Au collisions from the STAR experiment" by Mr. Ashish Pandav (for the STAR Collaboration) at Quark Matter 2019 - the XXVIIIth International Conference on Ultra-relativistic Nucleus-Nucleus Collisions, China, November 4-9, 2019.
33. "Spin alignment measurements of vector mesons with ALICE at the LHC" by Mr. Sourav Kundu (for the ALICE Collaboration) at Quark Matter 2019 - the XXVIIIth International



Conference on Ultra-relativistic Nucleus-Nucleus Collisions, China, November 4-9, 2019.

34. "Feasibility studies of conserved charge fluctuations in Au-Au collisions with CBM by Dr. Subhasis Samanta (for the CBM Collaboration) at Quark Matter 2019 - the XXVIIIth International Conference on Ultra-relativistic Nucleus-Nucleus Collisions, China, November 4-9, 2019.
35. Measurement of higher moments of net-proton distributions in Au+Au collisions at $\sqrt{s_{NN}} = 5.44$ GeV at RHIC" by Mr. Ashish Pandav (for the STAR Collaboration) at The 18th International Conference on Strangeness in Quark Matter (SQM 2019), Bari, Italy, June 10-15, 2019.
36. "Spin-Orbital Angular Momentum Interaction in Heavy-Ion Collisions" by Prof. Bedangadas Mohanty at Workshop on QCD in the Nonperturbative Regime, TIFR, Mumbai, November 18-20, 2019.
37. "Fluctuation Measurements: Existing and Future Efforts of the STAR Experiment" by Prof. Bedangadas Mohanty at Dynamics of critical fluctuations: theory -phenomenology - HIC, GSI, Germany, 8-12 April 2019.
38. "Spin alignment studies in heavy-ion collisions" by Mr. Sourav Kundu (for the ALICE Collaboration) at Workshop on the QCD Phase Structure at High Baryon Density Region, Central China Normal University, Wuhan, China, November 12 - 14, 2019.
39. "Measurement of cumulants of net-particle distributions in Au+Au collisions at 5.44 GeV at RHIC" by Mr. Ashish Pandav (for the STAR Collaboration) at Workshop on the QCD Phase Structure at High Baryon Density Region, Central China Normal University, Wuhan, China, November 12 - 14, 2019.
40. "Probing Thermal Nature of Matter formed at RHIC via Fluctuations" by Mr. Debasish Mallick at Workshop on the QCD Phase Structure at High Baryon Density Region, Central China Normal University, Wuhan, China, November 12 - 14, 2019.
41. "SuperCDMS SNOLAB" by Vijay Iyer (for the SuperCDMS Collaboration) at Advances in Astroparticle Physics and Cosmology (AAPCOS-2020), SINP, Kolkata, India, January 6-10, 2020.
42. "Low gain operation of RPC, Update with results from low resistivity glass" by Dr. Varchaswi K S Kashyap at The 34th CBM collaboration meeting, GSI, Darmstadt, Germany, September 29 to October 3, 2019.
43. "Noise reduction and double gap operation of RPC" by Dr. Varchaswi K S Kashyap at the 35th CBM collaboration meeting, GSI, Darmstadt, Germany, March 23-27, 2020.
44. "The Universe in Collision", Invited seminar given at Inter University Accelerator Center (IUAC), New Delhi, 23 August 2019 by Dr. Sanjay K Swain.
45. Dr. Colin Benjamin- Invited talk delivered at Berhampur University on "An introduction to quantum walks and quantum games" during QCQT 2020 on Mar. 9, 2020.
46. Dr. Colin Benjamin- Talk delivered at INSA, New Delhi on "Josephson junctions with strained Dirac materials and their application in quantum information processing" during SERB presentation.
47. Dr. Kush Saha, Higher harmonic generation in interacting bosons in optical lattices, Young



Investigator Meet on Quantum Condensed Matter Theory, S N Bose National Centre for Basic Sciences Kolkata, Dec 11-13, 2019

48. Dr. Nishikanta Khandai- 11 June 2019 - (Contributed Seminar) - IUCAA Neem Seminar Title - The Population of Galaxies that contribute to the HI Mass Function

49. Dr. Nishikanta Khandai-13 September 2019 - (Invited Colloquium) - IISER Bhopal Title - Mass and Luminosity Functions

50. Dr. Nishikanta Khandai- 23 January 2020 - (Invited Speaker) - IIT Madras, Chennai Symposium on Gravitation and Cosmology Title - Cosmological Hydrodynamical Simulations of Structure Formation

51. Dr. Nishikanta Khandai- 13 February 2020 - (Invited Speaker) - IISER Tirupati - ASI Workshop: SKA in India: Science with Big Data Title - SKA Simulations with the Prototype SRC

Poster presentations:

1. "Measurement of K^{*+} in p-Pb collisions with ALICE at the LHC" by Mr. Dukhishyam Mallick (for the ALICE Collaboration) at The 18th International Conference on Strangeness in Quark Matter (SQM 2019), Italy, June 10 - 15, 2019.
2. "Hadronic resonance production in asymmetric collisions with ALICE at the LHC" by Mr. Dukhishyam Mallick (for the ALICE Collaboration) at Quark Matter 2019 - the XXVIIIth International Conference on Ultra-relativistic Nucleus-Nucleus Collisions, China, November 4-9, 2019.
3. Ritwick Das, "Optical Parametric Oscillators: Single frequency optical sources," at Indian Institute of Science Education and Research, Kolkata, May 2019.

4. Ritwick Das, "Stimulated polariton scattering in Optical Parametric Oscillator," at Physical Research Laboratory, Ahmedabad, September 2019.

5. Ritwick Das, "Optical Parametric Oscillators: Single frequency optical sources," at Indian Institute of Science Education and Research, Kolkata, May 2019.

6. Ritwick Das, "Topological invariants in one-dimensional photonics crystal," at Central University of Rajasthan, Ajmer, September 2019.

7. Ritwick Das, "Topological edge-modes in one-dimensional photonics crystal," at Indian Institute of Technology, Delhi, November 2019.

Doctoral degree awarded to Ph.D. Students:

1. Ekta Bhatia under Dr. Kartikeswar Senapati
2. Deepali Mishra under Dr. Yogesh Srivastava
3. Dr. Vipul Bairathi under Prof Bedangadas Mohanty-Thesis title: 'Azimuthal anisotropy of strange and multi-strange hadrons in heavy-ion collisions at RHIC'
4. Dr. Debadeepti Mishra under Prof Bedangadas Mohanty-Thesis title: 'Particle Production Studies in Au+Au and U+U Collisions using the STAR Detector at RHIC and Understanding the Freeze-out Dynamics'
5. Subrata Jana under Dr. Prasanjit Samal
6. Sushree Subhadarshinee Sahoo under Dr. Ashok Kumar Mohapatra



Outreach Program:

1. Dark Matter Day 2019: Dark Matter Day (DMD) organised on 31 October, 2019 at NISER. The event was graced by the NISER Director, Associate Dean, and Chairperson SPS among other faculties. The goal of organising this event is to reach out to undergraduate students and make them aware of the missing mass problem haunting the physics community for decades. Over 200 students from colleges around Bhubaneswar and Jatani participated in the event. We had a guest speaker (Dr. Subhaditya Bhattacharya) from IIT Guwahati. An in-house speaker (Vijay Iyer), and several demonstration experiments setup for the event.
2. Dr. Subhankar Bedanta- Invited to give the BK Mohanty memorial lecture at Ravenshaw University in February 2020.
Title: Excitements in Nanomagnetism.
3. Dr. Sanjay K Swain-NCERT-NTS awardees nurturance Outreach Program: "Understanding Universe: Two Biggest Discoveries of 21st Century", talk to NTS awardees on 9th Dec, 2019, organized by NCERT.
4. Dr. Sanjay K Swain- "Early Universe" Chief Speaker in the Inaugural function at the District level Exhibition and Project Competition, Kendrapara, December 12, 2019
5. Dr. Sanjay K Swain-"Early Universe", Hon'ble resource person for the seminar on Flood lightning forecasting and prevention disaster, Physics Department, Marshaghai Collge, Kendrapara, January, 2020
6. Dr. Colin Benjamin Organized Colloquium for Prof. M. P. Das, Professor Emeritus, ANU, Canberra, Australia in SPS, NISER in December 2019

Major research facilities added in School of Physical Sciences:

1. Dr. Subhankar Bedanta- New sputtering system to deposit thin films.
2. Dr. Sanjay Kumar Swain- CMS Phase-II silicon tracking facility: The CMS tracker facility is being built with support from NISER. This facility will be used to make mass production of 2000 si-tracking modules over next few years. This facility houses state of the art machines such as automatic wire-bonder, robotic glue dispenser, automatic pull tester and many more. This can be used to train the PhD and master students in long run. This is very unique facility in India as this kind of detector was never built by any Indian institutes in the past.
3. Dr. Kush Saha- Virgo Cluster
4. Dr. Nishikanta Khandai- Chandra Server - Funded by Ramanujan Fellowship - Currently used by students/faculty from NISER, Presidency and visiting project students.

Other Additional Information:

1. Dr. Najmul Haque appointed as Adjunct professor in IISER Berhampur in the autumn semester 2019-20 and taught a course on Electrodynamics.
2. Dr. Nalmul Haque is an Active referee of the following journals: Physical Review D, Pramana, International Journal of Modern Physics A, International Journal of Modern Physics E, International Journal of Modern Physics A, European Physical Journal A, International journal of the physical sciences, Particles, Springer Proceedings of Physics
3. Dr. Colin Benjamin visited to INSA New Delhi in



connection with SERB project presentation, September 2019.

4. Dr. Colin Benjamin visited to Berhampur University in connection with QCQT 2020, March 2020.

5. Dr. Colin Benjamin's research Guidance:

- ❖ Senior Research Fellow Subhajit Pal is working on his Ph D thesis from July 2015 onwards.
- ❖ SRF Tusaradri Mohapatra was promoted to SRF from JRF in August 2019. She is working on her Ph. D thesis on "Hanbury Brown and Twiss correlations in hybrid junction with Dirac materials", from July 2018 onwards.
- ❖ Master's student Abhisek Panda submitted his Master's thesis on "On quantum walks and quantum games", he worked with me from Aug. 2019-June 2020.

- ❖ Master's student Pratyush Sahoo of IISER, Kolkata submitted his Master's thesis on "Interplay of localization and entanglement in photosynthetic complexes: a Quantum Stochastic Walk study", he worked with me from Aug. 2019-June 2020.

- ❖ Ayush Singh, 6th semester student of SPS, NISER did his project with me on "On Cyclic Quantum Heat Engines" from Jan-June 2020.

- ❖ B. Varun Govind, 6th semester student of SPS, NISER did his project with me on "Generating Highly Entangled States Using Discrete-Time Quantum walks" from Jan-June 2020.

- ❖ Naini Dudhe, 6th semester student of SPS, NISER did her project with me on "Quantum Pigou games" from Jan-June 2020



SCHOOL OF EARTH AND PLANETARY SCIENCES

I. Brief Research activities

Star and Planetary Formation

Dr. Liton Majumdar, Assistant Professor

The star and planetary formation group led by Dr. Liton Majumdar works at the interfaces of planetary science, cosmochemistry/astrochemistry and astronomy- mostly focused on understanding the physical and chemical origins of planetary systems such as our own.

In the last one year, we have been studying the list of following fundamental problems in our group:

- What is the link between comets, chondritic meteorites, and the building blocks of the planets?
- What were the critical processes that guided the early evolution of the solar system?
- Are these processes common or rare in other protoplanetary systems?
- Further, are there other planetary systems similar to ours in the Milky Way, or is ours relatively unique?

Planetary composition

Dr. Guneshwar Thangjam, Assistant Professor

Understanding planetary formation and evolution, including our unique home - the planet Earth, is one of the prime science objectives of Planetary Science. In this context, information of planetary surface composition plays an important role to reveal not only the surface characterization but also the sub-surface and interior composition and their formation mechanism allowing to construct the overall evolutionary history. Therefore, study of surface

composition and the geology of various planetary bodies are being carried out along with participation and collaboration at national and international platform (i.e., active participation in NASA Dawn mission to the largest asteroids Vesta and Ceres; ISRO Chandrayaan-2 mission to the Moon, etc.). Besides, study of planetary analogue samples and the meteorites or space rocks are also one of the major activities to decipher the early solar physico-chemical and geologic conditions.

Regional Hydroclimatology

Dr. Jaya Khanna, Assistant Professor

Research in this group focuses on identifying regional drivers of climate modulation and change as compared to synoptic and larger scale climate dynamics. Anthropogenic modifications to climate are increasingly and rapidly becoming a policy issue because unlike climate change over eons, humans and ecosystems are not adapted to sudden climate change. The PI's past, ongoing and future research interests focus on the regional impacts of the the following anthropogenic drivers of climate.

- Climate modulation by large swaths of forests and deforestation in the Amazon rainforest and Himalayan broadleaved forests.
- Regional climatic impacts and modulation by atmospheric absorbing aerosols and their role specifically in near surface heat stress.
- Impacts of global warming on high latitude glaciers.

II. Publications (Journals)

- C. N. Shingledecker, G. Molpeceres, V. M. Rivilla, L. Majumdar, J. Kastner, Isomers in



Interstellar Environments (I): The Case of Z- and E-Cyanoethanimine, 2020, The Astrophysical Journal, 897, 158

- K. Taniguchi, A. Guzman, L. Majumdar, M. Saito, K. Tokuda, Chemical composition in the IRAS 16562–3959 high-mass star-forming regions, 2020, The Astrophysical Journal, 898, 54
- Nathues A., Hoffmann M., Ripken J., Thangjam G., Platz T., Schmedemann N., Takir D., 2019. Unique light scattering at Occator's faculae on (1) Ceres. The Astronomical Journal, 158, 85.
- Khanna, J., Cook, K.H. and Vizi, E.K., 2020. Opposite spatial variability of climate change-induced surface temperature trends due to soil and atmospheric moisture in tropical/subtropical dry and wet land regions. International Journal of Climatology. Doi:10.1002/joc.6554

III. Publications (Book chapters)

- Jimenez-Serra, S. Viti, V. M. Rivila, L. Majumdar, D. Johnstone, P. Klaassen, 2019, From Astrochemistry to the origin of life, SKA High-Frequency Book Chapter.

IV. Conference/Workshop

- (1) Fall Meeting of the American Geophysical Union, 2019, A33A-06. J Khanna, BR Lintner, DK Adams, L Silva, Links between Vertical Distribution of Moisture and Convective Frequency and Intensity in the Amazon Rain Forest.
- (2) NASA Dawn mission Framing Camera team workshop, Max Planck Institute for Solar System Research, Germany. June 05-29, 2019. (Dr. Guneshwar Thangjam)
- (3) NASA Dawn mission Framing Camera team

workshop, Max Planck Institute for Solar System Research, Germany. Jan 10-18, 2020. (Dr. Guneshwar Thangjam)

- (4) Indian Planetary Science Conference, PRL, ISRO, Ahmedabad, Feb 17-19, 2020 (Dr. Guneshwar Thangjam)
- (5) Chandrayaan-2 data analysis workshop, ISSDC, ISRO, Bangalore, Jan 6 - 7, 2020 (Dr. Guneshwar Thangjam)
- (6) Chandrayaan-2 data User's meet, DOS, ISRO, Delhi, Oct 22, 2019 (Dr. Guneshwar Thangjam)
- (7) Workshop on 'Source Mission' to Study the Trail of Water from Interstellar Clouds to Habitable Planets, held in Hotel Solamar, 435 6th Avenue, San Diego, California, USA August 25, 2019 (Dr. Liton Majumdar)

V. Projects from Non-DAE schemes:

Project: Max Planck India Partner Group

Research Project Title: Dwarf planet Ceres: Inner or outer solar system origin?

PI: Dr. Guneshwar Thangjam

Funding Agency: Max Planck Society, Germany

Budget: 20,000 € per year (Total: 100,000 € for 3+2 years)

Project: MHRD-STARS

Research Project Title: Comparing the disparate impacts of Oak and Chir pine tree species on their local hydrological and hydroclimatic regimes in the west-central Himalayas

PI: Dr. Jaya Khanna (Co-PI: Sumit Sen, IIT, Roorkee, Jagdish Krishnaswamy, ATREE, Bangalore)

Funding Agency: MHRD, India

Budget: 97,08,000 INR

Project: National Mission for Clean Ganga, Ministry of Water Resources



Research Project Title: Rejuvenation of drying springs in Takoli Gad catchment of Tehri district, Uttarakhand using Geochemistry and Geophysical techniques

Co-PI: Dr. Jaya Khanna (amongst others, & PI- Abhayanand Singh Maurya, IIT, Roorkee)

Funding Agency: Ministry of Water Resources, India

Budget: 6,00,000 INR (for NISER)

Project: Ramanujan Fellowship (research grant component declined by SERB's new rule)

Research Project Title: Tracing the ingredients for a habitable Earth from interstellar space through planet formation: Exo-planets, Star and Planet formation

PI: Dr. Liton Majumdar

Funding Agency: SERB/DST, India

Eligible for a fellowship grant of Rs.1,35,000/- per month (including HRA component), research grant of Rs.7,00,000/- p.a and overheads of Rs.60,000/- p.a. for 5 years (Total-1.19 Crores in INR)

Project: Ramanujan Fellowship (research grant component declined by SERB's new rule)

Research Project Title: Asteroid Vesta- Understanding early geologic processes of planetary differentiation and evolution

PI: Dr. Guneshwar Thangjam

Funding Agency: SERB/DST, India

VI. Sponsored & Collaborative Research Visits

- NASA Dawn mission Framing Camera team workshop, sponsored by Max Planck Institute for Solar System Research, Germany. June 05-29, 2019. (Dr. Guneshwar Thangjam)
- NASA Dawn mission Framing Camera team workshop, sponsored by Max Planck Institute for Solar System Research, Germany. Jan 10-18, 2020. (Dr. Guneshwar Thangjam)

- NASA JPL's Emerging World Research Program, visited NASA JPL from Jan 18 to Feb 2, 2020 (Science PI- Dr. Liton Majumdar)

VII. Talks (invited and contributory)

- (1) Current challenges and progresses in astronomy and planetary sciences. Centurion University of Technology and Management (CUTM), Jatni, Odisha, November 2, 2019 (Dr. Liton Majumdar, Invited Talk).
- (2) Asteroid Exploration Mission proposal: Hygiea – Explore and Discover the unknown. Indian Planetary Science Conference, PRL, ISRO, Ahmedabad, Feb 17-19, 2020 (Dr. Guneshwar Thangjam, Invited talk).
- (3) Mineralogy studies on the Moon using IR spectrometer data & science outcome. Chandrayaan-2 data analysis workshop. ISSDC, ISRO, Bangalore, Jan 6 - 7, 2020 (Dr. Guneshwar Thangjam, Invited talk).
- (4) Planetary science and exploration in Solar System and beyond. Department of Earth Sciences, Manipur University, Imphal. 16th October, 2019 (Dr. Guneshwar Thangjam, Invited talk).
- (5) Links between Vertical Distribution of Moisture and Convective Frequency and Intensity in the Amazon Rain Forest. Fall Meeting of the American Geophysical Union, 2019, A33A-06 (Dr. J. Khanna, Contributory Talk).

VIII. Popular Talks

- (1) Are We Alone in the Universe? Public Outreach program 'Chandrayaan-2: Historic Moon Landing', School of Earth and Planetary Sciences, NISER, 07 September, 2019 (Dr. Liton Majumdar).



- (2) Climate Change and Earth Habitability? Public Outreach program 'Chandrayaan-2: Historic Moon Landing', School of Earth and Planetary Sciences, NISER, 07 September, 2019 (Dr. Jaya Khanna).
- (3) Wonderlands of Solar System. Public Outreach program 'Chandrayaan-2: Historic Moon Landing', School of Earth and Planetary Sciences, NISER, 07 September, 2019 (Dr. Guneshwar Thangjam).
- (4) Exploring the Earth System, the Solar System and Beyond. NCERT-NTS awardees nurturance program, organized by NISER, Dec 9 - 13, 2019 (Dr. Guneshwar Thangjam).
- (5) The threat of climate change. Sainik School, Bhubaneswar, 11 September 2019 (Dr. Jaya Khanna)

IX. Outreach Program

1 Chandrayaan-2: Historic Moon Landing, the outreach program was organized by School of Earth and Planetary Sciences with support and coordination with NISER students, especially with NISER Astronomy Club, Robotics Club, Arts Club and ZAARIYA members. The objective was to make awareness and public education about science and its value in the society using Chandrayaan-2 as a medium of communication.

Distinguished Padma Shri prof. JN Goswami was invited as the Chief Guest. We received an overwhelming response.

About 400 people registered online or via email, and we declined lots of students/requests because of limited audience capacity in our lecture halls. About 330 students from NISER (majority), IIT, IISER, AIIMS, and schools (about 70 from JNV, Sainik, KV, Carmel), and others attended the program. About 65 students volunteered mainly for the event arranging everything, organizing Astro-Arts Competition, preparing the badges and decorating the halls, making the rover and Moon surface, and also managing the crowd. Apart from the main event, there was also an informal interaction session in the evening exclusively with the Chief Guest motivating the students towards science and education and their career.

X. Major teaching and research facilities built:

SEPS is on a mission building a first and unique department of its kind in the Earth, Atmospheric-Ocean and Planetary Sciences in India. The state-of-the-arts teaching and research facilities are in the development phase. The research works have already begun in full swing with outputs of international reputation and recognition.



SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

Postcolonialism, Popular Culture, Mythology, Subaltern Studies

Dr. Amarjeet Nayak, Reader-F

Popular Culture and Mythology:

In my paper "Syncretic Jagannath Culture and Popular Odia Imagination: Representations of Lord Jagannath in Odia Cinema", I have looked at the ways in which Odia cinema has helped foster a bond between Lord Jagannath and the Odia community that adores Him. The focus of this paper is primarily on looking at four dominant ways in which Odia film-makers have used Jagannath. Firstly, looks at how, in spite of technical inadequacies, early Odia mythological films were able to strike a chord with Odia audience. Secondly, it makes an analysis of how Jagannath culture has been presented as egalitarian and syncretic, which exhorts the cinema-going audience to rise above socio-economic differences and embrace universal brother-hood. Using Jagannath in Odia cinema to address issues of caste and gender, two existing fault-lines in the Odia society's quest for social justice, are primarily addressed in this section. Thirdly, Odia cinema's attempt at presenting the syncretic nature of Jagannath culture is brought to the fore to show how it is different from many 'cults' whose existence is based on exclusionary practices. Lastly, the paper looks at Odia cinema's thrust on the importance of bhakti (devotion) and gyana (wisdom or 'enlightenment') in a true Jagannath devotee, to bring home the point that tradition and modernity can have a happy co-existence in Jagannath culture. A discussion of these ideas are largely informed by the way Jagannath and Jagannath mythologies have been historically represented in Odia

cinema. (Tripathy, J & Skoda, U. 2019. Bonding with the Lord: Jagannath, Popular Culture and Community Formation, Bloomsbury)

Postcolonialism and Subaltern Literature:

Unlike Johan Galtung (1969) who drew the distinction between personal and structural violence "arguing convincingly that structures such as social injustice can be understood as violence". Thomas Teo argues that epistemological violence can at times be closer to personal violence than a structural violence, and often in empirical social sciences, "the subject of violence is the researcher, the object is the Other, and the action is the interpretation of data that is presented as knowledge." (2010) While the mainstream postcolonial literature primarily continues to highlight the various contours of colonialism and its impact on the postcolonial society, it is the subaltern literatures produced in the postcolonial society such as Dalit and tribal literatures that highlight the need to look within and understand the complex hierarchical socio-cultural dynamics within the society wherein the Dalits and tribals have been at the receiving end of both the structural and personal violence. One can extrapolate Thomas Teo's above-mentioned view of the social science researcher to a researcher in Dalit and Tribal literature, and consider the gaze of the researcher on the subaltern to be a form of personal violence. However, the contention of my work is not to undermine or underestimate the importance of research on subaltern literature, but to remain aware of such a possibility so that he / she does not fall into the trap of either "civilizing the subaltern into the mainstream culture" or romanticizing the subaltern literatures without a critical gaze. I try to explore the



sometimes overt, but mostly subtle ways in which structural and personal violence are perpetrated on the subaltern. ("Subaltern Literature in the Postcolonial Society: Exploring Structural and Personal Violence in Hansda Sowvendra Shekhar's short story 'They eat Meat'". Muse India. vol. 15 issue 86, 2019).

Popular Cinema and Gandhi

In my work, I aim to critically look at some select films where Gandhi is present not as the central figure, but as someone who plays a role in the life or/and politics of another historical figure. The intent is to see how Gandhi and his ideas are presented in those films where the gaze is focused predominantly on another historical figure, so that Gandhi becomes a part of another person's narrative, who could be an adversary (Jinnah), an ideologue with a contrarian ideology (Bhagat Singh) or someone who is being increasingly seen in an ideologically oppositional camp to that of Gandhi in recent times (Sardar Patel). Through a close reading of Gandhi's portrayals, sometimes with shades of grey and at times in shades of mostly black, in three films, *Sardar* (1993, Dir. Ketan Mehta), *Jinnah* (1998, Dir. Jamil Dehlavi) and *The Legend of Bhagat Singh* (2002, Dir. Rajkumar Santoshi), my work makes an attempt at understanding some of the plausible reasons for the same. Even when such portrayals may be harsh, based on half-truths or are even outright historically inaccurate, it is important to study them in order to understand why the South Asian popular culture, in which films have a dominant space, continues to have space for such portrayals. It is my contention that counter-narratives to the dominant discourse on Gandhi are important (to modify an Amartya Sen phrase), for the 'argumentative South Asian', if for nothing else, at least to falsify such narratives. It is important not to ignore or silence such counter-

narratives, but to analyse the politics of such portrayals, which I intend to do through a close-reading of popular cinema such as the aforementioned three films. (an ongoing project – has resulted in a seminar paper so far)

Cultures of Listening in Contemporary Black Fiction

Dr. Joe Varghese Yeldho, Reader-F

The production of sounds and its consumption is a continuing area of interest for the researcher. While the phenomenology of sound provides an anchoring framework, it would be pertinent to engage more emphatically with the cultures that contextualize the consumption of sound in twenty first century black fiction. It must be noted that the focus is on the figural representation of urban sounds as they create the space of habitation, which is not restricted to the rhythms and beats of music, but includes among others the practice of listening in on the everyday routines of people living in racially segregated zones.

Human-Elephant Interactions

Dr. Pranaya Kumar Swain, Reader-F

Multi-stakeholder Perspective: Human and elephant relationship resonates with cultural significance, but with rapid changes there is increasing uncertainty over their harmonious coexistence. Since human settlements with agricultural lands are expanding towards the elephant habitat and fragmenting their migration corridor, there are increasing incidences of negative interactions between humans and elephants foraging for food. Elephants raiding crops, damaging houses, causing deaths and injuries to humans and in retaliation humans inflicting harm on elephants are the indicators of Human-Elephant Conflict (HEC) (Sukumar, 1986;



Fernando, et al., 2008; Choudhury, et al., 2008; Sar & Lahiri-Choudhury, 2009; Lenin & Sukumar, 2011; Behera, 2013; Thekaekara & Thornton, 2016; Sukumar, et al., 2018;). Ways of reducing and resolving such conflicts are of immense significance for conservation of elephants as well as mitigating the damages to human lives and their livelihood. Social scientists and natural scientists have recently started acknowledging that elephant habitat and behaviour cannot be understood in isolation from humans who help configure it. Significantly, nor human political, economic and social life can be studied without learning about the elephants that shape and share the world with humans. Therefore, realizing that it is time to cultivate and negotiate relations between humans and elephants, we attempted to understand human dimensions of HEC by analyzing perspectives of various stakeholders and to offer sustainable mechanisms for their coexistence (resulting in couple of academic publications and policy documents).

Domestication of Jagannath Temple Rituals:

Sociological Understanding of the Pantheism: Few other Hindu gods guide a regional consciousness, pervade walks of everyday life and define a collective psyche the way Lord Jagannath does in Odisha and its contiguous areas. Jagannath is metonymic of Odisha and the Odia way of life, arguably much more than any other god for a particular geography or its peoples. While not derecognising the historical and the spiritual aspects of Jagannath, the collaborative work- Bonding with the Lord attempted to look at the deployment of Jagannath in contemporary cultural practices involving the sensorium in the widest sense. The project of a cultural Jagannath not only materialises him in people's everyday practices but also democratises scholarship on him. The expansion of the scope of research on Jagannath

to cultural expressions in a more encompassing way rather than confining to 'elitist' religious/literary sources makes him an everyday presence and significantly enhances his sphere of influence. (Tripathy, J& Skoda, U. 2019. Bonding with the Lord: Jagannath, Popular Culture and Community Formation, Bloomsbury).

Lifeworld of Early Career Teachers:

In the popular discourse in India, teachers are often blamed for the declining standard of education in governmental schools. However, we know very little about how teachers are positioned in the system, their working and living conditions, accountability systems and effective autonomy in the classroom (Ramachandran et al., 2018). This ongoing research seeks to explore the lifeworld of early career elementary teachers of governmental schools in Odisha. Previous research has shown that the first few years of teaching career have the most socialising influence. In the academic literature this period is usually called the phase of 'survival', 'exploration' and 'discovery'. Positive experience in the first phase usually leads to a phase of "stabilization" where teachers consolidate their experience from the first phase, gain confidence in teaching and master teaching skills (Tsui, 2007). In Odisha early career teachers undergo a six-year probation period which is a significant proportion of their work life. Therefore, the need was felt to understand the personal and professional lives of these early career teachers to make sense of the workings of the school system in the state and the country.

Sociological Investigation of Gender Reassignment Surgery among the Transgenders:

Transgenders constitute one of the most marginalised communities in society (Atheequae et. al.2016). Albeit not collected as a specific demographic category, the decennial Census of



India, 2011 estimates around 488 thousand of transgenders in the country. Issues and problems related to transsexualism cannot be ignored and people who fall under transsexuality feel that their gender identity is in contrast to the gender assigned to them at the time of birth and because of this they fall in the trap of gender identity disorder (Biosnich et al.2013). As if that is not enough, in case of health care services relating to gender transitioning and hormonal therapy, transgenders face many other problems (Klein et al. 2009). The 12th five year plan of the Government of India (GoI) has underlined targeted interventions for the transgender community by advocating the Governmental support to their education, housing and access to healthcare. In doing so, the GoI has also emphasized that the health policies must focus on the special requirements of LGBTQ community as a whole. However, the gap between the theory and practice has been noticeably reported by many social scientists, activists and policy makers. Hence, this calls for a systematic understanding of the current issues that concern the transgenders. With this backdrop this ongoing study intends to explore the sociological aspects of access to health services by the transgenders in general and to sex reassignment surgery in particular.

Waste Management and Segregation in Households

In Sociology, the environmental problems are not simply explained as the result of human action only but by applying the sociological imagination to the connections among people, institutions, technologies and ecosystems that make society possible (Lockie, 2015). "Nature can no longer be understood outside of society, or society outside of nature ... in advanced modernity, society with all its subsystems of the economy, politics, culture and the family can no longer be

understood as autonomous of nature"(Beck, 1992). Rapid urbanization and population growth of Bhubaneswar city have resulted in unprecedented increase in the overall waste generation. In the city, solid waste management falls short of the desired level as the systems adopted do not appear so efficient and adequate. There is a need to make substantial improvement in the waste management practices prevailing in the city to raise the standards of health, sanitation and urban environment (Mohanty, 2014). In line of the above, this existing work intends to bring to the fore habits and practices concerning waste segregation at the household level, which could go a long way in planning for better and sustainable waste management.

Research group engages in research areas resulting in immediate deliverables for some of the most vulnerable groups in our society such as children with neurodevelopmental disorders, differently abled individuals, and institutionalized children.

Dr. Rooplekha Khuntia, Assistant Professor

Work includes developing a screening tool for early detection of Autism Spectrum Disorder that would facilitate early diagnosis and intervention. Social interaction pattern of such children with their and parents and siblings is also an important aspect undertaken for study with an aim to facilitate right intervention modules.

Strengthening one's psychological capital is often a precursor to a happy and meaningful and life. When individuals engaging in self rating do so in irrational ways, it can be dysfunctional and self defeating in nature. Unconditional self - acceptance as a construct acknowledges individual uniqueness and all its complexities. So the research focus is understanding the construct of unconditional self concept and its



association with important life outcomes, both personal and professional.

Designing Social Entrepreneurship Models for Individuals with Special Needs. Creating an inclusive society for and with the differently able augmented by scientific and evidence based research.

Primary areas of interest are in the fields of Social network analysis, Health care, eSociety and Tourism

Dr. Debashis Pattanaik, Assistant Professor

Social network analysis: It focuses on understanding of individual outcomes of social processes through flow of resources across network in a given social structure. It offers an understanding of the responsive of a system towards individual or system outcomes. Currently the research group is working on network effects on care of terminally ill and tourism network.

Health, care and disability: Health care, as a component of social life is a major need of patients across the world. The research focuses on understanding of the medical processes in caring at an institutional setting along with systems of care.

e-Society: ICT is one of the development pillars in today's world it is tool for learning, employment and amusement. In the emerging context of eSports today there is growing concern about its professionalization, governance and socio-technical issues. The research group focuses on professional aspects of eSports and socio-cultural ramifications arising in the field of electronic gaming system.

Tourism: Tourism is an activity which cuts across conventional sectors. There is no common structure which is representative of the industry

in every country. It is one of the largest growing service sectors in the world spreading over simple home stays to star rated hotels and associated activities. The research group focuses on understanding the underlying dynamics host and the visitor in mountain regions of India.

"Integrated Environmental and Economic Accounting" and Intra-State Development Disparity in Odisha

Dr. Amarendra Das, Reader-F

Economic Accounting of the cost of Natural Disasters. Depreciation of Natural Disaster and the Adjusted Net Domestic Product. Our group of students is working on the Integrated Economic and Environmental Accounting of Minerals, and Agriculture. Intra-state economic disparity in Odisha. The economic impact of COVID-19 on the Indian Economy and Odisha Economy. Environmental Performance Index for the Coals Mines in India. Environmental Impact Assessment of OMC.

Publications (2019-20)

Dr. Amarjeet Nayak, Reader-F

- ❖ Nayak, Amarjeet. "Subaltern Literature in the Postcolonial Society: Exploring Structural and Personal Violence in Hansda Sowvendra Shekhar's short story 'They eat Meat'". *Muse India*. vol. 15 issue 86, 2019.
- ❖ Nayak, Amarjeet. "Syncretic Jagannath Culture and Popular Odia Imagination: Representations of Lord Jagannath in Odia Cinema" published in *Bonding with the Lord: Jagannath, Popular Culture and Community Formation*, 2019. Eds. Jyotirmay Tripathy and Uwe Skoda. Bloomsbury India, New Delhi. pp. 58-66.



Dr. Joe Varghese Yeldho, Reader-F

- ❖ Yeldho, Joe Varghese. "Sounding Harlem: Ann Petry's The Street and the Experience of "Dwelling." American, British and Canadian Studies. 34 (2020): Accepted.

Dr. Pranaya Kumar Swain, Reader-F

- ❖ Swain, P.K. (2020). Desperate Measures at Desperate Times: A case study of Odisha Addressing the Ongoing Covid-19 Pandemic. In 'Recent Trends in Global COVID-19 Pandemic', Shriyanshi Prakashan. forthcoming
- ❖ Nayak, Medha and Swain, Pranaya (2020). Pachyderms through Pencil: Children's Perception and Understanding of Human Elephant Conflict and Coexistence.

Sage Submissions. Preprint.

<https://doi.org/10.31124/advance.12361484.v1>

- ❖ Swain, Pranaya (2020): Reorientation of State Policies to Combat COVID-19: A Rapid Assessment of an India State Exerting Social Control Measures. Sage Submissions.

Preprint.

<https://doi.org/10.31124/advance.12345806.v2>

- ❖ Swain, Pranaya, and Medha Nayak. (2020). "From Fear to Festivity: Multi-stakeholder Perspectives on Human-elephant Conflict and Coexistence in India." SocArXiv. May 22. doi:10.31235/osf.io/mv4jc
- ❖ Swain, P.K. & Nayak, M. (2019). Ill-effects of Mining on Elephant Conservation in Odisha, Proceedings of Odisha Environment Congress. pp.135-141
- ❖ Swain, P.K. (2019). "Domestication of Jagannath Temple rituals in Odia Households: A Sociological Understanding of the Pantheism", in Bonding with the Lord:

Jagannath, Popular Culture and Community Formation, Eds Jyotirmaya Tripathy and Uwe Skoda, Bloomsbury Publishing, New Delhi, pp 111-134

Media Publication

- ❖ State Exerting Social Control Measures: A Rapid Assessment of Addressing COVID-19 in Odisha. <https://pragativadi.com/state-exerting-social-control-measures-a-rapid-assessment-of-addressing-covid-19-in-odisha/>. May 2020
- ❖ At the End, even Covid-19 is also about Numbers, Insightful Numbers. <https://pragativadi.com/at-the-end-even-covid-19-is-also-about-numbers-insightful-numbers/>, March 2020.

Dr. Amarendra Das, Reader-F

- ❖ With Lalitarani Pradhan and Himanshu Sekhar Rout (2019) "Local Self-Governance: A Case Study in Odisha" Orissa Economic Journal. Vol. 51. Issue 1. Pp. 45-68.
- ❖ Das Amarendra (2020) 'Turnaround in Maternal and Child Healthcare of India: Role of Institutional Innovation and ASHA' in 'Inclusive Innovation: Evidence and Options in Rural India' Editors Rajeswari S. Raina and Keshab Das, Springer
- ❖ With Dasarathi Padhan and Chinmayee Sahoo "Depreciation of Physical Capital Due to Natural Disaster and Adjusted NDP" submitted to Ecology, Economy and Society
- ❖ With Biplab Guru "Cost of Human-Elephant Conflict and Perception on Compensation: Evidence from Odisha, India" revised paper submitted to Journal of Environmental Planning and Management.



- ❖ India's Compliance with Sendai Framework for Disaster Risk Reduction: A Case Study of 'Fani' Cyclone Management under review with International Journal of Disaster Risk Reduction Journal
- ❖ With Subhankar Mishra (2020) "India Growth Forecast for 2020-21" arXiv preprint arXiv:2005.06461
- ❖ Das Amarendra (2020) Odisha's Growth Forecast for 2020-21 SageSubmissions

Conferences and Seminars

Dr. Amarjeet Nayak, Reader-F

- ❖ Seminar Paper: Nayak, Amarjeet. "To Eulogize or Paint with Shades of Grey? – A Study of Counter-Narratives of Gandhi vis-à-vis Other Historical Characters in Select Films" presented at the Interdisciplinary National Seminar on Relevance of Gandhian Thoughts in the Twenty-first Century at Gangadhar Meher University, Sambalpur, Odisha. 08-09 February, 2020.

Dr. Pranaya Kumar Swain, Reader-F

- ❖ Ill Effects of Mining on Elephant Conservation in Odisha, Odisha Environment Congress, 20-22 December 2019
- ❖ Theorizing and Integrating Political Ecology and Actor Network Theory in Waste Study, 45th All India Sociological Conference, University of Kerala, Thiruvananthapuram, 27-29 Dec 2019 (co-presented with Swatiprava Rath)
- ❖ Metonymic and Pantheistic Bonding with Lord Jagannath: Reflecting upon the Everyday Lives of the Lord and the Commoner, National seminar on Sociology

and the Everyday: Possibilities and Perspectives, Jadavpur University, Kolkata, 19-20 September 2019

- ❖ From Fear to Festivity: The Case of Human-Elephant Conflict and Conservation in Odisha, India, in RN12 – Environment and Society at the 14th Conference of the European Sociological Association, held in Manchester, 20-23 August 2019

Dr. Rooplekha Khuntia, Assistant Professor

- ❖ Consultative Workshop on Disability and Employability.
Date: 14th February, 2020
- ❖ National Symposium on End-User Interface and Translational Approaches in Employability among the Differently Able: Integrating Social Entrepreneurship and Pro-People Social Communication.
Date: 6th March, 2020

Dr. Amarendra Das, Reader-F

- ❖ With Laxmikanta Gual presented "Behavioural Changes in the Utilisation of Maternal and Child Health Care in India" in the Indian Health Economics and Policy Association 8th Annual conference of Indian Health Economics and Policy Association held at NISER, Bhubaneswar during January 23-24, 2020.
- ❖ With Suvangi Rath "Payments for Ecosystem Services and their market: A Review on the challenges and Issues in India in 52nd Annual Conference of Orissa Economics Association held at Parala Maharaja Engineering College, Berhampur during February 08-09, 2020.
- ❖ With Chinmayee Sahoo "Status of Organic Farming and its role in providing ecosystem



services India in 52nd Annual Conference of Orissa Economics Association held at Parala Maharaja Engineering College, Berhampur during February 08-09, 2020.

Invited Talks

Dr. Amarjeet Nayak, Reader-F

- ❖ Delivered a talk on Speculative Fiction to the students of English department at Vikram Dev Autonomous College, Jeypore, and Odisha on 10th February, 2020.

Dr. Pranay Kumar Swain, Reader-F

- ❖ Qualitative Research: Making sense of Qualitative Data, Bullet Points or Impactful Insights?, at the Workshop on Tribal Intellectuals and Inclusion: A need based Assessment, organised by the Indian Institute of Public Administration, New Delhi, Supported by the Ministry of Tribal Affairs, Govt of India, 28 February 2020
- ❖ Participatory Research Methods, at the ICSSR sponsored Research Methodology Workshop, Kalinga Institute of Social Sciences, Bhubaneswar, 20 Feb 2020
- ❖ Doing Research: Case Study Method, at the ICSSR sponsored Research Methodology Workshop, Kalinga Institute of Social Sciences, Bhubaneswar, 20 Feb 2020
- ❖ Social Media: the double Edged Sword, at the National Seminar on Social Media and its Impact on Society, organised by Achievers Foundation, Bhubaneswar, 16 February 2020
- ❖ Social Dimensions of Scientific Knowledge, NCERT NTS Nurturance Programme 2019, at NISER Bhubaneswar 9-13 December 2019

- ❖ Metonymic and Pantheistic Bonding with Lord Jagannath: Reflecting upon the Everyday Lives of the Lord and the Commoner, Jadavpur University, Kolkata, 19-20 September 2019

- ❖ Ethical Behaviour in Educational Institutions, AICTE Sponsored Faculty Development Programme at Gandhi Institute for Technology, Bhubaneswar, 8-13 July 2019
- ❖ Classroom Management and Discipline, AICTE Sponsored Faculty Development Programme at Gandhi Institute for Technology, Bhubaneswar, 8-13 July 2019

Dr. Amarendra Das, Reader-F

- ❖ Invited talk at SVM autonomous college, Kendrapara on February 24, 2020 on "Economics of Climate Change"
- ❖ Pre-Budget Consultation organised by the Finance Minister, Govt. of Odisha in January 2020.
- ❖ Post Budget Discussion at Utkal University in February 2020.
- ❖ Post Budget Discussion at CYSD, Bhubaneswar in February 2020

Research Collaboration

Dr. Amarendra Das, Reader-F

- ❖ ICFRE, Dehradun for developing the methodology for Environmental Performance of Coal Mines with ICFRE, Environmental Impact Assessment of OMC at Daitari mines at Jajapur.



SCHOOL OF COMPUTER SCIENCES

Cryptography

Dr. Rishiraj Bhattacharyya, Reader F

The efficiency of a black-box reduction is an important goal of modern cryptography. Traditionally, the time complexity and the success probability were considered as the main aspects of efficiency measurements. In CRYPTO 2017, Auerbach et al. introduced the notion of memory-tightness in cryptographic reductions and showed a memory-tight reduction of the existential unforgeability of the RSA-FDH signature scheme. Unfortunately, their techniques do not extend directly to the reductions involving intricate RO-programming. The problem seems to be inherent as all the other existing results on memory-tightness are lower bounds and impossibility results. In fact, Auerbach et al. conjectured that a memory-tight reduction for IND-CCA security of Hashed-ElGamal KEM is impossible. -We refute the above conjecture. Using a simple RO simulation technique, we provide memory-tight reductions of IND-CCA security of the Cramer-Shoup and the ECIES version of Hashed-ElGamal KEM.

We prove memory-tight reductions for different variants of Fujisaki-Okamoto Transformation. Our techniques can withstand correctness-errors, and applicable to several lattice-based KEM candidates.

Computational Geometry and Parameterized Algorithms

Dr. Aritra Banik, Assistant Professor

I have mainly worked on the problems closely related to computational geometry. Along with the optimization criteria there is an inherent

conflict was given among the objects of the output space. A conflict or a choice defined among two objects forces the solution or choose at most one of them in a solution. Formally stated, we have a graph G_c where the vertices of the graph are the objects in the output space. An edge between two A and B are present if A and B are in conflict. We call G_c a conflict graph. In this project, we have considered three geometric problems with conflict settings.

Multiple choice Geometric Covering Problems: The input for the Geometric Coverage problem consists of a pair (P, R) , where P is a set of points and R is a set of subsets of P defined by the intersection of P with some geometric objects. The objective is to find the minimum cardinality subset of R which covers all the points. We considered the conflict version of the problem. We consider the parameterized complexity of the problem based on the structure of the conflict relation. Our main result is that as long as the conflict graph has bounded arboricity (that includes all the families of intersection graphs of low-density objects in low dimensional Euclidean space), there is a parameterized reduction to the problem without conflicts on the covering objects. This is achieved through a randomization-derandomization trick. As a consequence, we have the following results when the conflict graph has bounded arboricity. If the Geometric Coverage problem is fixed-parameter tractable (FPT), then so is the conflict-free version. If the Geometric Coverage problem admits an x -factor approximation, then the conflict-free version admits a factor x -approximation algorithm running in FPT time.

Approximation Algorithms for Multiple choice Geometric Covering Problems: We consider the



Unit Interval Covering where P is a set of points on the real line, and O is a set of closed unit-length intervals. We prove that for an arbitrary conflict graph the problem is Poly-APX-hard. We present an approximation algorithm for a special class of conflict graphs with a bounded graph parameter Clique Partition Chromatic Number. We present a 4γ approximation algorithm for conflict graphs having Clique

Partition Chromatic Number γ . We show that unit interval graphs and unit disk graphs have constant Clique Partition Chromatic Number while for chordal graphs, it is bounded by $\log n$. Note that, Clique Partition Chromatic Number is less than or equal to the chromatic number. Thus our algorithm achieves a constant approximation factor for graphs with a constant chromatic number (e.g. planar graphs).

Secure Multi-party Computation

Dr. Manoj Mishra, Assistant Professor

Computing functions of multiple, distributed inputs with unconditional privacy

Efficient Scalar Multiplication, Hash-based Signature Scheme

Dr. Sabyasachi Karati, Assistant Professor

- ❖ In this work, we try to achieve fastest scalar multiplication using binary Kummer Line with target of 128-bit security. One version of the work is under review.
- ❖ We are working on tight security analysis of K2SN-MSS hash-based signature scheme and intend to propose different and efficient parameter sets for different security levels.

Machine Learning and Privacy

Dr. Subhankar Mishra, Assistant Professor

It was important to look at areas machine learning is used and is effective in learning patterns from

mobile usage. However, it also included some compromise in privacy of mobile device owners in order to build the behavioural model.

Hence, research focus was learning differential privacy to build a base towards secure and private machine learning.

Algorithmic Game Theory

Dr. Sushmita Gupta, Assistant Professor

The works explore parameterized complexity of problems arising from Algorithmic Game Theory

Publications (F.Y 2019-2020)

Dr. Rishiraj Bhattacharya, Reader F

- ❖ Memory-tight Reductions for Practical Key Encapsulation Mechanisms, IACR Public Key Cryptography 2020.

Dr. Aritra Banik, Assistant Professor

- ❖ A. Banik, V. Sahlot, S. Saurabh, Approximation Algorithms for Geometric Conflict Free Covering Problems, Computational Geometry: Theory and Applications, 89, 101591, 2020.
- ❖ P. Arora, A. Banik, V. K. Paliwal and V. Raman, List-coloring – Parameterizing from triviality, Theoretical Computer Science, 821, 102-110, 2020.
- ❖ A. Banik, F. Panolan, V. Raman, V. Sahlot, S. Saurabh, Parameterized Complexity of Geometric Covering Problems Having Conflicts, Algorithmica, 82, 1-19, 2020
- ❖ A. Banik, P. Choudhary, D. Lokshantov, V. Raman, and S. Saurabh, Polynomial Sized Kernel for Tracking Paths Problem, Algorithmica, 82, 41-63, 2020



- ❖ A. Banik, S. Das, A. Maheshwari, M. Smid, The Discrete Voronoi Game in a Simple Polygon, Theoretical Computer Science, 793, 28-35, 2019
- ❖ A. Banik, B. B. Bhattacharya, S. Das, S. Das, The 1-Dimensional Discrete Voronoi Game, Operations Research Letters, 47 115-121, 2019

Dr. Manoj Mishra, Assistant Professor

- ❖ V. Narayanan, M. Mishra, V. M. Prabhakaran, "Private Two-Terminal Hypothesis Testing", IEEE International Symposium on Information Theory, 2020 (accepted)
- ❖ B. Applebaum, T. Holenstein, M. Mishra, O. Shayevitz, "The Communication Complexity of Private Simultaneous Messages, Revisited", Journal of Cryptology, September, 2019

Dr. Sabyasachi Karati, Assistant Professor

- ❖ S. Karati and P. Sarkar, Kummer for Genus One over Prime-Order Fields, Journal of Cryptology, Volume 33, Number 1, pp 92-129, Springer, 2020
- ❖ S. Karati and P. Sarkar, Connecting Legendre with Kummer and Edwards, Journal of Advances in Mathematics of Communications, AIMS, Volume 13, Issue 1, pp 41-66, 2019.
- ❖ S. Karati, and R. Safavi-Naini, K2SN-MSS: An Efficient Post-Quantum Signature, The 14th ACM ASIA Conference on Computer and Communications Security - ACM ASIACCS 2019, pp 501-514, Jul 7-12, 2019, Auckland, New Zealand.
- ❖ S. Karati, Binary Kummer Line, IACR Cryptology ePrint Archive 2019: 1316 (2019).

Dr. Subhankar Mishra, Assistant Professor

- ❖ Sudipta Paul and Subhankar Mishra. Ara: Aggregated rappor and analysis for centralized diferential pri-vacy. SN Computer Science, 1(1):22, 2020
- ❖ Subhankar Mishra. Learning from usage analysis of mobile devices. Procedia Computer Science, 167:1648 -1655, 2020. International Conference on Computational Intelligence and Data Science.

Dr. Sushmita Gupta, Assistant Professor

- ❖ Sushmita Gupta, Pallavi Jain, Sanjukta Roy, Saket Saurabh, Meirav Zehavi: Gehrlein Stability in Committee Selection: Parameterized Hardness and Algorithms. AAMAS 2019: 511-519
- ❖ Sushmita Gupta, Fahad Panolan, Saket Saurabh, Meirav Zehavi: Stability in barter exchange markets. Auton. Agents Multi Agent Syst
- ❖ Sushmita Gupta, Sanjukta Roy, Saket Saurabh, Meirav Zehavi: Parameterized Algorithms and Kernels for Rainbow Matching. Algorithmica

Conferences and Seminars

Dr. Rishiraj Bhattacharya, Reader F

- ❖ Indocrypt 2019
- ❖ Boolean Function Analysis Workshop

Dr. Aritra Banik, Assistant Professor

- ❖ CALDAM 2020

Dr. Manoj Mishra, Assistant Professor

- ❖ BITS 2020, ISI Seminar on Computing Boolean Functions



Dr. Subhankar Mishra, Assistant Professor

- ❖ Invited - ACM Microsoft Research Academic Research Summit on Cybersecurity - BITS Goa

Invited Talks:

Dr. Rishiraj Bhattacharyya, Reader F

- ❖ Locally Decodable Codes against Computationally Bounded Adversary, Indian Statistical Institute

Dr. Aritra Banik, Assistant Professor

- ❖ Invited to deliver lectures at ACM Winter School on Geometric Algorithms and their Applications, 16 to 24 December 2019 IISER Pune

Dr. Sabyasachi Karati, Assistant Professor

- ❖ ACM Winter School on Cybersecurity, 2019

Dr. Subhankar Mishra, Assistant Professor

- ❖ Machine Learning and Privacy for Medical Devices, CET Bhubaneswar (March 2020)
- ❖ Data Science for Economics, PMEC Berhampur, Odisha Economics Association (February 2020)
- ❖ Natural Language Processing - NIST Berhampur (Dec 2019)
- ❖ Machine learning for Smart Cities - FDP on Recent Trends in AI and ML, Malappuram, Kerala (June 2019)
- ❖ Cyber Threats - ABPSchool (Nov 2019)
- ❖ Artificial Intelligence - DAV Pokhariput (July 2019)

Sponsored Projects:

Dr. Rishiraj Bhattacharya, Reader F

- ❖ SERB, Early Career Award, Property Testing Using Conditional Samples.

Dr. Aritra Banik, Assistant Professor

- ❖ Design of Efficient Algorithms for Multiple Choice Resource Allocation Problems, 2016-2019, SERB

Dr. Subhankar Mishra, Assistant Professor

- ❖ DST-NRDMS - AutoBIM

Conferences and Seminars organized by the faculty in the School during 2019-2020:

Dr. Aritra Banik, Assistant Professor

- ❖ Organized ACM Summer School on Geometric Algorithms and their Applications, 3-15 June, 2019 at NISER jointly with Dr. Arijit Ghosh

Dr. Manoj Mishra, Assistant Professor

- ❖ Lecture Series on Discrete Mathematics, by Dr. Amitava Bhattacharya, School of Mathematics, TIFR (Mumbai)

Dr. Subhankar Mishra, Assistant Professor

- ❖ Dec 10-17, 2019 ACM Winter School on Cyber Security ACM and NISER



RECOGNITION, HONOURS & AWARDS

Honours/Awards/Recognition received by NISER

1. India Research Excellence – Citation Awards

2019 - NISER was recognized as the the most influential researchers and institutions for its outstanding and pioneering research contribution to the country under the category of Institutions established within 15 years. This Award was presented to NISER by Clarivate Analytics in its seventh edition.

2. Prof. Sudhakar Panda, Director, NISER – Fakir Mohan University of Odisha, in its 21st Foundation Day honoured Professor Sudhakar Panda, Director, NISER for his outstanding contribution to the field of science in general and Physics in particular. Prof. Panda was honoured for popularization of Science, his scientific works in USA, Germany, Netherlands, Japan, Italy etc. and in India under various capacities such as Research Scientist, Guide and administrator in prestigious institutes like Institute of Harischandra Research Institute, Institute of Physics and in National Institute of Science Education and research, to name a few.

Honours/Awards/Recognition received by Faculty members/Students

School of Biological Sciences

1. A new species of skink (*Eutropis dattaroyi*) from Nicobar Islands named after Dr. Aniruddha Datta Roy to commemorate his contributions in the study of skinks from the Indian subcontinent. See paper below:
Amarasinghe, A. A. Thasun, S. R. Chandramouli, Kaushik Deuti, Patrick D. Campbell, Sujan M. Henkanaththege, and Suranja Karunarathna. "A REVISION OF *Eutropis* rudis

(BOULENGER, 1887), RESURRECTION OF *E. lewisi* (BARTLETT, 1895) AND DESCRIPTION OF A NEW SPECIES (REPTILIA: SCINCIDAE) FROM GREAT NICOBAR."

2. Dr. Chandan Goswami was selected as the "DAAD Research Ambassador for 2018-2022".
3. Dr. Debasmita Pankaj Alone has become the Reviewer of the "Investigative Ophthalmology & Visual Science, Experimental Eye Research, Journal of Genetics, PLOS One and Clinical Ophthalmology.
4. Dr. Debasmita Pankaj Alone has become the Expert Committee Member, NPDF and Early Career Grants, SERB.
5. Dr. Debasmita Pankaj Alone has become Expert for a Grant Review for Czech Science Foundation, the main public funding agency in the Czech Republic supporting all areas of basic research.
6. Dr. Debasmita Pankaj Alone is contributing as a Doctoral Committee member, for three students in the Institute of Life Sciences.
7. Dr. Harapriya Mohapatra is contributing as Reviewer for several national and international journals such as International Journal of Antimicrobial Agents, Microbial Insights, Journal of Global Antibiotic Resistance, and Current Science.
8. Dr. Kishore CS Panigrahi has been awarded "Swayamprabha Digdarshan Award 2019".
9. Dr. KVS Badireenath has become the Reviewer of SERB project proposal on covid19.
10. Dr. KVS Badireenath has contributed as the Thesis examiner at OUAT.



11. Dr. KVS Badireenath has contributed as Guest lecturer at Institute of Life Sciences at Bhubaneshwar for the course on bio-informatics.
12. Dr. KVS Badireenath has contributed as a Jury member for poster evaluation.
13. Dr. KVS Badireenath has contributed as the Session Chairperson at NCNB Conference
14. Dr. KVS Badireenath has become the Editorial board member for two journals.
15. Dr. KVS Badireenath has become the Reviewer for five scientific journals.
16. Dr. Palok Aich has been awarded with "Global Travel Award" by the University of Saskatchewan, Saskatoon, SK, Canada for the year 2019.
17. Dr. Palok Aich has been awarded with the "Badge of Honor, Public Health, Sofia Medical Academy, Sofia, Bulgaria for the year 2018.
18. Dr. Palok Aich has contributed as Review Editor for Frontiers of Cellular and Infection Microbiology, USA.
19. Dr. Palok Aich has contributed for PLoS One, USA as an Academic Editor.
20. Dr. Palok Aich has contributed as an Associate Editor for The Current Bioinformatics, Bentham Science Publishers, The Netherlands and U.S.A (Associate Editor)
21. Dr. Subhasis Chattopadhyay has contributed as a guest lecturer at KIIT, School of Biotechnology, Bhubaneswar, in the "Short term training course on Basic Tools and Techniques in Cell Biology and Immunology" on 31st August 2019 funded by DBT.
22. Dr. Subhasis Chattopadhyay has secured 2nd position in the 35th DAE ZONAL Table Tennis event held on 30th November to 1st December 2019 at NISER.
23. Dr. Shyamasree Basu has been selected as the Editorial Board member for Journal of Applied Zoological Researches for 2020-2025.

By Students:

1. Sushree Sulava (PhD student), has best Oral presentation, Evaluation of dihydroartemisinin for potential anti-cancer activity using in vivo glioma models, National Conference on Cancer Biology and Therapeutics, 29th-30th November, 2019, Institute of Life Science, Bhubaneswar.
2. Preeti Prava Sahu- Int MSc student:
 - a. Awarded "Baden Wurrenberg Stipendium" supported by the German Research Foundation (DFG) scholarship to work in the group of Prof Peter Nick, Karlsruhe Institute of Technology (KIT), GERMANY.
 - b. Awarded a PhD position in the prestigious Ludwig Maxmuller University, Munich (LMU). Awarded travel grant to attend the interview @LMU, Germany.
3. Anamika Singh - PhD student has received DAAD Award for the extension of Bi-nationally supervised Doctoral fellowship from DAAD, Germany.

School of Chemical Sciences

Dr. Chidambaram Gunanathan: (a) Thieme Chemistry Journals Award 2020, (b) Selected for CRSI Bronze medal 2020, (c) Top Peer Reviewer Award 2019 by Publons

School of Earth and Planetary Sciences

1. Visiting Scientist position offered from NASA Jet Propulsion Laboratory, Pasadena, USA in 2019 (Dr. Liton Majumdar)
2. Dr. Liton Majumdar Awarded with DST/SERB Ramanujan Fellowship in 2019
3. Dr. Liton Majumdar selected as a life member of the Astronomical Society of India
4. Dr. Liton Majumdar selected as a life member of the American Geophysical Union



5. Returning Expert, Programme Migration for Development, 2019, by Centre for International Migration and Development (CIM) jointly run by GIZ and ZAV/BA, Germany, promoting knowledge transfer through migrants in their countries of origin; Offer edtop-up salary for two years and one-time relocation cost (Dr. Guneshwar Thangjam)
6. Life membership, Astronomical Society of India (Dr. Guneshwar Thangjam)
7. Ramanujan Fellowship, 2019, SERB/DST, India (Dr. Guneshwar Thangjam)
8. Member, Lunar Science Working Group, Chandrayaan-II, ISRO, India
9. Member, External Advisory Board, Centre For Terrestrial And Planetary Exploration laboratory (C-TAPE), University of Winnipeg, Canada (Dr. Guneshwar Thangjam)
10. Participating Scientist, NASA Dawn mission, Framing Camera team (Dr. Guneshwar Thangjam)

School of Physical Sciences

1. Dr. Ajaya Kumar Nayak has become Associate of the Indian Academy of Sciences (IASc), 2019.
2. Dr. Subhankar Bedanta- Awarded the visiting associate professor position at the International Center for Collaborative research of Institute of Material Research (ICC-IMR) at Tohoku University, Sendai, Japan for the summer 2019.
3. Dr. Subhankar Bedanta- Young Achiever Award (YAA)-2019 by Solid State Physics Symposium of Department of Atomic Energy, India.
4. Prof. Bedangadas Mohanty took up the Scientific Associate Position in the

Experimental Physics Division at CERN, Geneva, Switzerland.

5. Prof. Bedangadas Mohanty took up the Visiting Professor position by Institute of Modern Physics, Chinese Academy of Sciences (CAS), Lanzhou, China as part of CAS President's International Fellowship Initiative (PIFI)
6. Dr. Ritwick Das- The Optical Society (OSA), USA senior membership
7. Dr. Colin Benjamin's group recent research on reasons for cooperative behavior in the Thermodynamic limit using the template of a Public goods game, published in Chaos: An Interdisciplinary Journal of Nonlinear Science has been selected as a featured article in Chaos.
8. Dr. Colin Benjamin's group paper "The emergence of cooperation in the thermodynamic limit" has been published as a Letter to the Editor in Chaos, Solitons & Fractals.
9. Dr. Colin Benjamin Awarded science & engineering research board, DST, Government of India, CRG grant on "Josephson junctions with strained Dirac materials and their application in quantum information processing". Grant No. CRG/2019/006258 from Mar. 2020-Mar. 2023.
10. Dr. Nishikanta Khandai- IUCAA Associate Continuing.

School of Humanities and Social Sciences

Dr. Amarendra Das:

- (a) Serving as the Secretary of Orissa Economics Association.
- (b) Member of Executive Committee, The Indian Econometric Society.

RESEARCH AND DEVELOPMENT PROJECTS: EXTRAMURAL FUNDING

Project during the Year-2019-20

Sl No	Project Code	Name of the P.I./Co.Pi	Dept	Sponsor Dept	Project Title	Cost of the Project (₹)	Duration		Total Year
							From	To	
1	PH1902	Dr. Tuhin Ghosh	SPS	SERB	Modeling and simulation of polarized dust emission using the Planck data and external templates.	44,93,059	03.05.2019	02.05.2022	3
2	PH1903	Dr. Tarun Sharma	SPS	SERB	Ramanujan Fellowship Enantioselective synthesis of Aryl	1,19,00,000	29.07.2019	28.07.2024	5
3	CH1901	Dr. Smitha Mohanlal Women scientist	SCS	DST	derivatives of β -Alanine/ γ -Amino butyric acid through C(sp ³)-H Activation (Palladium catalysis) and Biophysical studies of their Homo ($\beta\gamma$) Hybrid ($\alpha,\beta/\alpha,\gamma$ - pept.	28,85,000	29.07.2019	28.07.2022	3
4	PH1905	Dr. Najmul Haque	SPS	SERB	QCD thermodynamics using non-perturbative Dyson-Schwinger Equation approach	16,38,714	03.12.2019	02.12.2021	2
5	PH1904	Dr. Ashis Kumar Nandy	SPS	SERB	Electric Field Control of the Dzyaloshinskii-Moriya Interaction And hence, Topological Spin Textures	28,41,344	03.12.2019	02.12.2021	2
6	BL1903	Dr. Mohammed Saleem	SBS	DST Inspire	INSPIRE faculty Award transferred to NISER on 13.12.2019	35,00,000	27.06.2014	26.06.2019	5
7	BL1902	Dr. Mohammed Saleem	SBS	SERB	Force generation by Amyloid β during aggregation mediated neuronal cell membrane rupture in neurodegeneration	32,45,000	25.10.2018	24.10.2021	3
8	CS1902	Dr. Sushmita Gupta	SCoS	SERB	MCoMAS: A multivariate computational lens for problems arising in multi agent systems	5,50,800	31.12.2019	30.12.2021	2
9	BL1904	Dr. Ramanujam Srinivasan	SBS	DBT	Bioactive Bhubaneswar biophysical characterization facility	15,94,37,920	24.12.2019	23.12.2023	4



10	CH1902	Dr. Aneeya Kumar Samantara Guide- Dr. Jogendra Nath Behera	SCS	SERB	SERB NPDP	21,31,200	27.01.2020	26.01.2022	2
11	CH1903	Dr. Soumyakanta Prusty Guide- Dr. Prasenjit Mal	SCS	SERB	SERB NPDP	19,20,000	21.01.2020	20.01.2022	2
12	BL1905	Dr. Mohammed Saleem	SBS	DBT	Spatio-temporal mapping of membrane deformation induced by Amyloid-beta 40 during neurodegeneration	49,28,200	13.03.2018	12.03.2021	3
13	BL1909	Dr. Chandan Goswami	SBS	ICMR	Modified Polysaccharide based hydrogels for cost-effective bone tissue engineering	6,55,396/- (Breakup of 1st installment)	30.08.2019	29.08.2022	3
14	BL1906	Dr. Debasmitta P. Alone	SBS	SERB	Proteostasis Impairment in the Progression of Pseudoexfoliation syndrome and Glaucoma	75,68,000	07.02.2020	06.02.2023	3
15	BL1907	Dr. Kishore C S Panigrahi	SBS	CSIR	Development of a plant based platform for the production of human interleukin 33(hIL33) in Moss, Physcomitrella patens	16,50,000	31.07.2019	30.07.2022	3
16	BL1908	Dr. Moon Moon Das Guide- Dr. Harapriya Mohapatra	SBS	SERB	National Post Doctoral fellowship	19,20,000	05.02.2020	04.02.2022	2
17	MT1902	Dr. Sanjay Parui	SMS	SERB	Lacunary Maximal functions for Dunkl Operators	6,60,000	05.02.2020	04.02.2023	3
18	MT1903	Dr. Dinesh Kumar Keshari	SMS	SERB	Unitary, similarity invariants and curvature inequalities for operators in the Cowen-Douglas class	6,60,000	11.02.2020	10.02.2023	3
19	PH1906	Dr. Colin Benjamin	SPS	SERB	Josephson junctions with strained Dirac materials and their application in quantum information processing	21,85,920	19.03.2020	18.03.2023	3
20	CS2001	Dr. Subhankar Mishra	SCoS	DSF	3D Digitization of historical temples and develop heritage building information Modelling (H-BIM)	24,50,000	20.02.2020	19.02.2021	1



LIST OF STAFF

Administrative Staff

Sl. No.	Name of the Employee	Designation
1	Dr. A K Naik	Registrar
2	Shri Deepak Srivastava	Stores & Purchase Officer
3	Shri Ramakant Kar	Administrative Officer-III
4	Shri Abhaya Kumar Mohanty	Administrative Officer-I
5	Shri Chandra Sekhar Mahapatra	Administrative Officer-I
6	Shri Dhaneswar Nayak	Administrative Officer-I
7	Shri Dinesh Bahadur Singh	Administrative Officer-I
8	Shri Dolananda Pradhan	Administrative Officer-I
9	Shri Gopal Krishna Rath	Administrative Officer-I
10	Shri Hiralal Das	Administrative Officer-I
11	Shri Pradeep Kumar Mishra	Administrative Officer-I
12	Shri Purna Chandra Sahu	Administrative Officer-I
13	Shri Rajeev Kumar Singh	Administrative Officer-I
14	Shri Sanjay Kumar Patro	Administrative Officer-I
15	Smt. Shabnam Khanum	Administrative Officer-I
16	Shri Madhusudan Padhy	Office Assistant (MS)
17	Shri Nabin Kumar Sahoo	Office Assistant (MS)
18	Shri Ranjan Kumar Das	Office Assistant (MS)
19	Shri Sujit Kumar Bastia	Office Assistant (MS)
20	Shri Jogendra Jena	Operator (General Function)
21	Smt. Sasmita Sahoo	Operator (General Function)
22	Shri Subrat Ranjan Hota	Operator (General Function)
23	Shri Tusar Kanta Sahoo	Operator (General Function)
24	Smt. A B Rosy	Upper Division Clerk
25	Shri Amarendra Kumar Behera	Upper Division Clerk
26	Smt. Apolina Lakra	Upper Division Clerk
27	Kum. Babita Pradhan	Upper Division Clerk
28	Smt. Banita Pradhan	Upper Division Clerk
29	Shri Bijay Kumar Behera	Upper Division Clerk
30	Shri Biplab Kanungo	Upper Division Clerk
31	Kum. Bishnupriya Das	Upper Division Clerk
32	Shri Chitta Ranjan Nayak	Upper Division Clerk
34	Shri D. Lingaraj	Upper Division Clerk
34	Smt. Elina Das	Upper Division Clerk
35	Smt. Lipsa Das	Upper Division Clerk
36	Smt. Lopamudra Sahoo	Upper Division Clerk
37	Shri M Siba Prasad Rao	Upper Division Clerk



38	Kum. Monalisa Baliarsingh	Upper Division Clerk
39	Kum. Sandeepa Sahoo	Upper Division Clerk
40	Smt. Smruti Kanungo	Upper Division Clerk
41	Shri Susanta Kumar Sethi	Upper Division Clerk
42	Shri Vijay Singh	Upper Division Clerk
Scientific and Technical Staff		
SL. No.	Name of Employees	Designation
1	Dr. Arun Kumar	Scientific Officer-F
2	Shri Saikat Hira	Scientific Officer-F
3	Dr. Shyamasree Basu	Scientific Officer-F
4	Dr. Sudakshina Prusty	Scientific Officer-F
5	Dr. Biswajit Mishra	Scientific Officer-E (Medical)
6	Shri Souvagya Mahapatra	Scientific Officer-E (Civil)
7	Shri Dilip Jha	Scientific Officer-E (Electrical)
8	Dr. Gunda Santosh Babu	Scientific Officer-E
9	Dr. Ranbir Singh	Scientific Officer-E
10	Dr. Saurabh Chawla	Scientific Officer-E
11	Dr. Bandita Dash	Scientific Officer-D (Medical)
12	Shri Ananda Raman	Scientific Officer-D (HPC)
13	Dr. Chandramohan Bathrachalam	Scientific Officer-D
14	Dr. Haraprasanna Lenka	Scientific Officer-D
15	Dr. Priyanka Pandey	Scientific Officer-D
16	Dr. Saralasrita Mohanty	Scientific Officer-D
17	Dr. Varchaswi K S Kashyap	Scientific Officer-D
18	Shri Ashank Vishwakarma	Scientific Officer-C (Mechanical)
19	Dr. Ajay Kumar Dash	Scientific Officer-C
20	Shri Dipak Kumar Rout	Scientific Assistant-E
21	Shri Jitendra Narayan Dash	Scientific Assistant-D (Library)
22	Shri Ranjan Kumar Rana	Scientific Assistant-D (Electrical)
23	Shri Sambid Kumar Pradhan	Scientific Assistant-D (Civil)
24	Shri Amit Kumar Panigrahi	Scientific Assistant-D (Electrical)
25	Shri Bhagaban Dhal	Scientific Assistant-D (Electrical)
26	Shri Binod Bhagat	Scientific Assistant-D (Civil)
27	Shri Pramod Kumar Nath	Scientific Assistant-D (Civil)
28	Shri Deepankar Dash	Scientific Assistant-D (Computer)
29	Shri M Suryanarayan	Scientific Assistant-C (PET)
30	Shri Ajit Kumar Mohanty	Scientific Officer-C (Mechanical)



31	Shri Sujit Kumar Raut	Scientific Officer-C (Mechanical)
32	Shri Alok Sahoo	Scientific Assistant-C
33	Shri Bidyut Siba Sankar Mohanty	Scientific Assistant-C
34	Shri Rabindra Kumar Maharana	Technician-F (Library)
35	Kum. Suchismita Dash	Technician-F (Library)
36	Smt. Anuradha Das	Technician-D
37	Shri Alok Kumar Jena	Technician-D
38	Shri Pravakar Mallick	Technician-D
39	Shri Amit Sankar Sahu	Technician-D
40	Shri Balaji Venkatesan	Technician-D
41	Shri Prafulla Kumar Sethi	Technician-D
42	Shri Susanta Kumar Parida	Technician-C
43	Shri Bikash Chandra Behera	Technician-C
44	Shri Ramprasad Panigrahi	Technician-C
45	Shri Rudranarayan Mohanty	Technician-C
46	Shri Deepak Kumar Behera	Technician-C
47	Shri Sanjaya Kumar Mishra	Technician-C
48	Shri Mukesh Kumar Meena	Technician-C
49	Shri Subhransu Sekhar Panda	Technician-C
50	Shri SK Safatulla	Technician-C (Library)
51	Shri Kuna Mahara	Technician-C
52	Shri Mriganka Sadhukhan	Technician-C
53	Shri Prakash Chandra Behera	Technician-C
54	Shri Rakesh Kumar Behera	Technician-C
55	Shri Sandeep Kumar Behera	Technician-C
56	Shri Tapan Kumar Panigrahi	Technician-C
57	Kum. V Shiny Jerusha Joseph	Technician-C
58	Shri V.A. Sakthivel	Technician-C
59	Smt. Ashwini Babrubahan Sethi	Technician-B
60	Shri Debasis Das	Technician-B
61	Shri Srikrushna Sahu	Technician-B

Employee Data on SC, ST, OBC and PWD

As on 31.03.2020

ACADEMIC

SC	ST	OBC	PWD
01	Nil	12	Nil

NON-ACADEMIC

SC	ST	OBC	PWD
14	07	16	Nil



8th GRADUATION CEREMONY

The **8th Graduation Ceremony** was held on **10th June, 2019**. Honourable Chief Guest **Prof. Mustansir Barma, Professor Emeritus and DAE-Homi Bhabha Chair Professor, TIFR Centre for Interdisciplinary Sciences, Hyderabad** had graced the occasion and awarded the degrees to the Graduated students.

Twenty One Ph.D scholars and **Ninety Four** Integrated M.Sc students were graduated in the 8th Graduation ceremony. School wise award of degree in 'Doctor of Philosophy' during the 8th Graduation Ceremony held on 10th June, 2019 is as follows.

- | | |
|------------------------------------|------|
| 1. School of Biological Sciences | = 06 |
| 2. School of Chemical Sciences | = 05 |
| 3. School of Physical Sciences | = 07 |
| 4. School of Mathematical sciences | = 03 |

The students who own various awards in the 8th Graduation Ceremony are mentioned below;

Gold Medal for Best All Round Performances-2019

Mr. Bineet Kumar Dash, School of Physical Sciences

Silver Medal for Best Academic Performance in each discipline of the graduating class-2019:

Mr. Tejus S, School of Biological Sciences

Mr. Aman Kumar Agrawal, School of Chemical Sciences

Mr. Dibyayoti Dhananjay Jena, School of Mathematical Sciences

Mr. Bineet Kumar Dash, School of Physical Sciences





Best M.Sc Thesis Award-2019

Mr. Tejus S

(School of Biological Sciences)

Mr. Jugal Kishore

(School of Chemical Sciences)

Mr. Gaurish Korpai

(School of Mathematical Sciences)

Mr. Subhobrata Chatterjee

(School of Physical Sciences)

Memorial Awards-2019

1. Winner of Sarat Chandra Annapurna Award-2019: Mr. Bineet Kumar Dash (School of Physical Sciences)

2. Winner of Smt. Jayalaxamma Award-2019:

Mr. Aman Kumar Agrawal (School of Chemical Sciences)

3. Winner of Prof. Tribikram Pati Memorial Award-2019

Mr. Dibyayoti Dhananjay Jena (School of Mathematical Sciences)

4. Winner of Dr. Sumitra Moharana Memorial Award-2019

Mr. Tejus S (School Biological Sciences)

Admission Statistics in the 5yr Integrated M.Sc programme, 2019

Approved intake for 5 year integrated M.Sc programme is 200.

Total admitted into the 5 year integrated M.Sc programme in the year 2019 is 196.

Admission Statistics in the PhD programme, 2019

School of Biological Sciences	= 19
School of Chemical Sciences	= 11
School of Computer Sciences	= 06
School of Mathematical Sciences	= 06
School of Physical Sciences	= 11
School of Humanities & Social Sciences	= 04

Admission Statistics in the Integrated M.Sc-PhD programme, 2019

School of Physical Sciences	= 08
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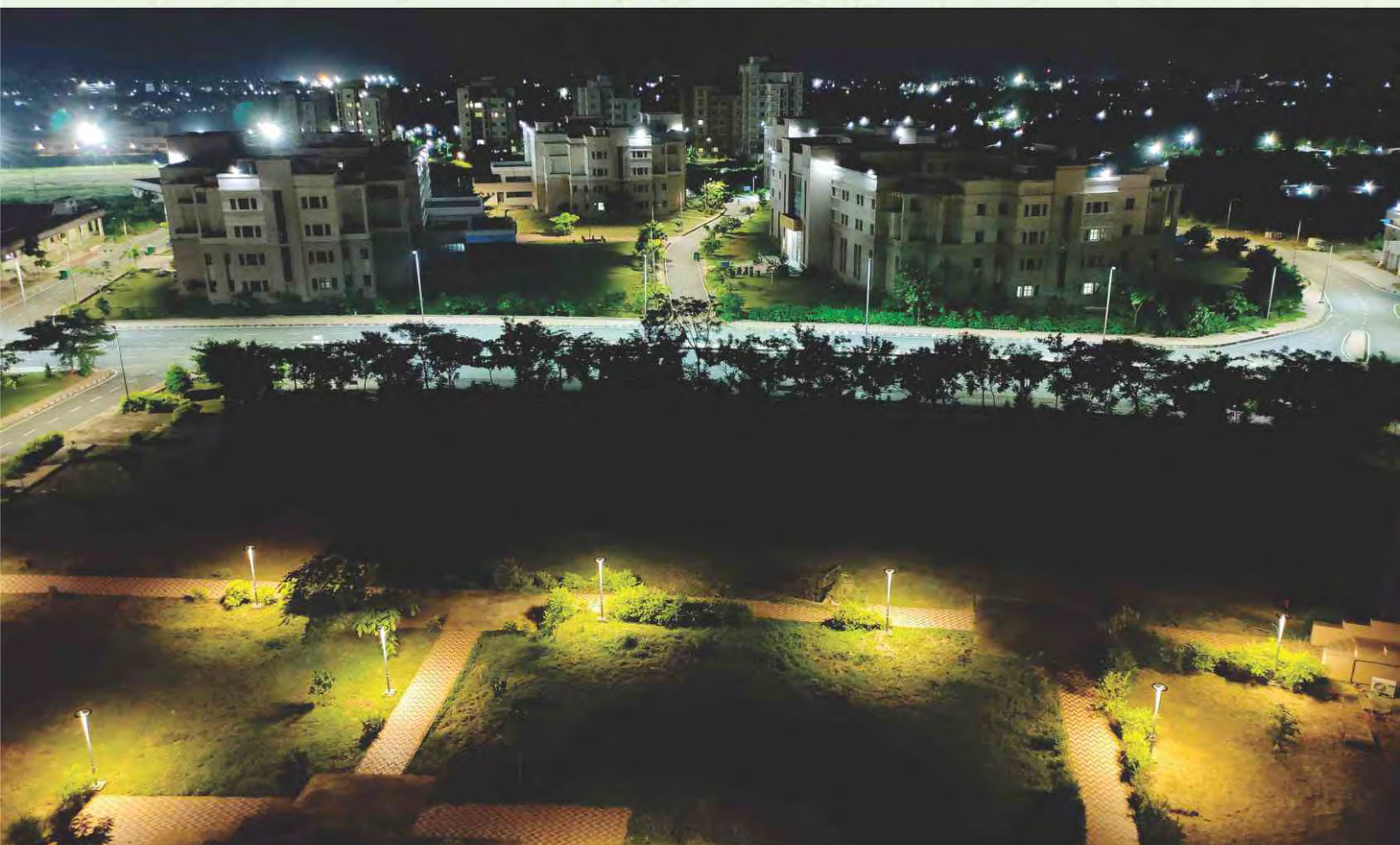
INFRASTRUCTURE

NISER Bhubaneswar Project at Jatni was undertaken and completed by M/s L&T under the supervision of Directorate of Construction, Services and Estate Management (DCSEM), Mumbai along with the help of NISER, Institute Works Department (IWD). It covers an area of 300 acres and is located at Jatni along Jatni-Khurda road, Odisha at a distance of about 6 km from NH-5.

Permanent Campus at Jatni



Pictures of night view of the campus



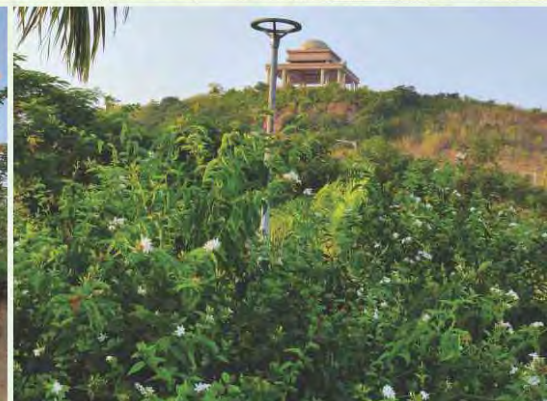


NISER, Jatni Project comprises a total of 127 buildings, having plinth area 175937.92 sqm. The building comprises of various types like Academic buildings, Amenities buildings, Service buildings, Residential, Hostels.

Academic building consists of Schools of Chemical Science, Biological Science, Library, Physical Science, Mathematical Science, Humanities and Social Science, Green House, Animal House, Auditorium, Workshop and Meditation center. **Amenities building** consist of Health center, bank and Post office, Primary school, Community Centre and shopping complex, Student activity center and Aquatic complex. **Service building** consists of AC plant room, Main receiving station (MRS), Local control substations (LCS), Gas bank, water works and gate house. **Residential Buildings** consist of Flats of A, B, C, D and individual duplex houses like E type, Dean Bungalow and Director Bungalow. **Hostels** consist of Double Occupancy and single Occupancy.

Plantation drives have been a regular feature at NISER permanent campus being constructed at Jatni. Every year while celebrating the significant days such as: Republic Day, Independence Day and NISER Foundation Day, the staff, students and faculty members of NISER participate in the go-green drive sending out a message to the stakeholders and public at large to care for and preserve our immediate environment. Thousands of saplings have been planted and various other plantation drives are being taken up from time to time with a target to make the campus as one of the greenest campus in India. This was the pledge taken after the NISER was officially dedicated to Nation by Honorable Prime Minister, Shri Narendra Modi on 7th February 2016. The campus has been shifted to its permanent campus on 1st July, 2015 after which the works department is very much actively participating the needs of its end users i.e. staff, faculties and residents.





Rain water harvesting structures like ground water recharging pits and ponds in the Jatni campus of NISER. The water to the campus is filled in the water tank placed at the hill top from where the water is filled to the respective water tanks at the multi storied buildings through gravity which is economical as far as the expenditure with regards to keeping a pump and its operation and consumption of diesel etc. The Sewage Treatment Plant (STP) is in place. The treated water from the STP can be used for arboriculture and landscaping.

Recently, the **thermoplastic marking on road** was done within scheduled date and the kerb stone painting and marking done. In order to arrest the soil slipping out during rain, kerb walls in left over portion taken up and completed. This enhances the scenic beauty of the campus also the numbering of all residential quarters done.

Some of the salient features of this project are:

Water harvesting is fully ensured by recharging of ponds in the campus by rain water and ground water recharging pits. STP and ETP are provided to make use of waste water. Separate flushing tank is provided, so that STP treated water can be used in flushing. To ensure minimum water utilisation dual flushing system is provided.

Proper utilisation of day light to conserve electricity by providing glass window and Polycarbonate sheets in the top truss enabling proper lighting. The orientation of building was done in such a way that proper lighting and ventilation is ensured. To ensure heat transfer thermal insulation to the top floor is provided in academic complex.

The water tank catering to the entire campus water demand is placed at the top most location



of the campus enabling proper conservation of pumping charges and allied expenses. The water is able to reach the high rise buildings through gravity as a result of this arrangement. A separate irrigation tank is provided for arboriculture.

Smoke proof doors around the corridors to confine the smoke in local area so that rescue can be done. Fire proof doors (2hrs resistivity) at exit point of staircase in every floor during fire emergency.

Source of Electricity and water in campus: The electricity supply for NISER campus is arranged from Aurugul Grid (5km) near IIT Bhubaneswar which was successfully energized since 28th April 2015.

The shopping complex is also taken over. Various shops have been allotted.

The community centre is already in place which is being regularly used by staff and faculty for family functions and various departmental functions. In construction of various things proper value engineering is taken care and accordingly the

scarps taken over from fencing materials are used as guard rails saving huge amount of money etc.

The solid waste disposal is being maintained by Jatni Municipality. Jatni Municipality is picking the solid waste daily and dumping in their designated dump yards.

Opening of Post Office: A Post Office was inaugurated by the Director, NISER as Chief Guest. Director of Postal Services was the Guest of Honour on the occasion and Shri Satyabadi Biswal, Senior Superintendent of Post Offices and other officials of Postal Department as well as NISER faculty members, staff, students were present on the occasion. The Post Office is located in the bank building complex and started postal services like speed post, mail dispatch. Going forward the Postal department will start other services like PLI, Savings Bank etc.

350 seater Amphitheatre was inaugurated on 26.01.2020 along with Central Mechanical Workshop by the Director, NISER.





Details of Electrical power demand, consumption, power saved, total units consumed etc. is enumerated below.

Per Month Energy Saving								
SI #	Description	Qty (No.)	Saving in each light (W)	Total Saving (W)	Total Savin Saving in Units(KWH)/Day (conside light usage of 12 hrs per day)	No of days in month	Saving in Units/	Remark Month
1	72 W PL-Lamp street light replaced with 36w LED street light	225	36	8100	97.2	30	2916	Street Light & Utility Area
2	8 Nos of 800W HPMV replaced with 6 nos of 400W led flood light	6	666.66	4000	48	30	1200	
3	20 Nos of 11W bulkhead light replaced with 6.5W LED light	20	4.5	90	1.08	30	32.4	
4	20 nos of 72W post top lamp replaced with 27W led post top light	20	45	900	10.8	30	324	
5	250 W conventional street light replaced with 90W led street light	80	160	12800	153.6	30	4608	
6	150 W conventional street light replaced with 70W led street light	215	80	17200	206.4	30	6192	
7	36W replaced with 20 W led	52	16	832	9.984	30	299.52	Academic Building
8	2X 28 replaced with 2X 18W led batten	448	20	8960	107.52	30	3225.6	
9	18W led replaced with 10W led	432	8	3456	41.472	30	1244.16	
10	2X18 W batten replaced with 1X18w	99	18	1782	21.384	30	641.52	
11	18W led replaced with 9 W led	64	9	576	6.912	30	207.36	
12	2X 28 replaced with 1X 34W led batten	146	6	876	10.512	30	315.36	
13	400W flood light replaced with 150W LED	5	250	1250	15	30	450	
Total units saving per Month (KWH)							21655.92	



OUTREACH ACTIVITIES



NISER is mindful of its social responsibilities and has been reaching out to students and teachers to motivate them in their Scientific pursuit. Spearheaded by Dr. Debasmita P. Alone the activities are coordinated and spread round the year in three categories: NISER Open Day, Teacher training workshops and Educational visits of schools.

We conducted NISER Open Day on the 6th of April 2019. The program was aimed for school students (class 8th-12th) and involved lectures by NISER faculty members, laboratory visits and demonstrations conducted by students of the institute. The Open Day is conducted every year as

an outreach activity to introduce young students to different fields of basic sciences and scientific research. Not only does it help school students make informed career choices but also is an excellent opportunity for inducing creative thinking in NISER students who apply the knowledge gained in various coursework to come up with excellent and motivating new experiments every year. About 181 students and escort teachers of 11 schools from Jatni, Bhubaneswar, and Cuttack area attended the program. Children of NISER faculty and staff also had an opportunity to experience their parent's workplace. Dr. Arindam Ghosh of the School of Chemical Sciences



delivered a talk on "History of Codes and Codebreaking" which was widely appreciated by participating students and teachers. NISER Students from different departments exhibited several experiments demonstrating scientific concepts taught in school as well as some relatively advanced ideas. Based on the feedback, NISER Open Day was an enjoyable learning experience for the participating students and there has been a repeated request since the last two years to extend the program for at least a couple of days in coming years.

Secondly, NISER along with Institute of Physics is executing the Vigyan Pratibha Project of the Department of Atomic Energy to train teachers by conducting various teacher-training workshops in Odisha and Chhattisgarh region. Vigyan Pratibha is a novel initiative of Government of India under the aegis of Department of Atomic Energy for extended nurture of talent in Science and Mathematics among school students of Class 8th to 10th in Kendriya Vidyalaya, Jawahar Navodaya Vidyalaya, and Atomic Energy Central schools across the country. The core of the project will be in the form of learning units that are an extension to the topics taught in classrooms which can deliver practical knowledge and instill the basic concepts through "Learning by Doing" in the students. The key aspect of this program is that science circles in schools, in which students will conduct Learning Units developed as a part of the program at Homi Bhabha Centre for Science Education (HBCSE) with the help of faculties all over the country. It also have an exposure dimension as a part of which the students and teachers will get to see high-end scientific

research facilities by visits to national scientific institutions. This year have conducted two workshops for training teachers of various learning units for the teachers who in turn have been able to conduct the learning units in their respective schools involving students and the reviews have been very satisfactory.

There are year-round visits of students and faculty from various institutions who get a first-hand experience of an elite Scientific Institution. The Scientific Officers at various schools have been carrying out the responsibility of these activities. Students and teachers from all around the country, nearby, far and remote areas, have been encouraged to participate in these visits. They are escorted through various research facilities of all the departments for a better understanding of the academic learning at an educational institution such as NISER. These kind of educational trips provide the students to learn through a genuine experience to gather knowledge and perspective into the possible career paths in the scientific community. They help in breaking the stereotypes related to academics and provides insight as to why Science and Mathematics is highly important for the society, and also why it can be interesting as well. When school students observe the work-life of people at NISER and interact with them, it leads to better achievement, standards, motivation, personal development and behavior in them. These visits also help to enhance the social, personal and emotional development of all participants. They are left with a sense of imagination and new found interest for science.





MISCELLANEOUS

International Day of Yoga

International Day of Yoga was celebrated by the institute on 21.06.2019. NISER conducted various yoga sessions, pranayama etc in which the faculty members, staff and students of the institute participated with all enthusiasm.



Rastriya Ekta Diwas (National Unity Day)

The Rastriya Ekta Diwas was observed 31st October, 2019. Director, NISER administered Rastriya Ekta Pledge to all the officers and employees of the institute.

Foundation Day

Since the inception of NISER, the Institute has been celebrating its foundation day every year. On this occasion eminent scientists are invited to deliver popular lectures. On 6th September 2019, NISER celebrated its 10th Foundation Day of the institute, commemorating initiation of the academic programs at NISER. On this occasion, NISER had the pleasure to have Prof. Amitava Raychaudhuri, Professor Emeritus, University of Calcutta and former Director, HRI Allahabad. Prof. Raychaudhuri delivered the foundation day and awarded the degrees to the Semester Toppers students.

Sadbhavana Diwas

The Sadbhavana Diwas was observed on 20th August 2019. All the officers and employees took the Sadbhavana Pledge for maintaining communal harmony.

Vigilance Awareness Week

The vigilance awareness week was observed during 28th October, 2019- 02nd November, 2019. All the employees of NISER took the oath of official secrecy and pledged on 29th October, 2019, for maintenance of honesty and transparency while delivering their work. Essay competition was organized on the topic "Integrity a Way of Life". The competition was divided into Faculty & staff one group, students in another group. The winners were given cash award of ₹2000/-, ₹1000/- & ₹500/- for securing first, second and third position respectively.

Seminars/Conferences/Workshops etc. during the period 2019-20

- ❖ Hands-on Workshop on Methodology in Clinical Cancer Research - 20/05/2019 to 22/05/2019



- ❖ ACM Summer School- 03/06/2019 to 15/06/2019
- ❖ The Summer Outreach Program in Mathematics (SOPM 2019) - 17/06/2019 to 29/06/2019
- ❖ Workshop on Geometrical and Topological Methods for Cosmological Data Analysis - 20/07/2019 to 23/07/2019
- ❖ One day workshop on PRECESSION ELECTRON DIFFRACTION - 26/07/2019
- ❖ Advanced Foundation School - III - 01/07/2019 to 27/07/2019
- ❖ Dynamics of QCD matter - 15/08/2019 to 17/08/2019
- ❖ NISER Outreach Program, "Chandrayaan-2: Historic Moon Landing", on 7th September, organised by School of Earth and Planetary Sciences - 07/09/2019
- ❖ Vigyan Pratibha (Teachers' Training Workshop) - 17/10/2019 to 19/10/2019
- ❖ Bringing The Nanoworld Together (BTNT) 2019 - 05/12/2019 to 06/12/2019
- ❖ Lecture series on Transcendence on Commutative Algebraic Groups - 09/12/2019 to 15/12/2019
- ❖ ACM Winter School 2019 on Cybersecurity - 10/12/2019 to 16/12/2019
- ❖ Vigyan Pratibha (Teachers' Training Workshop-III) - 18/12/2019 to 20/12/2019
- ❖ National Arabidopsis Meeting - 29/12/2019 to 31/12/2019
- ❖ Conference on Noncommutative Geometry and its applications - 06/01/2020 to 10/01/2020
- ❖ Open Day 2020 - 28/03/2020





Swachha Bharat Abhiyan



Swachhata Hi Seva Hai (SHS) Campaign

Cleanliness is Godliness

NISER is committed to maintain complete cleanliness in its entire campus viz. offices, labs, classrooms, lecture halls, library, medical dispensary, hostels, corridors, roads, parks, playgrounds etc. In order to accomplish this task, the institute conducts special cleanliness drives, peoples' sensitization programmes in coordination with Swachhata Committee. Some student volunteers are also significantly contributing to this cause by conducting frequent cleanliness drives especially in the Hostel areas. The Institute is also observing **"Swachhata Pakhwada"** as per directions received time to time from DAE. Some of such events conducted during the year 2019-20 are being reported here.

Under **"Swachhata Hi Seva Hai"** campaign initiated by the Government of India on October 2, 2019 following programmes were conducted in the institute:

- A programme on the theme **"Say No to single use Plastic"** was conducted in the campus with the help of NISER Employees & Students. Different types of placards with relevant slogans were displayed during the march past conducted in the campus and surrounding localities to sensitize the people towards harmful effects of single use plastic.
- A rally was conducted on **Swachhata Hi Seva hai** in and outside of the campus. In the rally staff, faculty, students, workers, general public, invited guests, and other volunteers had participated and made the campaign successful.
- A **cleanliness /shramdaan drive** was also conducted to clean the garbage / waste lying here and there in the campus and surrounding localities.





Swachhata Pakhwada – February 16th to 28th, 2020:

(a) **February 16th, 2020:** Swachhata Movie Show by NISER Film Club was organized in the institute and clips from the following documentaries were shown to the campus community:

- A world without water - True Vision, 2006
- Cry of a river, the trouble with India's toilets and drinking water - RT Documentaries, 2017.
- H2wOe, India's Water Crisis, Warning to the World - RT Documentaries, 2016
- When every drop counts - TERI and Ministry of Drinking Water and Sanitation, 2013

(b) **February 17th, 2020 : Swachhata Based Eco – Quiz Competition :**

- Nine teams of two Students / Employees each have participated in the event.
- The competition was consisting of written screening round, five rounds of oral quizzing and a final round of group discussion.
- First, Second and Third place winner teams were rewarded with Certificate and Cash Prize of Rs.1500/- 1000/- and 500/- respectively.
- A photograph of the Group Discussion is depicted below:



(c) **February 18th, 2020 : Cleanest Hostel Competition:**

Cleanest Hostel Competition was announced for 10 days. During the period every participant hostel students have maintained best possible cleanliness in their respective hostel areas. A committee was constituted to decide the Cleanest Hostel has inspected all the Hostels regularly and announced **DOH-1 - Krishna Hostel** as the winner. The team of students was given the Certificate by the Director on the Pakhwada Closing Ceremony.

(d) **February 19th, 2020: Swachhata Art and Craft Competition:**

- The competition was announced on February 19th and registration of participants done on the same day.
- The theme of the competition was **"Best out of Waste"**.
- The creations were display / shown and ranked in the Pakhwada Concluding Function held on February 28th, 2020.
- First, Second and Third place winners were rewarded with Certificate and Cash Prize of Rs.1500/- 1000/- and 500/- respectively.



(d) February 20th, 2020: March-Past and Campus Cleaning Drive

- March-Past with campus cleaning drive was conducted by NISER employees and students during 11am to 1pm within NISER campus.
- Roadsides, parks, playground, streets of residential colony, hostels, dispensary, bank and vehicle parking areas were cleaned.

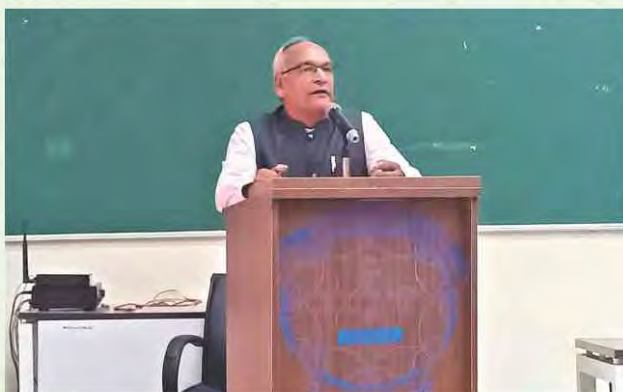
Some photographs are shown below.





(e) February 21st, 2020 : Swachhata Seminar :

A Seminar was organized on Swachhata. Shri Bhanu Pratapa Singh, IFS, Chairman, State Level Expert Appraisal Committee (SEAC), Pollution Control Board, Odisha was invited as the Guest Speaker. He has delivered a talk on "Water and Sanitation" which was attended by the NISER Employees and Students. After the talk there was an interaction session with the speaker on local pollution related problems of Odisha State. Few snaps of the seminar are shown below.



(f) February 22nd & 26th ,2020: Essay / Poem Writing Competition

- An Essay / Poem writing competition on "The Impact of Cleanliness on our Health" was conducted in the Institute.
- For convenience of the Students the competition was conducted on February 22nd, 2020 and for Employees on 26th, 2020.
- First, Second and Third place winners were rewarded with Certificate and Cash Prize of Rs.1500/- 1000/- and 500/- respectively

(g) February 23rd to 25th 2020 :

- February 23rd, 2020, Electrical & Electronic waste lying here and there was collected from the entire campus by Electrical Division of the Institute Works Section.
- February 24th, 2020: Plantation drive was conducted in the campus. Few snaps are shown below.
- February 25th, 2020: Watering drive was conducted for newly planted saplings.





(h) Pakhwada Concluding Programme on February 28th, 2020 :

- Panel Discussion on Availability of Water and Sanitation was conducted

Panelists: Shri Pradeep Baisakh

Global Call to Action Against Poverty

Shri Arpita Pattnaik,

Humara Bachpan Trust

Bauri Bandhu Bej

Advocate and noted Environmentalist

Bibhu Satapati

Spandan Foundation

Moderator: Dr Amarendra Das,

NISER Bhubaneswar

Few Photographs of the Panel Discussion are shown below:



The Chief Guest of the function Prof. Sudhakar Panda, Director, NISER has distributed prizes to the winners of all competitions conducted during the Swachhata Pakhwada period.

The winners were:

Eco-Quiz Competition

Names of Winners	Prize Money (₹)
Ms. Payal & Mr. Ashutosh,	1,500
Ms. Apramita Chand & Mr. Ambuj Dhakad	1,000
Mr. Akhil Tripathi & Mr. Nikhil Kumar	500

Essay / Poem writing Competition

Ms. Apramita Chand	1,500
Smt. Smruti Kanungo	1,000
Mr. Dinesh Beniwal	500

Painting & Craft Competition

Ms. Barsharani Pradhan	1,500
Ms. Geetanjali Bhoi	1,000
Mr. Pranjal Roopnath	500





Official Language in NISER

NISER is making all possible efforts to accomplish the targets towards compliance of effective implementation of Official Language Policy of the Union in the institute. An "Official Language Implementation Committee (OLIC)" under Chairmanship of Director, NISER is already in place and plays an active role in making various decisions for proper implementation of the policy level orders, instructions received from DAE as well as Government of India. Under the policy, some of the mandatory requirements like bilingual signage, stamps, letterheads, advertisements, tenders, and reports are being done in the institute. The staff members those have been trained through various official language Hindi courses are doing their official work partially in Hindi. To encourage and motivate more employees to execute their official work in Hindi, the DAE's Incentive Scheme (ATOLIS - Atomic Energy Official Language Implementation Scheme) has also been implemented. The institute time to time also conducts Hindi Seminars, Conferences, Workshops and Training Sessions. During the Hindi Pakhwada / Hindi Diwas celebrations we also conduct competitive events in official language Hindi like essay writing, film quiz, open speech competitions etc. Some of such major events and activities conducted during the year 2019-20 are being reported below:

1. A **Joint Hindi Workshop** was conducted in NISER on June 12th, 2019 in collaboration with Institute of Physics. More than 30 participants from both the institutes were participated and benefited from this one-day event. The event was inaugurated by the Honorable Director, NISER Prof. Sudhakar Panda and Prof. Radhakant Mishra, Rtd. Professor of Hindi and Head, Department of

Hindi, Ravenshaw University, Cuttack was the Key Speaker of the session. Few snaps of its inaugural session are shown below:



2. A Joint Hindi Vaigyanik Sangoshthi / Scientific Seminar was organized in the Institute of Physics Bhubaneshwar in collaboration with NISER, HWP Talchar, Indian Rare Earths (IRE), OSCOM Chhatarpur and IPO on August 23, 2019. More than 50 participants have participated in this seminar and three speakers viz Dr. Saurabh Chawla, Dr. Arun Kumar and Mr. Ramakant Kar from NISER have presented their talks.
3. Under the directions received from DAE vide letter No.21/Hindi/2019-20/1233-1320 dated July 12th, 2019 an in-house hands-on training session on **"Working in Hindi on Computer"** was organized with the help of Computer Centre to train our Admin, Scientific & Technical staffs. The Scientific

Officer of Computer Centre **Shri Saikat HiraJI** has provided all kind of technical support required for the training. He played the key role of **"Chief Instructor"** during the session. The event was coordinated by the Officer –In-Charge (OL) Shri Dinesh Bahadur Singh.

4. A one day annual Official Language **"Joint Scientific Seminar"** in collaboration with NISER, IOP, IMMT, AIIMS, CIFA, CIWA, & ILS was organized on the occasion of World Hindi Day i.e. on January 10th, 2020 at Institute of Life Sciences, Bhubneswar. There were more than 100 participants from all the collaborative institutions have attended the Seminar. From NISER 15 Admin, Scientific & Technical staff members have participated in this event and two speakers viz. Dr. Saurabh Chawla & Mr. Dinesh Bahadur Singh have presented their talks in Hindi on theme of the Seminar **"Role of Scientific and Technical Institutions in Prevention of Negative Effects of Environmental / Climate Change"** The event was Co-ordinated by Mr. Dinesh Bahadur Singh, Administrative Officer and Officer In-Charge (OL), NISER. Few glimpses of the event are given below:



5. **Hindi fortnight** was observed in the Institute during September 1st to 15th, 2019. On this occasion following events / activities were conducted:
 - a. **Hindi Film Quiz Competition:** This event was conducted on September 4th, 2019 and coordinated by Dr. Pranay Swain. Amongst the participants, groups of two people were formed. First there was a screening / elimination round conducted in writing and



after that amongst the eligible groups four rounds of oral quizzing were conducted. The Winner Groups of this event were:

- i. **First Prize (Cash award of ₹2,000):** Ms Bishnupriya Dash & Ms. Sandeepa Sahoo (Employees)
- ii. **Second Prize (Cash award of ₹1,500):** Ms. Pranjali Singh & Mr. Prasanjit Sahu (Students)
- iii. **Third Prize (Cash award of ₹1,000):** Shri Vijay Singh & Shri Sukant Kumar Das (Employees)
- b. **Hindi Essay writing competition:** This event was conducted in two categories viz. Students and Employees on September 6th, 2019 on the topics of "Karyalay me Anushasan" and "Vidhyarthi Jeevan: Kartavya Evm Adhikaar" respectively. Winners of this competition were:

Students Category:

- i. **First Prize (Cash award of ₹2,000):** Ms. Pranjali Singh & Mr. Sudhanshu Kumar Kanaujia. (Both contestant got equal marks)
- ii. **Second Prize (Cash award of ₹1,500):** Mr. Pankaj Kumar
- iii. **Third Prize (Cash award of ₹1,000):** Ms. Yashashwani Gupta

Employees Categories:

- i. **First Prize (Cash award of ₹2,000):** Ms. Sunayna Kashyap
- ii. **Second Prize (Cash award of ₹1,500):** Mr. Sauvagya Mahapatra
- iii. **Third Prize (Cash award of ₹1,000):** Mrs. Elina Das
- c. **Short - Speech programme:** This programme was conducted on HINDI - DIWAS in two categories viz. Hindi Speaking Group and Non-Hindi Speaking Group. The topic of the speech for both the categories was

"Importance of Literacy in Democracy". The winners of this event were:

Hindi Speaking Category:

- i. **First Prize (Cash award of ₹2,000):** Ms. Priya Sahu
- ii. **Second Prize (Cash award of ₹1,500):** Dr. Sourabh Chawla
- iii. **Third Prize (Cash award of ₹1,000):** Mr. Sriman Keshari

Non-Hindi Speaking Category:

- i. **First Prize (Cash award of ₹2,000):** Mr. Radha Madhab Paathi
- ii. **Second Prize (Cash award of ₹1,500):** Mr. Rahul Raj Mishra
- iii. **Third Prize (Cash award of ₹1,000):** Mr. Ramakant Kar

6. Hindi Diwas Celebration:

- a) Hindi Diwas was celebrated in the Institute on September 14, 2019. Honorable Director has distributed the prizes to the winners of different events conducted during the Hindi Pakhwada which was observed from September 1st to 15th in the Institute. The Chief Guest of this year's Hindi Diwas Programme was Prof. Saudamini Mishra, Principal, Hindi Teachers Training Institute, Cuttack.
- b) **Kavi Sammelan Programme:** On the occasion of "Hindi Diwas" a Kavi Sammelan was organized in the Institute. There were six locally famous Kavis viz. Shri Ravindra Nath Chaand, Shri R. K. Sharma, Shri Kishan Khandelwal, Smt. Rinku Taunk, Shri Narayan Dash were invited for poetry. The programme was conducted in the Community Hall of the Institute on the evening of Hindi Diwas i.e. September 14, 2019. The programme was enjoyed by all the campus community,



students and employees. Few glimpses of the Hindi Diwas Programme and Kavi Sammelan are depicted below:





NATIONAL ENTRANCE SCREENING TEST (NEST)

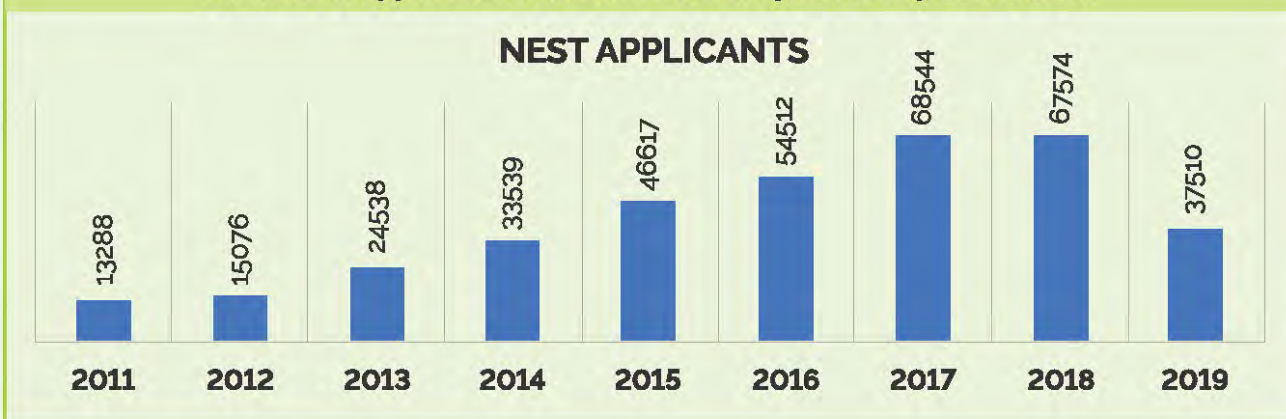
Intake to the Flagship Program – NEST

National Entrance Screening Test (NEST), the nation-wide test that NISER conducts to select the most deserving candidates for admission into its flagship programme, has been extremely popular and effective. NEST is conducted for admission to National Institute of Science Education and Research (NISER), Bhubaneswar and University of Mumbai - Department of Atomic Energy Centre for Excellence in Basic Sciences (UM-DAE CBS), Mumbai. National Entrance Screening Test 2019, was conducted on June 01, 2019 (Saturday) at various centers in 91 cities/towns across the country for admissions into Integrated M. Sc programs of NISER, Bhubaneswar and UM-DAE CEBS, Mumbai, for admissions into Integrated M. Sc programs of

NISER, Bhubaneswar and UM-DAE CEBS, Mumbai. A total of 37,510 applications were received for NEST 2019 examination. Out of which, nearly 17,000 applications were from Odisha and Kerala put together alone.

NEST 2019 examination was conducted in two sessions on the same day, with two different sets of question papers of equal/comparable difficulty level. Examination was conducted in 91 major cities/towns across the country. The result for NEST 2019 was published on the website on June 17, 2019 [Third Monday of June]. Proposed student intake at NISER, Bhubaneswar for was: 200+2 (J&K) for the session 2019-24. Total 200 candidates were admitted into various streams of integrated M. Sc program of NISER for the Academic Session 2019-24.

Number of applications received over the years is depicted below.



Brief summary of the gender and category wise applicants is as follows:

Gender	GEN	OBC	SC	ST	Supernumerary	PD	Total
Male	10,701	6,235	2,116	711	15	120	19,778
Female	9,838	5,673	1,556	638	27	41	17,732
Total							37,510



The state wise distribution of the applications received is shown in the following table.

State of Domicile	Number	Percentage	State of Domicile	Number	Percentage
Odisha	11562	30.824	Punjab	286	0.762
Kerala	5391	14.372	Gujarat	207	0.552
Uttar Pradesh	3186	8.494	Jammu & Kashmir	191	0.509
West Bengal	2750	7.331	Assam	169	0.451
Maharashtra	1694	4.516	Tripura	128	0.341
Bihar	1658	4.42	Chandigarh	69	0.184
Rajasthan	1634	4.356	Puducherry	50	0.133
Telangana	1180	3.146	Meghalaya	37	0.099
Andhra Pradesh	1088	2.901	Manipur	35	0.093
Tamil Nadu	1014	2.703	Arunachal Pradesh	21	0.056
Madhya Pradesh	821	2.189	Andaman & Nicobar	10	0.027
Delhi	775	2.066	Goa	9	0.024
Jharkhand	743	1.981	Dadra & Nagar Haveli	4	0.011
Haryana	741	1.975	Sikkim	3	0.008
Chhattisgarh	690	1.84	Daman & Diu	2	0.005
Himachal Pradesh	586	1.562	Lakshadweep	1	0.003
Karnataka	420	1.12	Nagaland	1	0.003
Uttarakhand	354	0.944	TOTAL	37,510	100%

The admissions to the Ph. D programmes were conducted through an even more rigorous process that included short-listing of eligible applicants followed by in-house written tests and interviews. The selection process for the Ph. D programmes in various schools were completed in the month of July 2019 and January 2020. Close to one thousand seven hundred applications were received for the Ph. D programme this time and the school wise break up of Ph. D and Integrated Ph. D is as follows:

2019- July Session (23.07.2019)			
Sl. School No.	Number of Applications Received	Number of Candidates Shortlisted for Interview	Number of candidates admitted
1. School of Physical Sciences	470	274	07
2. School of Biological Sciences	511	320	12
3. School of Chemical Sciences	238	209	07
4. School of Mathematical Sciences	157	90	06
5. School of Humanities and Social Sciences	77	73	02
6. School of Computer Sciences	51	26	04
7. Integrated M.Sc – PhD in School of Physical Sciences	131	89	08
2020- January Session (02.01.2020)			
1. School of Physical Sciences	111	68	04
2. School of Biological Sciences	217	189	07
3. School of Chemical Sciences	51	51	04
4. School of Mathematical Sciences	0	0	0
5. School of Humanities and Social Sciences	34	27	02
6. School of Computer Sciences	26	11	02
7. Integrated M.Sc – PhD in School of Physical Sciences	0	0	0



STUDENTS ACTIVITIES

Students

Our students have always been our most prized possessions. Since NISER's inception, we have been trying to create, nurture and sustain an academic environment which can be compared with the best nationally and internationally.

Many of our students have bagged fellowships and awards from various quarters. One of them is worth a mention here. Dr. Sougata Mallick's thesis work has been selected for the "Outstanding Student Award" in Physics by HBNI with a thesis title "Static and Dynamic Magnetization in Magnetic Antidot Lattice Arrays". He is currently a postdoc at University of Paris-Saclay, France.

Placement

It is a matter of immense pride that the Integrated MSc students that are graduating have bagged offers for Ph.D. positions from various universities in India and abroad. In India, they have secured positions at TIFR-Mumbai, TIFR-Hyderabad, IISc-Bangalore, HRI-Allahabad, IUCAA-Pune, etc. Some of the students are also waiting for the selection process at the BARC training school. From abroad, students have received offers from various Universities including many Universities under top 50 global rankings in respective subjects. Some of them are Universities of Yale, Princeton, Chicago, Rutgers, Sunny Buffalo, Purdue, Illinois, Texas, IST-Austria, Max Planck, Florida, Gottingen, Pennsylvania, Wisconsin Madison, Arizona State, LMU-Germany, Pittsburgh, Max Planck-Florida, Stowers Institute for Medical Research, Utah, Alabama, New Mexico, Florida, Kansas, Rochester, Stony Brook, etc.

Some of them have also bagged offers for MS programmes from several top rated universities

like: Paris- Saclay, Univ of Bonn, Cologne and Utrecht. It is also a pleasure to note that some of our graduating students have chosen alternate careers and are joining the MBA programmes at IIMs and IITs.

Many of them have performed exceedingly well and bagged the CSIR and UGC Fellowships for pursuing Doctoral programmes in various universities in India. Similarly, the graduating PhD students have secured post-doctoral fellowships from esteemed places like IISc Bangalore, Max Plank Institute, etc.

Zaariya: the Social Initiative of NISER students

Like every year, Zaariya was proactive throughout the year and involved the NISERites as well as social activists, in and around, in various tasks and events.

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2019

**EARTH DAY LITERARY AND
AWARENESS EVENT**
"FROM EARTH WITH LOVE"



In order to encourage the global awareness and action to protect our environment we team Zaariya organised an open multilingual literary and awareness event "From Earth, With Love" where everyone got a chance to become the voice of our planet earth and compose a letter addressing to humans, what as a part of planet earth they feel and would like to say. And it was great to witness all the writings in various languages, various institutes from all over the nation.





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BLOOD DONATION CAMP



A blood donation camp was successfully organised by Zaariya in association with Sahaya at Students Activity Centre(SAC) in NISER on Tuesday, September 10, 2019. The blood donation drive was organised in collaboration with Capital Hospital, one of the oldest government hospital in Bhubaneswar.

In this event, total 100 people participated in donating blood for a noble cause. Each person donated 1 unit of blood and a total of 100 units of blood was collected.



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WORLD CANCER DAY

2020



Zaariya invited all the members of NISER fraternity to join this awareness programme.

The primary goal of World Cancer Day is to significantly reduce illness and death caused by cancer and is an opportunity to rally the international community to end the injustice of preventable suffering from cancer.

Being in a research institute, Zaariya took pride in organizing an awareness campaign inside the campus.



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BICYCLE TO PRIYANKA PANIGRAHI

2019

A second hand bicycle was provided to Priyanka Panigrahi by Zaariya. Mitu Panigrahi, who is currently working in Mahanadi canteen, SOH1, as a food server is in needed a cycle for his daughter to minimize the difficulties she faced during travelling to college everyday. His daughter is studying in Sant Ganinath Government College and now she happily goes to college without any obstacle.



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SWACHHTA PAKHWADA

2020



Instruction of the DAE to conduct a Swachata Pakhwada (confirm the spelling please) Week in all the institutes brought the NISER authorities into action. And Zaariya actively participated in both the event planning and organizing steps. Zaariya organized 2 events during this week, namely, The Cleanest Hostel competition and The Water Leakage Survey.

Cleanest Hostel competition

Giving the cleaning process the tag of an inter-hostel competition, Zaariya brought many dormant students into action and many people participated in cleaning their hostels and their surrounding very actively. The judgement was done by a panel consisting of various NISER authorities who visited all the hostels during this week and as a result DOH-1 was the winner

Water Leakage Survey

Witnessing the leakage from various taps and pipes across the campus, the Zaariya volunteers came up with this idea of conducting a survey. We noticed some sites where there was leakage and many were instantly repaired taking the help of the mechanic whose contact we had.

Also members of Zaariya along with the Arts club helped to organize the best out of waste craft competition.



Inter-IISER Sports Meet

The 8th Inter-IISER NISER Sports Meet (IISM) 2019 was hosted by IISER, PUNE with six days of intense competition among the ten participating institutions.

Achievement of NISER students in the event is as follows:

1. NISER contingent won bronze medal in the March-past.
2. NISER won bronze medal in Chess (Team Event).
3. NISER won silver medal in Carrom (Team Event).
4. Mr. Dipanshu Kumar won silver medal in discus throw.
5. Mr. Aranya Giri won silver medal in shotput throw.
6. Mr. Mubasir won bronze medal in 200m.
7. Ms. Kiran Meena won bronze medal in discus throw girls.





Science Activities Club: The SAC is actively engaged in conducting various types of sessions for the science enthusiasts. Seminars, Skype sessions (Webinar) with experts from various fields of science and observation sessions are some of the activities of the Science Activities Club. They have had various Astronomy sessions, telescope handling sessions and LIGO webinars.

SPICMACAY NISER chapter hosted various events during the past academic year- a performance by Hindustani Vocal Maestro Pt. Jayateerth Mevundi accompanied by Shri Kulamini Sahoo on Tabla, who is also among the top artists in India and has performed along with legendary artists such as Pt. Hariprasad Chaurasia, Pt. Bhajan Sopori, and Pt. Kelucharan Mohapatra. Few more events of SpicMacay were in the pipeline in coming months.



NISER Students Gymkhana organised UMANG-2019, an intra NISER cultural and sports fest during 18th to 20th Oct 2019. Various events have been organised like Art Competition, Dance Competition, Open Mic, Singing Competition, Yoga etc.





ANNUAL REPORT 2019 - 2020
& Audited Statement of Accounts





OUTSTANDING PERFORMERS AWARD

Our Administrative and Technical staff play an invaluable role in ensuring the smooth functioning of all Institute activities. This year (2020) on Republic Day the Institute acknowledged the contributions made by them and felicitated several members of the NISER family for their devotion to duty. The Institute has also decided to make the excellence awards an annual component of our Republic Day celebrations.



Sh. Pramod Kumar Nath, Scientific Assistant-D



Dr. Santosh Babu Gunda, Scientific Officer-E



Sh. Amarendra Kumar Behera, Upper Division Clerk



Ms. Sandeepa Sahoo, Upper Division Clerk



Ms. Suchismita Dash, Technician-F

Audited Statement of Accounts & Statutory Auditor's Report for the Financial Year 2019 - 2020



**National Institute of Science Education and Research
Bhubaneswar**

Auditor

J PRADHAN & CO.

CHARTERED ACCCOUNTANTS

L3/69, Acharya Vihar, Bhubaneswar-751013, Odisha
Tel.: 0674-2542418, Email: jmpbbsr@yahoo.com



J PRADHAN & CO.
Chartered Accountants



L3/69, Acharya Vihar, Bhubaneswar-751013
Tel.: 0674-2542418
Email: jmpbbsr@yahoo.com

INDEPENDENT AUDITORS' REPORT

TO,

THE MEMBERS

**National Institute of Science Education and Research,
P.O: Jatni, Dist: Khurda, Odisha
PIN-752050**

We have audited the accompanying financial statements of National Institute of Science Education and Research ('The Institute'), which comprise the Balance Sheet as at 31 March 2020, the Income and Expenditure account and the Receipt & Payment account for the year ended, and a summary of significant accounting policies and other explanatory information.

Management's Responsibility for the Standalone Financial Statements

The management is responsible for the preparation of these financial statements that give a true and fair view of the financial position, financial performance of the Institute in accordance with the accounting principles generally accepted in India. This responsibility also includes maintenance of adequate accounting records for safeguarding the assets of the Institute and for preventing and detecting frauds and other irregularities; selection and application of appropriate accounting policies; making judgments and estimates that are reasonable and prudent; and design, implementation and maintenance of adequate internal financial controls, that were operating effectively for ensuring the accuracy and completeness of the accounting records, relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We have taken into account the accounting and auditing standards generally accepted in India.

We conducted our audit in accordance with the Standards on Auditing issued by the Institute of Chartered Accountants of India. Those Standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and the disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal financial control relevant to the Institute's preparation of the financial statements that give a true and fair view in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on



whether the Institute has in place an adequate internal financial controls system over financial reporting and the operating effectiveness of such controls. An audit also includes evaluating the appropriateness of the accounting policies used and the reasonableness of the accounting estimates made by the Institute as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion on the standalone financial statements.

Opinion

In our opinion and to the best of our information and according to the explanations given to us, the aforesaid financial statements give the information required by the Act in the manner so required and give a true and fair view in conformity with the accounting principles generally accepted in India,

Further to our observations annexed hereto, we report as follows:

1. We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for the purpose of our audit.
2. In our opinion proper books of accounts have been kept by the Institute so far as appears from our examination of those books.
3. The Balance Sheet and the Income and Expenditure Account dealt with by this report are in agreement with the books of accounts maintained by the Institute.
4. In our opinion and to the best of our information and according to explanations given to us the said accounts give a true and fair view:
 - (i) In the case of the Balance Sheet, of the state of affairs of the Institute as at 31st March, 2020.

AND

- (ii) In the case of Income and Expenditure Account of the excess of Expenditure over income for the year ended on that date.

Place: Bhubaneswar
Date: 08.09.2020



For J Pradhan & Co.
Chartered Accountants
FRN- 326206E

Amiya Kumar Pradhan (FCA)
Partner
M. No. 054626
UDIN- 20054626AAAAAP9088



ANNUAL REPORT 2019 - 2020
& Audited Statement of Accounts



NATIONAL INSTITUTE OF SCIENCE EDUCATION AND RESEARCH (NISER)

ANNUAL ACCOUNTS

2019-20

BALANCE SHEET AS AT 31ST MARCH, 2020

Amount in Rs.

Particulars	Schedule	As at 31st March, 2020	As at 31st March, 2019
<u>CORPUS/CAPITAL FUND AND LIABILITIES</u>			
Corpus / Capital Fund	1	7,84,19,27,484	8,09,54,38,796
Reserves & Surplus	2	-	-
Earmarked / Endowment Fund	3	-	-
Secured Loans & Borrowings	4	-	-
Unsecured Loans & Borrowings	5	-	-
Deferred Credit Liabilities	6	-	-
Current Liabilities & Provision	7	12,62,82,434	15,11,51,404
TOTAL		7,96,82,09,918	8,24,65,90,200
<u>ASSETS</u>			
Fixed Assets	8	7,03,96,00,288	7,00,64,55,528
Investments of Earmarked / Endowment Funds	9	-	-
Investments (Others)	10	34,92,12,030	20,21,24,908
Current Assets, Loans & Advances etc.	11	57,93,97,600	1,03,80,09,764
Miscellaneous Expenditure (to the extent not written off or adjusted)		-	-
TOTAL		7,96,82,09,918	8,24,65,90,200
Significant Accounting Policies	24		
Contingent liabilities & Notes on Accounts	25		

As per our report of even date attached

For J Pradhan & CO.
Chartered Accountants
FRN - 326206E

(Amiya Kumar Pradhan, FCA)

Partner

M. No. 054626

Administrative Officer-I

Finance

Officer on Special Duty

Finance

Director

Place: Bhubaneswar

Date: 08.09.2020

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2020

Amount in Rs.			
Particulars	Schedule	For the Year Ended 31st March, 2020	For the Year Ended 31st March, 2019
INCOME			
Income from Sales/ Services	12	-	-
Grant / Subsidies	13	1,10,20,00,000	88,00,00,000
Fees / Subscriptions	14	2,16,02,073	1,78,17,402
Income from Investment	15	-	-
Income from Royalty, Publication etc.	16	-	-
Interest Earned	17	3,88,16,917	2,89,92,280
Other Income	18	-	-
Increase/(Decrease) in stock of Finished Goods & Work-In-Progress	19	-	-
TOTAL(A)		1,16,24,18,990	92,68,09,682
EXPENDITURE			
Establishment Expenses	20	62,47,63,677	52,41,89,547
Other Administrative Expenses etc.	21	25,23,67,848	25,13,58,244
Expenditure on Grants, Subsidies etc.	22	-	-
Interest	23	-	-
Depreciation (Net total at the year-end corresponding to Schedule 8)		69,37,98,776	60,23,09,428
TOTAL(B)		1,57,09,30,302	1,37,78,57,218
Balance being Excess of Income over Expenditure (A-B)		(40,85,11,312)	(45,10,47,536)
Add/Less: Prior Period Expenditure (Adjustment)		17,61,97,309	1,02,540
TO CORPUS / CAPITAL FUND		(58,47,08,621)	(45,11,50,076)
Significant Accounting Policies	24		
Contingent liabilities & Notes on Accounts	25		

As per our report of even date attached

For J Pradhan & CO.
Chartered Accountants
FRN - 326206E

(Amiya Kumar Pradhan, FCA)

Partner
M. No. 054626



Administrative Officer-I
Finance

[Signature]
Officer on Special Duty
Finance

[Signature]
08/09/2020
Director

Place: Bhubaneswar
Date: 08.09.2020



ANNUAL REPORT 2019 - 2020 & Audited Statement of Accounts



NATIONAL INSTITUTE OF SCIENCE EDUCATION AND RESEARCH (NISER) ANNUAL ACCOUNTS

2019-20

RECEIPTS AND PAYMENTS ACCOUNT FOR THE PERIOD FROM 1ST APRIL, 2019 TO 31ST MARCH, 2020

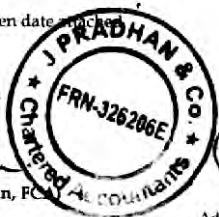
Amount in Rs.

RECEIPTS	For the Year Ended 31st March, 2020	For the Year Ended 31st March, 2019	PAYMENTS	For the Year Ended 31st March, 2020	For the Year Ended 31st March, 2019
I. Opening Balances			I. Expenses		
a) Cash In Hand	-	-	a) Establishment Expenses (corresponding to Schedule 20)		
b) Bank Balances:			i) Pay & Allowances	44,00,06,504	36,07,16,095
i) In Current Accounts	55,22,95,009	90,02,80,727	b) Administrative Expenses (corresponding to Schedule 21)		
ii) In Savings Accounts	26,51,71,326	34,62,16,500	i) Duties & Taxes	-	-
II. Grants Received			ii) Other Administrative Expenditure	31,04,72,711	27,69,64,057
a) From Government of India	1,25,20,00,000	88,00,00,000	iii) Prior Period Expenses	-	96,000
b) From State Government	-	-	iv) NISER XII Plan	3,56,26,925	4,90,47,404
III. Income on Investments	-	-	II. Payments made against funds for various projects		
IV. Interest Received			III. Investments and Deposits made		
a) On Bank Deposits (SBI & IOB)	6,78,09,197	5,14,84,306	IV. Expenditure on Fixed Assets & Capital Work- In- Progress		
V. Other Income			a) Purchase of Fixed Assets	72,63,56,348	45,65,10,940
a) Registration Fee (MSc & PhD)	10,72,296	10,32,545	b) Expenditure on Capital WIP	-	-
b) Job Application Fee	51,500	1,26,500	V. Refund of Surplus Money/Loans	-	-
c) Summer Course Fee	1,22,000	1,44,500	VI. Finance Charges (Interest)	2,89,92,280	2,25,38,958
d) RTI Application Fees	120	336	VII. Other Payments		
e) Sale of Tender Paper	1,74,316	2,84,120	a) Samrt City Fund	-	7,350
f) Guest House Rent	17,06,058	12,21,805	b) NISER R&D	68,00,812	66,734
g) License Fees (Rent of Quarter/ Bank Branch)	17,34,808	15,47,067	c) IOAA - 2016	-	98,962
h) Fine	40,100	-	d) Deposit Asset (LC)	53,49,52,913	35,30,63,288
i) Transcript Fees	13,700	31,300	e) Deans Allowance Receivable	12,000	66,000
j) Identity Card/ Health Card (Duplicate) Fee	8,425	3,125	f) Security Deposit (Refundable)	18,29,229	14,29,497
k) Rent	2,88,708	5,09,452	g) Alumni Association Subscription	-	12,599
l) Water Charges	2,43,689	94,516	h) Duties & Taxes	6,46,46,800	5,35,81,175
m) Sale of News Paper	20,380	-	i) EMD	5,72,218	7,10,284
n) Liquidated Damage	26,82,557	-	j) Scholarship Payable	20,64,580	-
o) EMD/SD (Forfeited)	1,28,828	-	k) Statutory Recoveries	2,60,28,521	2,33,20,758
p) Sample Testing Charges	30,800	-	l) Student Dues	11,88,448	25,09,425
VI. Amount Borrowed	-	-	m) Registration Fee (MSc & PhD)	23,95,064	-
VII. Any other receipts (Loans, Advances & Expenses Recovered)			n) Loans & Advance (Asset)	2,04,56,020	1,36,78,848
a) Security Deposit (Refundable)	59,29,770	25,85,545	o) Liabilities for Expenses	11,18,00,009	9,26,94,204
b) E.M.D	8,93,135	24,82,078	p) Scholarship Receivable	-	40,58,210
c) Fixed Assets	44,49,596	31,054	q) Guest House Rent	9,600	-
d) Duties & Taxes	6,58,79,021	5,47,41,067	r) Hindi Sangoshthi	-	1,50,000
e) CSIR FUND	-	27,398	VIII. Closing Balances		
f) Statutory Recoveries	2,84,34,448	2,35,53,832	a) Cash In Hand	-	-
g) Student Dues	1,94,32,100	1,63,62,811	b) Bank Balances:		
h) Deposit Asset (LC)	38,78,65,791	21,87,65,698	i) In Current Accounts	20,98,18,718	55,22,95,009
i) Loans & Advance (Asset)	2,12,40,248	1,49,67,183	ii) In Savings Accounts	16,55,45,096	26,51,71,326
j) Scholarship Receivable	65,52,778	72,37,807			
k) Vigyan Pratibha-DAE Project	-	50,00,000			
l) NISER R&D Receivable	28,62,330	55,851			
m) Liabilities for Expenses	2,73,761	-			
n) Dean Allowances Receivables	1,68,000	-			
TOTAL	2,68,95,74,795	2,52,87,87,123	TOTAL	2,68,95,74,795	2,52,87,87,123

As per our report of even date attached

For J Pradhan & CO.
Chartered Accountants
FRN - 326206E

(Anuja Kumar Pradhan, FCA)
Partner
M. No. 054626



Administrative Officer-I
Finance

Officer on Special Duty
Finance

Director

Place: Bhubaneswar
Date: 08.09.2020

ANNUAL REPORT 2019 - 2020 & Audited Statement of Accounts



Schedule -1 : Corpus / Capital Fund

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)		Previous Year (2018-19)	
Balance as at the beginning of the year	8,21,07,00,000		8,21,07,00,000	
Add: Contribution towards Corpus/Capital Fund	5,00,00,000		-	
Add: XII Plan New Project	1,43,33,46,000		1,32,83,46,000	
a) Advance Materials for Different applications Grant	14,30,00,000		14,30,00,000	
b) Basic Research in Cellular & Modular Grant	15,76,00,000		14,76,00,000	
c) Centre for Fundamental Studies Grant	3,72,96,000		3,72,96,000	
d) Centre for Inter Disciplinary Sciences Grant	32,63,00,000		28,63,00,000	
e) Experimental Condensed Matter Ultra Cold Atom Grant	30,05,00,000		28,05,00,000	
f) Experimental High Energy Physics Programme Grant	4,30,00,000		3,42,00,000	
g) Microbes Immunity & Research Biology Grant	15,19,00,000		14,19,00,000	
h) Novel Organic Compounds for Biomedical Grant	14,52,00,000		14,52,00,000	
i) Outreach Programmes in Maths & Systems Biology Grant	34,50,000		34,50,000	
j) Research in Basic Sciences Grant	6,12,00,000		5,00,00,000	
k) Theoretical High Energy & Condensed Matter Grant	5,89,00,000		5,89,00,000	
l) Vigyan Pratibha Grant	50,00,000		-	
Less: Grant Transferred to Revenue	-		17,61,97,309	
		9,69,40,46,000		9,36,28,48,691
Add/(Deduct): Balance of net Income/ (Expenditure) transferred from the Income & Expenditure Account		(1,85,21,18,516)		(1,26,74,09,895)
TOTAL		7,84,19,27,484		8,09,54,38,796

Schedule -2 : Reserves & Surplus

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)		Previous Year (2018-19)	
1. Capital Reserve:				
As per last Account	-		-	
Addition during the year	-		-	
Less: Deduction during the year	-	-	-	-
2. Revaluation Reserve				
As per last Account	-		-	
Addition during the year	-		-	
Less: Deduction during the year	-	-	-	-
3. Special Reserve				
As per last Account	-		-	
Addition during the year	-		-	
Less: Deduction during the year	-	-	-	-
4. General Reserve				
As per last Account	-		-	
Addition during the year	-		-	
Less: Deduction during the year	-	-	-	-
TOTAL		-		-

For J Pradhan & CO.

Chartered Accountants

FRN - 326206E

(Amiya Kumar Pradhan, FCA)

Partner

M. No. 054626



Administrative Officer-I

Finance

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Officer on Special Duty

Finance

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08/09/2020

Director

NATIONAL INSTITUTE OF SCIENCE EDUCATION AND RESEARCH (NISER)
ANNUAL ACCOUNTS

2019-20

Schedule -3 : Earmarked/Endowment Fund

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Particulars	Fund-wise break up				Totals	
	Fund WW	Fund XX	Fund YY	Fund ZZ	Current Year(2019-20)	Previous Year(2018-19)
a) Opening balance of the funds :	-	-	-	-	-	-
b) Additions to the funds :						
i. Donations/Grants	-	-	-	-	-	-
ii. Income from Investments made on account of funds	-	-	-	-	-	-
iii. Other Additions	-	-	-	-	-	-
TOTAL (a + b)	-	-	-	-	-	-
c) <u>Utilisation/Expenditure towards objectives of funds :</u>						
i. Capital Expenditure :						
- Fixed Assets	-	-	-	-	-	-
- Others	-	-	-	-	-	-
Total	-	-	-	-	-	-
ii. Revenue Expenditure :						
- Salaries, Wages and Allowances	-	-	-	-	-	-
- Rent	-	-	-	-	-	-
- Other Administrative Expenses	-	-	-	-	-	-
Total	-	-	-	-	-	-
TOTAL (c)	-	-	-	-	-	-
Net Balance at the year end (a+b-c)	-	-	-	-	-	-

For J Pradhan & Co.

Chartered Accountants

FRN - 326206E



(Signature)
Amiya Kumar Pradhan, FCA
Partner

M. No. 054626

Administrative Officer-I

Finance

(Signature)
Officer on Special Duty

Finance

(Signature)
08/09/2020

Director



NATIONAL INSTITUTE OF SCIENCE EDUCATION AND RESERCH (NISER)
ANNUAL ACCOUNTS

2019-20

Schedule -4 : Secured Loans and Borrowings

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)		Previous Year (2018-19)	
1. Central Government		-		-
2. State Government (Specify)		-		-
3. Financial Institutions				
a) Term Loans	-		-	
b) Interest accrued and due	-	-	-	-
4. Banks:				
a) Term Loans	-		-	
Interest accrued and due	-		-	
b) Other Loans (specify)	-		-	
Interest accrued and due	-	-	-	-
5. Other Institutions and Agencies		-		-
6. Debenture and Bonds		-		-
7. Others (specify)		-		-
TOTAL		-		-

For J Pradhan & CO.

Chartered Accountants

FRN - 326206E

(Amiya Kumar Pradhan, FCA)

Partner

M. No. 054626



Administrative Officer-I
Finance

Officer on Special Duty
Finance

Director



NATIONAL INSTITUTE OF SCIENCE EDUCATION AND RESEARCH (NISER)

ANNUAL ACCOUNTS

2019-20

Schedule -5 : Unsecured Loans and Borrowings

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)		Previous Year (2018-19)	
1. Central Government		-		-
2. State Government (specify)		-		-
3. Financial Institutions		-		-
4. Banks:				
a) Term Loans	-	-	-	-
b) Other Loans (specify)	-	-	-	-
5. Other Institutions and Agencies		-		-
6. Debenture and Bonds		-		-
7. Fixed Deposits		-		-
8. Others (specify)		-		-
TOTAL		-		-

Schedule -6 : Deferred Credit Liabilities

(Schedule forming part of Balance Sheet as at 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)		Previous Year (2018-19)	
1) Acceptances secured by hypothecation of capital equipment & other assets		-		-
2) Others		-		-
TOTAL		-		-

For J Pradhan & CO.

Chartered Accountants

FRN - 326206E

(Amiya Kumar Pradhan, FCA)

Partner

M. No. 054626



Administrative Officer-I
Finance

Officer on Special Duty
Finance

08/09/2020
Director



ANNUAL REPORT 2019 - 2020 & Audited Statement of Accounts



Schedule -7 : Current Liabilities & Provisions

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

S.No.	Particulars	Current Year (2019-20)		Previous Year (2018-19)	
A.	CURRENT LIABILITIES				
1.	Acceptances		-		-
2.	Sundry Creditors:				
a)	For Goods	-		2,87,653	
b)	Others - EMD	80,31,747		77,30,734	
			80,31,747		80,18,387
3.	Advances Received		-		-
4.	Interest accrued but not due :				
a)	Secured Loans/Borrowings		-		-
b)	Unsecured Loans/Borrowings		-		-
5.	Statutory Liabilities				
a)	Overdue		-		-
b)	Others				
	i) TDS (Non Salary)	11,08,347		5,30,220	
	ii) TDS (CGST)	2,00,464		2,51,855	
	iii) TDS (SGST)	2,00,464		2,51,855	
	iv) TDS (IGST)	10,10,760		2,00,462	
	v) TDS (Salary)	(11,742)		15,258	
			25,08,292		12,49,650
6.	Other Current Liabilities :				
a)	Student Dues				
	Internal Amenities S.D.	1,89,000		1,84,000	
	Excess Prog. Regd. Fees	31,368		11,517	
	Caution Money (Labortary)	13,000		13,000	
	Caution Money (Library)	20,62,000		16,68,000	
	Caution Money (Institute)	36,07,250		28,63,250	
	Caution Money (Hostel)	1,35,600		94,000	
	CSIR Contingency	1,70,690		-	
	Smart City Fund	2,974		2,974	
	Odisha State Fund	43,805		43,805	
	Alumuni Association Subscription	65,800		82,001	
	Vigyan Pratibha (DAE Project)	-		50,00,000	
	Programme Registration	-		2,77,050	
	Student Welfare Fund	3,15,240		2,49,440	
	Kotak Mahindra Scholarship Payable	98,950		-	
	IOAA -2016	-		63,18,849	
	DBT Scholarship(PhD)	26,210		-	
	Inspire Scholarship(PhD)	19,02,617		-	
			86,64,504		1,68,07,886
b)	Security Deposit				
	Thames Consultant Pvt. Ltd.	22,722		22,722	
	Airway Bhubaneswar	28,000		28,000	
	Ashok Kumar Nayak	5,000		5,000	
	Amarendra Ojha	1,85,384		2,66,354	
	4S Interiors	26,50,577		25,39,832	
	Bigyan Kumar Pradhan	2,60,700		1,54,044	
	Bijay Kumar Behera	2,44,522		2,29,074	
	Bhagarathi Sahoo	22,638		1,27,745	
	B K Giri	18,133		18,133	
	Indo Electricals	16,666		16,666	
	Firestep Sales and Services	31,968		2,748	
	Biswajeet Kandi	59,665		35,879	
	Deepak Kumar Mishra	39,028		27,496	





ANNUAL REPORT 2019 - 2020 & Audited Statement of Accounts



Schedule -7 : Current Liabilities & Provisions

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

S.No.	Particulars	Current Year (2019-20)	Previous Year (2018-19)
	Geeken Seating Collection Pvt. Ltd.	55,36,542	55,36,542
	Biplab Kumar Parida	81,913	45,935
	HAK Electrical & Engineering Works	2,25,484	2,25,484
	H Electrical Engg. Works	16,439	16,439
	Jagannath Refrigeration Services	3,200	3,200
	Shri Rabindra Kumar Mallick	88,009	6,515
	Subhashree Engineering	4,890	4,890
	Pest Control India Pvt. Ltd.	360	360
	Biswajit Mishra	1,26,694	1,26,694
	Nirmal Chandra Sar	2,68,664	2,81,296
	Numeric Power Systems Ltd.	14,343	14,343
	Deepak Kumar Das	48,741	68,934
	Laser Science Services (I) Pvt Ltd	4,50,900	4,50,900
	Laxman Senapati	5,000	66,004
	Maa Dakhilachandi Catering Services	1,00,000	1,00,000
	Barnali Bera	-	80,886
	Bichitrnanda Samantaray	1,07,198	1,07,198
	Bikramajit Singh	5,000	5,000
	Chandan Electrical	10,000	10,000
	Debasis Pattanaik	94,772	2,08,580
	Ensure Support Services India Ltd	5,000	5,000
	Everest Computers	5,000	5,000
	IN2IT Technology Pvt. Ltd	5,000	5,000
	J N Sarma	1,00,000	1,00,000
	JOHNSON	6,34,285	1,30,504
	Kumar Electricals	5,000	5,000
	Manor Computers	5,000	5,000
	Maxim Systems	5,000	5,000
	Nablok Das	1,18,533	1,13,951
	Ray Electricals	2,30,084	1,36,987
	Santosh Kumar Paikaray	5,000	5,000
	SP Power System	13,975	13,975
	Suvidha Engineers Pvt. Ltd	1,88,590	1,15,644
	Vedica Resources	33,387	25,287
	Wizertech informatics Pvt. Ltd	5,000	5,000
	AS Associates	-	84,321
	Sai Aircon	28,009	9,509
	Sanjeeb Kumar Das	5,000	5,000
	Sridhar Routray	5,000	5,000
	Sritam Computers	6,01,453	3,66,997
	Sujit Kumar Nahak	44,579	44,579
	Indu Enterprises	19,783	19,783
	Mangaraj Hati	4,02,516	1,27,111
	Maratha engineerings and suppliers	25,716	19,641
	Namaha Shivaya Enterprise	21,230	2,00,260
	Rabindra Electricals	52,321	17,000
	Saraj Kumar Das	17,879	21,230
	Shree Maa Constructions	5,55,456	1,14,000
	Shreema Construction	60,039	60,039
	Sonatech Infosolutions pvt. Ltd.	89,614	32,822
	VL Access India Pvt. Ltd.	5,000	5,000
	Aurobindo Prasad Behera	25,200	-
	Bansidhar Hati	17,876	-
	Bhawani Air System	26,742	-
	Bibekananda Patra	1,15,100	-
	Electro Crafts	22,645	-
	Empire Hospitality	34,601	-
	Gupta Sports	23,098	-
	Chem Eco Engineers	16,670	-
	Utal Engineering	9,010	-
	Vijaypower Generators Ltd	9,66,885	-
	Janaki Engineering	41,474	-
	Lacminarayan Enterprises	3,210	-
	Lacminarayan Enterprises	8,486	-



PO.: Bhimpur - Padanpur, Jatani, Khurda - 752050, Odisha, India, Phone: 0674-2494008, Fax.: 0674-2494009,

Email: director@niser.ac.in, Web : www.niser.in

Schedule -7 : Current Liabilities & Provisions

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

S.No.	Particulars	Current Year (2019-20)		Previous Year (2018-19)	
	Manoranjana Pradhan	35,000		-	
	Mega Fitness Planet	2,33,156		-	
	Nandighosh Trading Agency	19,193		-	
	Nihar Ranjan Parida	1,57,078		-	
	Oberai Equipment	3,21,963		-	
	Odisha General Electronics	69,026		-	
	Oriental Security Services	1,29,881		-	
	Ratan J. Batliboi Consultancy Pvt. Ltd.	69,000		-	
	Sainath Fabric Care Pvt Ltd.	36,626		-	
	Sai Rasoi Sanstha	1,00,000		-	
	Security Deposit	3,670		-	
	Shree Mahalaxmi Traders	2,07,434		-	
	Shri Samaresh Chottaray	27,305		-	
	Tathagata Engineering	5,09,873		3,12,681	
			1,72,95,803		1,29,54,214
c)	Other Payables				
	CHSS	38,85,999		1,55,679	
	Flag-Day Recovery	-		3,000	
	NPS Recovery	1,01,196		1,60,939	
	Professional Tax	2,010		1,640	
			39,89,205		3,21,258
	Sub-total (A)		4,04,89,551		3,93,51,395





ANNUAL REPORT 2019 - 2020 & Audited Statement of Accounts



Schedule -7 : Current Liabilities & Provisions

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

S.No.	Particulars	Current Year (2019-20)		Previous Year (2018-19)	
B.	PROVISIONS				
	For Expenses Payable				
	Audit Fees	57,820		50,740	
	Fellowship	79,14,391		1,13,61,180	
	Hire Charges Vehicle	6,46,434		5,02,584	
	Stipend to Trainee Payable	81,000		81,000	
	Fuel Charges Payable	-		17,852	
	House Keeping Expenses Payable	26,800		25,000	
	Honorarium/Remuneration	2,96,000		2,89,836	
	Outsourced Manpower	51,24,587		48,95,068	
	Auditorium Complex (WIP) Payable	-		13,80,000	
	Medical Expenses	45,154		5,25,660	
	Electricity Charges Payable	48,80,815		34,16,017	
	Children Educational Allowance Payable	19,23,571		26,54,700	
	Contingency Expenditure Payable	-		4,23,123	
	Hospitality Expenses Payable	-		4,66,188	
	Meeting Expenses Payable	4,712		-	
	Newspaper & Magazine Expenses Payable	-		1,509	
	Printing & Stationary Expenses Payable	-		2,970	
	Postage & Telegram Payable	25,582		13,682	
	Leave Salary Contribution Payable	-		1,92,689	
	Purchase of Consumable Payable	-		33,04,075	
	Sports & Internal Activity Expenses Payable	-		5,400	
	Supplies & Materials Payable	-		19,95,382	
	Travelling & Conveyance Payable	-		7,13,752	
	Work-In-Progress Payable	24,88,325		41,97,654	
	Repair & Maintenance Expenses Payable	8,22,790		17,71,747	
	Professional update Allowance	-		48,29,792	
	Salary And Wages Pay and Allowances	2,73,59,729		2,43,94,778	
	Telephone & Internet	1,58,168		1,63,222	
	PRIS	2,09,87,161		1,79,06,273	
	Water Charges	-		8,400	
	NPS Employer Subscription	34,68,157		22,51,295	
	Books Payable	-		2,55,943	
	Computer Expenses Payable	-		4,12,289	
	Electrical Installation Payable	-		10,38,711	
	Furniture and Fixtures Payable	-		11,09,557	
	Horticulture and Plantation Exp. Payable	-		46,800	
	Insurance for Vehicle Payable	-		13,063	
	Lab Equipment Payable	-		64,44,603	
	Leave Encashment Payable	-		2,27,184	
	Beijing Quartz V. Glass Co. Ltd.	1,27,945		-	
	Icon Analytical Equipment Pvt. Ltd.	7,28,159		-	
	CRA Charges Payable	8,727		-	
	DSS Imagetech PBG Payable	24,99,840		-	
	Exim Logistics Pvt. Ltd. Payable	1,11,335		-	
	HDFC ECSS Scholarship Payable	25,000		-	
	Legal Expenses Payable	1,52,495		-	
	Professional Charges Payable	6,18,630		-	
	Machinery Equipment Payable	-		56,15,709	
	Office Automation Payable	-		9,34,052	
	Office Equipment Payable	-		32,76,544	
	Outsourced Security Payable	36,97,266		33,55,219	
	Scholarship Payable	15,12,290		8,80,000	
	Seminar, Workshop Payable	-		1,39,164	
	Transportation Charges Payable	-		21,881	
	IISER/NISER Expenses Payable	-		1,28,923	
	Payable to THDC Employer Share	-		58,799	
	Sub-total (B)		8,57,92,883		11,18,00,009
	Total (A+B)		12,62,82,434		15,11,51,404



ANNUAL REPORT 2019 - 2020 & Audited Statement of Accounts



2019-20

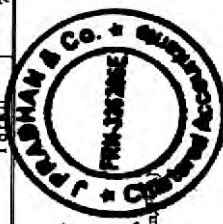
ANNUAL ACCOUNTS

Schedule - 8 : Fixed Assets
(Schedule forming part of the accounts for the period ended on 31.03.2020)

Sl. No.	Particular of Assets	Rate	WDV as on 01.04.2019	GROSS BLOCK		Deductions (Sale/Adjust) during the year	Cost / Valuation at the year-end	DEPRECIATION		NET BLOCK	
				Addition during the year				Depreciation for the year	Deductions during the year	As at the Current year-end on 31.03.2020	As at the Previous year-end on 31.03.2019
				> 180 days	< 180 days						
1	Land	0%	2,76,17,405	-	-	-	2,76,17,405	-	-	2,76,17,405	2,76,17,405
2	Building (Academic)	10%	2,25,18,45,313	-	1,95,37,284	-	2,27,13,82,607	22,61,61,396	-	2,04,52,21,211	2,25,18,45,313
3	Building (Residential)	5%	2,74,45,91,836	-	1,38,896	-	2,74,47,30,732	13,72,33,064	-	2,60,74,97,668	2,74,45,91,836
4	Electrical Installation	10%	18,72,59,861	-	1,40,53,961	-	20,13,13,822	1,94,28,684	-	18,18,85,138	18,72,59,861
5	Furniture & Fixtures	10%	27,67,02,202	33,53,001	1,22,11,647	-	29,22,45,850	2,86,16,003	-	26,36,49,847	27,67,02,202
6	Computers	40%	2,07,84,858	38,02,674	1,18,39,292	-	3,64,26,831	1,22,02,873	-	2,42,23,958	2,07,84,858
7	Software	40%	1,02,37,149	27,39,918	2,36,104	-	1,32,13,171	52,38,048	-	79,75,123	1,02,37,149
8	Lab Equipments	15%	56,94,90,957	15,27,64,013	16,93,85,301	47,14,098	88,69,26,373	12,10,42,158	-	76,58,84,215	56,94,90,957
9	Tools Equipments	15%	91,526	-	-	-	91,526	13,729	-	77,797	91,526
10	Books	40%	41,66,032	12,25,622	18,99,943	-	72,91,597	25,36,650	-	47,54,947	41,66,032
11	Journals	40%	4,90,68,288	7,78,19,756	33,76,679	-	13,02,64,723	5,14,30,553	-	7,88,34,170	4,90,68,288
12	Air Conditioners	15%	20,21,912	29,52,204	10,31,578	-	60,05,694	8,23,486	-	51,82,208	20,21,912
13	Vehicles	15%	2,94,156	-	-	-	2,94,156	44,123	-	2,50,033	2,94,156
14	Bicycle	15%	2,224	-	-	-	2,224	334	-	1,890	2,224
15	Machinery & Equipments	15%	9,58,24,955	60,27,309	97,68,29,978	2,19,739	1,07,84,62,503	8,85,40,088	-	98,99,22,415	9,58,24,955
16	EPABX	15%	6,959	-	-	-	6,959	1,044	-	5,915	6,959
17	Kitchen Equipments	15%	32,37,582	-	-	-	32,37,582	4,85,637	-	27,51,945	32,37,582
18	Telephones	10%	9,059	-	-	-	9,059	906	-	8,153	9,059
19	Capital Assets (WIP)	0%	13,80,000	5,32,59,926	5,31,75,910	7,39,52,586	3,38,56,250	-	-	3,38,56,250	13,80,000
20	NISER XII Plan Asset	0%	76,18,23,252.49	7,15,48,569.42	9,14,69,482.50	92,48,41,304.00	-	-	-	-	76,18,23,252.49
	TOTAL		7,00,64,55,528	37,54,84,993	1,35,51,86,272	1,00,37,27,726	7,73,33,99,066	69,37,98,776	-	7,03,96,00,288	7,00,64,55,528

For J Pradhan & Co.
Chartered Accountants
FRN - 326204E

(Amiya Kumar Pradhan)
Partner
M. No. 054626



[Signature]
Administrative Officer-1
Finance

[Signature]
Officer on Special Duty
Finance

[Signature]
Director

Schedule -9 : Investments - Earmarked / Endowment Funds

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)	Previous Year (2018-19)
1. In Government Securities	-	-
2. Other Approved Securities	-	-
3. Shares	-	-
4. Debentures & Bonds	-	-
5. Subsidiaries & Joint Ventures	-	-
6. Others (to be specified)	-	-
TOTAL	-	-

Schedule -10 : Investments - Others

(Schedule forming part of Balance Sheet as at 31.03.2020)

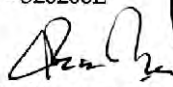
Amount in Rs.

Particulars	Current Year (2019-20)	Previous Year (2018-19)
1. In Government Securities	-	-
2. Other Approved Securities	-	-
3. Shares	-	-
4. Debentures & Bonds	-	-
5. Subsidiaries & Joint Ventures	-	-
6. FD against LC's	34,92,12,030	20,21,24,908
TOTAL	34,92,12,030	20,21,24,908

For J Pradhan & CO.

Chartered Accountants

FRN - 326206E

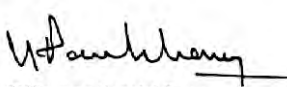

(Amiya Kumar Pradhan, FCA)

Partner

M. No. 054626




Administrative Officer-I
Finance


Officer on Special Duty
Finance


08/09/2020
Director



ANNUAL REPORT 2019 - 2020 & Audited Statement of Accounts



Schedule -11 : Current Assets, Loans, Advances etc.

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)		Previous Year (2018-19)	
A. CURRENT ASSETS:				
1. Inventories:				
a) Stores and Spares	-		-	
b) Loose Tools	-		-	
c) Stock-In-trade				
i) Finished Goods	-		-	
ii) Work-In-progress	-		-	
iii) Raw Materials	-	-	-	-
2. Sundry Debtors:				
a) Debts Outstanding for a period exceeding six months	-		-	
b) Others	-	-	-	-
3. Cash balances in hand	-	-	-	-
4. Bank Balances				
a) SBI A/C - 30755200010	14,31,58,307		55,11,51,982	
b) SBI A/C - 37871572767	96,54,574		11,43,027	
c) SBI A/C - 38629236942	5,70,05,837		25,32,97,129	
d) IOB A/C - 373701000000001	16,49,23,661		42,17,072	
e) IOB A/C - 373701000008888	-		76,57,125	81,74,66,335
f) IOB A/C -147601000015510	6,21,434			
Total (A)		37,53,63,814		81,74,66,335
B. LOANS, ADVANCES AND OTHER ASSETS:				
1. a) Staffs:				
i) Ashish Pandav	-		1,13,601	
ii) Bedangdas Mohanty	-		1,30,217	
iii) Atish Kumar Nayak, EX FO	1,06,000		-	
iv) Dukhishyam Mallick (Student)	97,953		3,03,660	
v) Biswajit Mishra	-		-	
vi) Debasish Mallick	1,14,993		1,45,674	
vii) Pradeep Kumar Mishra	-		17,404	
viii) Prasanjit Samal	-		2,00,000	
ix) Prolay Kumar Mal	1,80,000		-	
x) Vijay Singh	10,000		-	
xi) Pranaya Ku Swain	-		1,723	
xii) Debasmita P.A lone	50,000		30,000	
xiii) Kishore C S Panigrahi	87,100		3	
xiv) KVS Baidireenath	-		90,000	
xv) P.C. Ravikumar	3,11,309		-	
xvi) Chandan Goswami	-		1,35,000	
xvii) Sanjay Kumar Swain	-		3,12,930	
xviii) Saurav Kundu-SPS	-		6,43,230	
xix) Other Advances (Imprest)	2,16,058		66,697	
xx) Festival Advance to Staff	-		3,600	
xxi) Security Deposit	63,17,910		-	
		74,91,323		21,93,739





ANNUAL REPORT 2019 - 2020 & Audited Statement of Accounts



Schedule -11 : Current Assets, Loans, Advances etc.

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)		Previous Year (2018-19)	
b) Other Entities engaged in activities similar to that of others		-		-
c) Others				
i) NBHM Support DHA	-		1,67,174	
ii) Deans Allowance Receivable	85,200		2,41,200	
iii) Exim Logistics Pvt Ltd	-		19,00,000	
iv) M/s A One Hospitality & Catering	36,707		38,258	
v) Scholarship-UGC	-		28,22,247	
vi) Scholarship-INSPIRE	-		(3,46,191)	
vii) Scholarship- DBT	-		(26,210)	
viii) DCS & EM, Mumbai	19,00,03,993		19,00,03,993	
ix) Scholarship-CSIR	-		1,31,57,029	
x) Inspire Scholarship (MSC)	-		21,45,288	
xi) International Centre for Theoretical Science (ICTS)	3,00,000		-	
xii) IPG Photonics India Pvt. Ltd.-Bangalore	4,50,000		-	
xiii) DCS & M,VECC, Kolkata	-		6,87,029	
		19,08,75,900		21,07,89,817
2. Advances and other amounts recoverable in cash or in kind or for value to be received:				
a) on Capital Account	-	-	-	63,22,910
b) Prepayments	-	-	-	-
c) Others	-	-	-	-
d) DCSEM-Medical Expenses Receivable	12,17,090		12,17,090	
e) R&D Receivable	44,49,474		19,873	
		56,66,564		12,36,963
3. Income Accrued:				
a) On Investments from Earmarked/Endowment Fund	-	-	-	-
b) On Investment (Others)	-	-	-	-
c) On Loans and Advances	-	-	-	-
d) Others	-	-	-	-
4. Claims Receivables				
	-	-	-	-
Total (B)		20,40,33,787		22,05,43,429
TOTAL (A+B)		57,93,97,600		1,03,80,09,764

For J Pradhan & CO.

Chartered Accountants

FRN - 326206E

(Amiya Kumar Pradhan, FCA)

Partner

M. No. 054626

Administrative Officer-I

Finance

[Signature]

Officer on Special Duty

Finance

[Signature]
08/09/2020

Director



Schedule -12 : Income from Sales/Services

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)	Previous Year (2018-19)
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 Service	-	-
c) Agency Commission and Brokerage	-	-
d) Maintenance Services (Equipment/Property)	-	-
e) Others (Specify)	-	-
TOTAL	-	-

Schedule -13 : Grants/Subsidies

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)	Previous Year (2018-19)
(Irrevocable Grants & Subsidies Received)		
1) Central Government		
a) Revenue (Salary & General)	1,10,20,00,000	88,00,00,000
2) State Government(s)		
3) Government Agencies		
4) Institutions/ Welfare Bodies		
5) International Organisations		
6) Others (Specify)		
TOTAL	1,10,20,00,000	88,00,00,000

For J Pradhan & CO.

Chartered Accountant

FRN - 326206E

(Amiya Kumar Pradhan, FCA)

Partner

M. No. 054626



Administrative Officer-I

Finance

Officer on Special Duty

Finance

08/09/2020

Director

Schedule -14 : Fees/Subscriptions

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Particulars	Amount in Rs.	
	Current Year (2019-20)	Previous Year (2018-19)
1. Registration Fees (MSc & PhD)	1,43,49,679	1,38,15,716
2. License Fees	17,34,808	15,29,977
3. Sale of Tender Paper	1,74,316	2,84,120
4. RTI Application Fees	120	336
5. Transcript Fees	13,700	31,300
6. Identity Card/Health Card Fee	8,425	3,125
7. Summer Course Fees	1,22,000	1,44,500
8. Guest House Rent	16,96,458	12,86,260
9. Job Application Fees	51,500	1,26,500
10. EMD/SD (Forfeited)	1,43,228	-
11. Sample Testing Charges	30,800	-
11. Lease Rent	2,88,708	5,09,452
12. Water Charges	2,43,689	86,116
13. Misc. Receipts (Fine)	41,705	-
14. Liquidated Damages	26,82,557	-
15. Sale of News Paper	20,380	-
TOTAL	2,16,02,073	1,78,17,402

Schedule -15 : Income from Investments

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Particulars	Investment from Earmark Fund		Investment Others	
	Current Year (2019-20)	Previous Year (2018-19)	Current Year (2019-20)	Previous Year (2018-19)
(Income on Invest. From Earmarked/Endowment Funds) Transferred to Funds				
1) Interest :				
a) On Govt. Securities	-	-	-	-
b) Other Bonds/Debentures	-	-	-	-
2) Dividends :				
a) On Shares	-	-	-	-
b) On Mutual Fund Securities	-	-	-	-
3) Rents	-	-	-	-
4) Others (Specify)	-	-	-	-
TOTAL	-	-	-	-
Transferred to Earmarked/Endowment Funds	-	-	-	-

For J Pradhan & CO.
Chartered Accountants
FRN - 326206E

(Amiya Kumar Pradhan, FCA)
Partner
M. No. 054626



Administrative Officer-I
Finance

Officer on Special Duty
Finance

08/09/2020
Director



Schedule -16 : Income from Royalty, Publication etc.

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)	Previous Year (2018-19)
1) Income from Royalty	-	-
2) Income from Publications	-	-
3) Others (specify)	-	-
TOTAL	-	-

Schedule -17 : Interest Earned

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)	Previous Year (2018-19)
1) On Term Deposits:		
a) With Scheduled Banks	-	-
b) With Non-Scheduled Banks	-	-
c) With Institutions	-	-
d) Others	-	-
2) On Savings Accounts:		
a) With Scheduled Banks	3,88,16,917	2,89,92,280
b) With Non-Scheduled Banks	-	-
c) With Institutions	-	-
d) Others	-	-
3) On Loans:		
a) Employees/ Staff	-	-
b) Others	-	-
4) Interest on Debtors & Other Receivables	-	-
TOTAL	3,88,16,917	2,89,92,280

For J Pradhan & CO.

Chartered Accountants

FRN - 326206E

(Amiya Kumar Pradhan, FCA)

Partner

M. No. 054626



Administrative Officer-I

Finance

[Signature]

Officer on Special Duty

Finance

[Signature]
08/09/2020

Director

Schedule -18 : Other Income

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)	Previous Year (2018-19)
1. Profit on Sale/Disposal of Assets:		
a) Owned Assets	-	-
b) Assets acquired out of grants, or received free of cost	-	-
2. Export Incentives Realised	-	-
3. Fees for Miscellaneous Services	-	-
4. Miscellaneous Income	-	-
TOTAL	-	-

Schedule -19 : Increase/(Decrease) in Stock of Finished Goods & Work-In-Progress

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)	Previous Year (2018-19)
a) Closing Stock	-	-
Add: Finished Goods	-	-
Add: Work-in-Progress	-	-
b) Less: Opening Stock	-	-
Add: Finished Goods	-	-
Add: Work in Progress	-	-
NET INCREASE/(DECREASE) (a-b)	-	-

Schedule -20 : Establishment Expenses

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)	Previous Year (2018-19)
a) Pay and Allowances	28,18,36,008	24,96,09,826
b) Manpower (Outsourced)	10,47,46,920	9,75,26,515
c) Stipend to Trainee	9,69,387	7,81,937
d) Contribution to NPS	3,54,76,638	2,21,72,824
e) Leave Travel Concession	23,66,682	29,22,892
f) Fellowship to Phd Scholars	9,81,34,215	6,82,04,304
g) Fellowship to Post Doctoral Scholars	1,31,06,333	1,05,33,042
h) Contingency to PHD Students	73,70,132	59,26,511
i) Honorarium & Scholarship	58,04,671	51,12,499
j) PRIS	4,21,21,926	3,63,22,823
k) Medical Expenses	1,29,73,419	60,57,734
l) Children Education Allowance	20,04,571	28,12,036
m) Leave Encashment	9,46,976	11,20,155
n) Leave Salary Contribution	92,794	2,18,199
o) Professional Update Allowance	-	48,29,792
p) Pension Contribution	-	28,548
q) Contingency Expenses PDF	5,37,741	5,53,135
r) Msc Scholarship (DISHA)	1,56,58,456	94,56,775
s) Summer Course Fellowship - Student	3,05,249	-
u) Remittance of Employer Share	3,11,559	-
TOTAL	62,47,63,677	52,41,89,547

For J Pradhan & Co.
Chartered Accountants
FRN - 326206E

(Amiya Kumar Pradhan, FCA)

Partner

M. No. 054626

Administrative Officer-I

Finance

Officer on Special Duty

Finance

Director



ANNUAL REPORT 2019 - 2020
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Schedule -21 : Other Administrative Expenses

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Particulars	Amount in Rs.	
	Current Year (2019-20)	Previous Year (2018-19)
Graduation Ceremony Expenses	5,57,642	-
Freight & Forwarding Expenses	25,44,506	39,330
IISER/NISER Meet Expenses	-	28,71,602
Foundation Day Expenses	59,000	54,000
Purchases (Consumables)/ Supplies & Materials	6,32,17,519	5,92,06,663
Repair & Maintenance	3,82,26,648	2,42,99,107
Advertisement	26,63,802	14,34,472
Audit Fees	57,820	50,740
Bank Charges & Commission	2,15,310	2,79,004
CRA Service Charges	42,789	24,452
Electricity Charges	6,21,56,120	5,74,52,342
Fuel for DG Set	12,61,200	13,73,456
Hospitality Expenses	2,00,935	9,63,879
Housekeeping Expenses	28,23,226	20,34,349
Legal Fees	6,19,230	1,23,160
Meeting Expenses	20,09,648	40,00,415
News Papers & Periodicals	1,12,577	1,04,533
Postage & Courier	3,10,869	2,50,835
Printing & Stationery	7,50,880	9,96,830
Rent, Rates & Taxes	-	1,54,965
Seminar/ Workshop Expenses	13,04,014	25,36,167
Telephone & Internet Charges	1,23,96,119	24,34,577
Travelling & Conveyance - Domestic	79,56,139	71,79,546
T.A. on Transfer	4,13,518	-
Travelling & Conveyance - Foreign	54,43,899	79,78,580
Vehicle Maintenance Expenses	74,99,560	78,47,773
Professional Charges	24,14,527	1,38,291
Publication Charges	4,18,772	8,66,019
Horticulture & Plantation Expenses	20,600	4,37,972
Subscription Expenses	63,964	1,40,11,598
Thesis Evaluation Fee Expenses	2,00,000	-
NISER XII PLAN :		
a) Domestic Travel	4,62,678	5,76,346
b) Fellowships	10,68,485	12,22,126
c) Foreign Travels	48,65,081	15,06,661
d) Salary Expenses	20,80,624	16,74,232
e) Other Expense	9,97,332	69,12,504
f) Supplies & Materials	2,69,31,316	4,03,21,718
g) Honorarium	1,500	-
TOTAL	25,23,67,848	25,13,58,244
For J Pradhan & CO. Chartered Accountants FRN - 326206E		



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Schedule -22 : Expenditure on Grants, Subsidies etc.

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)	Previous Year (2018-19)
a) Grant given to Institutions/Organisation	-	-
b) Subsidies given to Institutions/Organisation	-	-
TOTAL	-	-

Schedule -23 : Interest

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amount in Rs.

Particulars	Current Year (2019-20)	Previous Year (2018-19)
a) On Fixed Loans	-	-
b) On Other Loans (including Bank Charges)	-	-
c) Others (specify)	-	-
TOTAL	-	-

For J Pradhan & CO.

Chartered Accountants

FRN - 326206E

(Amiya Kumar Pradhan, FCA)

Partner

M. No. 054626



[Signature]

Administrative Officer-I
Finance

[Signature]

Officer on Special Duty
Finance

[Signature]
08/09/20

Director



Schedule 24 - Significant Accounting Policies

(Schedule forming part of the accounts for the period ended on 31.03.2020)

About the Organization:

The National Institute of Science Education and Research (NISER) set up at Bhubaneswar by the Department of Atomic Energy was registered as a Society with the Registrar of Societies, Cuttack, Orissa vide registration no:22426/16 Dt. 10.07.2007.

NISER, a Grant-in-Aid institution of Department of Atomic Energy and affiliated to Homi Bhabha National Institute, Deemed University of DAE, Mumbai conducts the following academic programmes for bright and meritorious students who are selected through National Entrance Screening Test (NEST) conducted on all India basis.

- a) An integrated 5 year MSc programme in the core and emerging branches of basic sciences to students after 10+2 higher secondary schooling.
- b) Integrated MSc +PhD programmes after BSc from other universities.
- c) PhD programme after MSc from other Universities.
- d) Computer Science and Earth & Planetary Science

Presently NISER has 642 students admitted in 5 year MSc programme in the various streams of Basic Sciences. Moreover NISER has 325 research Scholar (PHD) in its roll.

1. Basis of Preparation of Financial Statements

The Financial Statements have been prepared on accrual basis following going concern concept, accounting standards and in accordance with the General Accepted Accounting Principles in India (Indian GAAP) except otherwise stated elsewhere.

The accounting policies adopted in the preparation of financial statements are consistent with those of previous year.

2. Fixed Assets

Fixed assets are stated at cost of acquisition inclusive of inward freight, duties & taxes and incidental & direct expenses related to acquisition.





3. Depreciation

Depreciation has been provided on written down value method as per rate prescribed in the Income Tax Act, 1961.

4. Capital Assets(WIP)

The institute has certain projects which are still in execution stage & hence these are taken as CWIP. As on 31.03.2020 Rs. 338,56,250/- remains in WIP stage.

5. Recognition of Income & Expenditure

Income & Expenditure are generally recognised on accrual basis & provision made for all known liabilities.

Lab consumables and stores consumables purchased during 2019-20 are treated as recurring expenditure and the consumables are transferred to respective Schools of study. Necessary records are maintained at the School concerned.

6. Foreign Exchange Transactions

Transactions involving foreign currency are accounted at the exchange rate prevailing on the date of the transaction.

7. Accounting for Registration Fees

Registration fee of students are being accounted for on receipt basis.

8. Accounting of Interest earned on FD

Interests earned on FD/ against LC are being accounted for on actual basis.

9. Government Grants/ Subsidies

- a) Government Grants of the nature of contribution towards capital cost of setting up projects are treated as Grant-In-Aid for creation of assets.
- b) Grants in respect of specific fixed assets acquired are shown as a deduction from the cost of the related assets.
- c) Government Grants is accounted on realisation basis.

10. Retirement Benefits

Liability towards gratuity payable on death/ retirement and provision for accumulated leave encashment benefit to employees is not applicable at present.



11. Taxation

Since the Institute is a research oriented organization wholly funded by Government of India, Department of Atomic Energy (DAE) and as the Institute has been issued 12A, no provision for Income Tax has been made during the year.

For J Pradhan & Co.

Chartered Accountants

FRN - 326206E



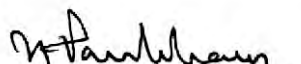
Amiya Kumar Pradhan (FCA)
Partner

M. No. 054626

UDIN - 20054626AAAAAP9088



Administrative Officer-I
Finance



Officer on Special Duty
Finance



Director



Schedule -25: Contingent liabilities & Notes on Accounts

(Schedule forming part of the accounts for the period ended on 31.03.2020)

Amt in Rs. (In Crores)

CONTINGENT LIABILITIES

1. Claims against the entity not acknowledge as debts	NIL
2. Liability for partly -paid investments	NA
3. Liabilities on account of outstanding forward exchange contracts	NA
4. Guarantee & letters of credit outstanding	NIL
5. Bills Discounted	NIL
6. Other items for which the entity is contingently liable	NIL

A) Notes on accounts

1. Deposit with DCSE&M, Mumbai :

During the period of report, DCSEM Mumbai has submitted detailed statement of accounts for Rs. 510,99,96,007.00 against the deposit of Rs. 530.00 crore placed with DCSE&M, Mumbai for construction of NISER Complex. The amount of Rs. 510,99,96,007.00 is being adjusted against the aforesaid deposit. Balance of Rs. 19,00,03,993/- will be adjusted after submission of final bill by M/S L&T Ltd. to DCSEM, Mumbai.

2. Lien against FD :

Lien against FD shown in Receipt & Payments account relates to items under import & the same is in order.

During the year under audit, Stock audit has been carried out by a firm of Chartered Accountants & the report shows the assets physically found along with the asset identification mark. However the balance is not duly reconciled with the accounts.

- Corresponding figures for the previous year have been regrouped/ arranged, where ever necessary.
- Rounded off to the nearest rupee.
- Schedules 1 to 25 are annexed to and form an integral part of the Balance Sheet as at 31st March, 2020 and the Income & Expenditure Account for the year ended on that date.

For J Pradhan & Co.

Chartered Accountants

FRN - 326206E

Amiya Kumar Pradhan (2244)
Partner

M. No. 054626

UDIN - 20054626AAAAAP9088



Administrative Officer-I
Finance

Officer on Special Duty
Finance

Director



NATIONAL INSTITUTE OF SCIENCE EDUCATION AND RESEARCH BHUBANESWAR

An Autonomous Institute under Department of Atomic Energy,
Government of India

P.O.- Jatni, District - Khurda, Pin - 752050, Odisha, India