



2020
2021

ANNUAL REPORT

& AUDITED STATEMENT OF ACCOUNTS

National Institute of Science Education
and Research Bhubaneswar





ANNUAL REPORT

&

Audited Statement of Accounts

2020 - 2021



National Institute of Science Education
and Research (NISER) Bhubaneswar

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Dr. Pranay Ku. Swain
Dean, Academic Affairs, NISER

FROM THE DIRECTOR'S DESK

"If I could turn the hands of time, I'll turn it forward to tomorrow. I want to move beyond with optimism and growth, taking the past which has gone by as my lessons in realising the future with hope, courage and determination."

- Anonymous



With the proud possession of the wisdom of the passing year and the promises of the one that beckons, I am delighted to present the annual report of National Institute of Science Education and Research (NISER) for the financial year 2020-21.

The year as a whole was an extremely challenging one with the pandemic situation engulfing almost everyone and throwing almost each of our scheduled activities awfully off track. However, the challenges notwithstanding, the entire NISER community lived up to the unprecedented situations and continued with good works in the best possible ways. Among the major achievements during this year, the stand out one has been the successful management of COVID-19 situation on the campus and completing the academic activities in online mode despite drastic and continuous realignments of the classes, examinations, results processing, etc. All this while and through the uncertain times, the quality and quantity of research publications by NISER faculty members have been nothing less than outstanding.

It is a matter of immense pride to note the success stories scripted by our students that graduated in 2020. 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 students of class of 2020 have enrolled for PhD programmes with fellowships from esteemed Universities and Institutes such as TIFR, IISc, CSIR-CDRI and various IITs. 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 Michigan, California, Oxford, Purdue, Syracuse, Manchester, Houston, Penn State, Louisiana, Texas A&M, to name a few, which reinforces the mandate that NISER is committed to create quality manpower for research in different areas of basic sciences.

In addition to the three academic programmes that NISER offers; 5 year Integrated MSc programme, PhD programme and Integrated MSc-PhD programme, it is all set to start a Master's Programme Medical and Radiological physics at NISER. The 2-year master's program will be followed by a one-year internship in a hospital. NISER has entered into an MOU with All India Institute for Medical Sciences (AIIMS) Bhubaneswar and Acharya Harihar Post Graduate Institute of Cancer (AHPGIC), Cuttack to help in the internship part and teaching of medical physics courses. I place on record our sincere gratitude to DAE and HBNI for starting this programme. The constraints associated with the pandemic have not been put to rest yet. We realize that the challenges are going to be there for some more time. However, we have pulled up our socks to be as resilient as possible to take everything in our stride and move on with our quest for excellence. 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. To add further to our research and development activities, extramural funding is also coming thick and fast from various sources underpinning our pursuit of research. Research being done here in our laboratories must translate into tangible benefits to humankind justifying the public funding that we receive and also reinforcing our commitment to pay back to the society at large. During the financial year ending in March 2021, our faculty members have added sixteen new research projects with funding to the tune of around ₹6.00 crores from non-DAE sources. Some of the major non-DAE sources include Dept. of Science and Technology (DST), Dept. of BioTechnology, (DBT), Science and Engineering Research Board (SERB), and Council of Scientific and Industrial Research (CSIR) Ministry of Human Resource Development, Govt. of India.

The youthful and vibrant faculty members are relentlessly working towards taking research activities at NISER to newer heights. Interdisciplinary and cutting edge research have created an enviable synergy that is contributing immensely to the Institution building. This has been reflected in the recent Nature Index HBNI (the degree awarding University for NISER and 10 other aided Institutes of the Dept. of Atomic Energy) is 1st in India, 30th in Asia Pacific and 97th Globally in the field of Physics. NISER

has close to 50% of the total papers published (by HBNI) which are used for this ranking. In all subjects, HBNI is ranked no. 2 in India and 71st in Asia Pacific. NISER has close to 45% of the total papers published which were used for this ranking. I congratulate the entire NISER community 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.

At NISER, we recognize that innovative approaches and contribution to furthering the intellectual environment are the only keys to creating a niche in the global knowledge community. Keeping those in vision, we must uncompromisingly raise the bar and rise up to that. Transcending academic and intellectual boundaries, the students and research scholars are being nurtured in the ambiance of this scientific culture with a single minded focus to contribute meaningfully to the growth and development of the country.

Finally, I am extremely thankful to the editorial team in bringing out this comprehensive Annual Report. Their efforts are sincerely appreciated.

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 interdisciplinary 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 1000 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 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 Ph.D. degree.

- 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, Nanophotonics

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 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 Phd 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 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, Earth Sciences, Atmospheric-Ocean and Planetary Sciences. SEPS has started PhD degree program offering research areas in emerging fields of Earth, Atmospheric and Planetary Sciences. The PhD students undergo one year of coursework which include introductory courses covering the three

disciplines in the first semester, followed by specialized courses in the second semester.

The School offers the following broad areas of research leading to PhD degree:

- Computational geophysics and seismology, Earthquake and landslide mechanics and physics
- Planetary composition and surface process, asteroids and Meteorites in the early solar system
- Astrochemistry, Star and planetary formation
- Atmospheric physics, regional hydroclimatology, land-climate coupling
- Exoplanets and Planetary Atmospheres

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 course work 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

"The only thing that you absolutely have to know is the location of the library".

- Albert Einstein

The Central Library is a unique Knowledge Center that offers access to essential and specialized information resources and other services to meet the growing information needs. The library's mission is to enhance and enable discovery through the effective utilization of the resources.

All the students, faculty members, and institute employees are entitled to use the library facilities. The Library building has a carpet area of 60,000 sq. meters and occupied a central location of the campus. It has a rich collection of Biology, Chemistry, Mathematics, Physics, Earth & Planetary Sciences, Humanities and Computer Sciences books.

Library Hours:

Regular Opening Time	9.00 am to 9.00 pm (All days)
Institutional Holidays	9:00 am to 5:30 pm

Library at a Glance:

The total collection of the central library as on March 2021 stands as follows:

Type of Resources	Volume
Purchased Books	21549
Gratis Books	1267
Print Journals and Scholarly Magazines	45
Bound Volume Journals	565
E-Books	44123
Electronic Databases	8
Electronic Journals	3765
CD/DVD	212
Thesis submitted by Students as partial fulfillment of Int. MSc./PhD. at NISER	176

Books (print) added during FY 2020-21: The total 578 books in print format added during FY 2020 - 21.

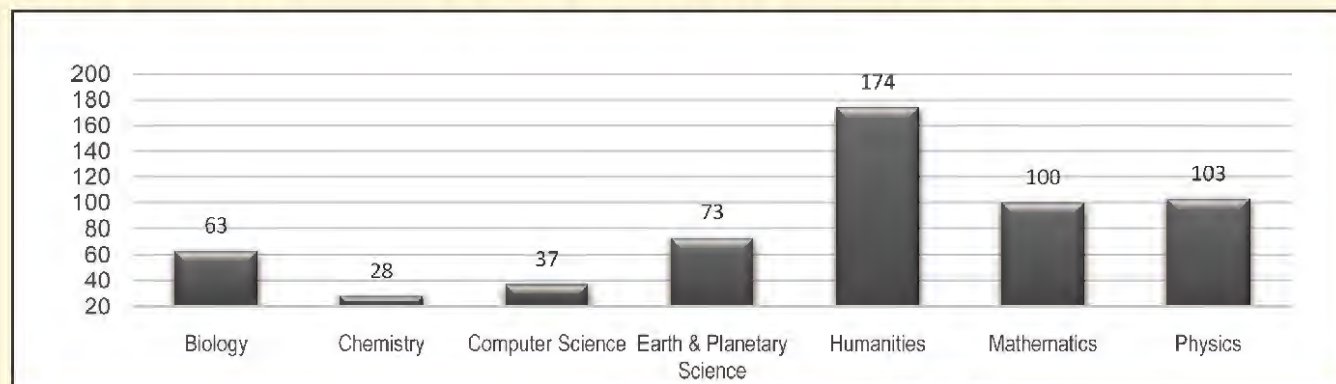


Figure 1: Number of books (print) added in FY 2020-21

Usage Statistics:

Issued Books: The number of books borrowed by various categories of users during the period 2020 – 21 as:

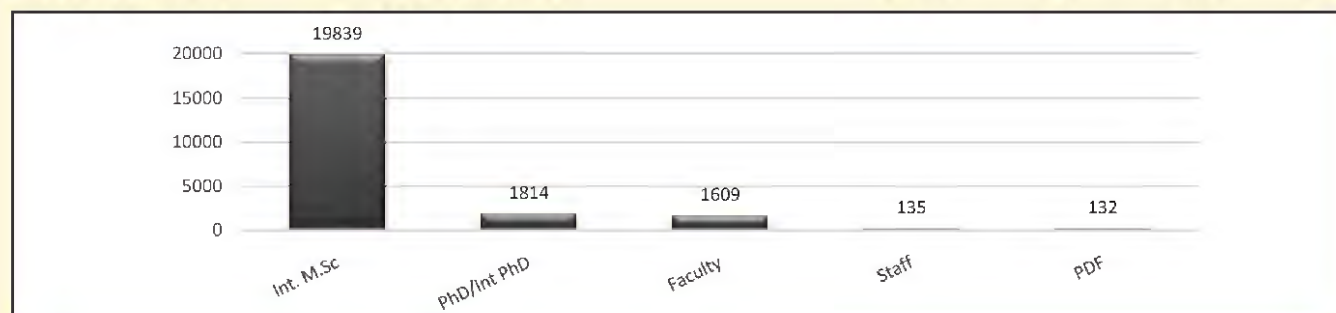


Figure 2: Issued books statistics during 2020-21

Topmost circulated items during 2020-21 FY:

The top 20 most circulated items during 2020-21 as:

Sl. No.	Item	Checkout Counts
1	Introduction to mechanics	77
2	Thermodynamics, kinetic theory, and statistical thermodynamics	65
3	Introduction to electrodynamics	62
4	Heat and thermodynamics	52
5	Organic chemistry	44
6	Atkins' physical chemistry	42
7	Topology	41
8	Understanding mathematics	41
9	Biology	36
10	Inorganic chemistry: principles of structure and reactivity	31
11	Mathematical methods in the physical sciences	29
12	Molecular biology of the gene	28
13	Introduction to protein structure	28
14	Kuby immunology	26
15	Schaum's outlines vector analysis and an introduction to tensor analysis	26
16	Concepts of modern physics	26
17	Principles of physics	25
18	Principles of quantum mechanics	25
19	Fundamentals of molecular spectroscopy	25
20	Introduction to the theory of computation	25

Patrons with most checkouts: The top 20 patrons

with most checkout during 2020-21 as:

Sl. No.	Patron	Checkout Counts
1	Sutany Roy	84
2	Najmul Haque	50
3	Analesh Ashok	24
4	Varun Subudhi	23
5	Guneshwar Thangjam	21
6	Dinesh Kumar Keshari	20
7	Sunandan Panda	19
8	Jabed Umar	19
9	Aher Jayesh Bhausaheb	18
10	Siddhant Mahato	18
11	Aniket Nath	18
12	Monalisa Pattanaik	18
13	Anamika Singh	18
14	Ayush Singhal	17
15	Neha Sanal Kumar	16
16	Ayush Bhadani	15
17	Deeptima Jaiswar	15
18	Hudha P M	15
19	Satyam Kumar Yadav	15
20	Aswini A	14

E-Resources:

E-Databases:

CCDC – CSD Enterprise License (CCDC)

EPWRF India Time Series

JSTOR (ITHAKA)

MathSciNet (AMS)

Natural Product Updates (Springer Nature)

Science of Synthesis (Thieme)

Sci-Finder (CAS- ACS)

Synthetic Reaction Updates (RSC)

E-Journals:

American Mathematical Society (AMS)	The Geological Society of America
American Metrological Society (AMS)	IEEE
American Association for Cancer Research (AACR)	IMPAN
American Association for the Advancement of Science (AAAS)	IOP Publishing
American Chemical Society (ACS)	John Hopkins University Press (JHUP)
American Economic Association (AEA)	Journal of Visualized Experiments (JoVE)
American Institute of Physics (AIP)	Lippincott Williams & Wilkins (LWW)
American Physical Society (APS)	Mary Ann Liebert
American Society for Biochemistry & Molecular Biology (ASBMB)	Mathematical Science Publishers (MSP)
American Society for Microbiology (ASM)	Optical Society of America (OSA)
Annual Reviews	Oxford University Press (OUP)
Association for Computing Machinery (ACM)	PNAS
Bentham	Ramanujan Mathematical Society (RMS)
Bioscientifica	Rockefeller University Press (RUP)
BMJ	Royal Society of Chemistry (RSC)
Cambridge University Press (CUP)	SAGE Publishing
Canadian Mathematical Society (CMS)	Society for Industrial and Applied Mathematics (SIAM)
Cold Spring Harbor Laboratory Press (CSHL)	Springer Nature
De Gruyter	Taylor and Francis (T&F)
Duke University Press	The Company of Biologists
EDP Sciences	The University of Chicago Press (UCP)
Emerald	Thieme Medical Publication
Elsevier (Through DAE Consortium)	Wiley
European Mathematical Society (EMS)	World Scientific

E-Books:

- Cambridge University Press (8 titles) – Perpetual Access
- Elsevier (561 titles)
- Oxford University Press (1 title) – Perpetual Access
- Pearson (8 titles) – Perpetual Access
- ProQuest S&T collection (35,000 titles) – One Year Subscription
- Springer Link (9567 titles) – Perpetual Access
- Taylor & Francis (4 titles) – Perpetual Access
- Wiley (5 titles) – One Year Subscription

Research Support Tools:

RemoteXS (Eclat) - Off-campus access of e-resources
 Ithenticate (Turnitin) - Originality/ Plagiarism check software

Library Services:

The Central Library offers the following services:

1. Current Awareness Service
2. RFID KIOSK (Self Check-out)
3. Book Dropper (Self Check-in)
4. Circulation (Issue, Return, Renewal & Reservation)

5. Web-OPAC (Intranet Access: <http://10.0.8.40:8001/>)
6. Reference and Information Services
7. User Awareness Program
8. Technical Processing of books (Purchased through contingency grants)
9. Anti-Plagiarism Software - iThenticate
10. Overnight Lending
11. QR Code
12. Reading Room
13. Document Delivery Services
14. Hindi Collection
15. RemoteXS (Off-campus access of e-resources)
16. Screen Reader: The Library has purchased the JAWS software. It is a computer screen reader program that allows blind and visually impaired users to read the screen either with a text-to-speech output or by a refreshable Braille display.
17. TrialAccess
 - ECS Digital Library (1st September 2020 – 31st January 2021)
 - Grammarly (22nd March 2021 – 22nd April 2021)

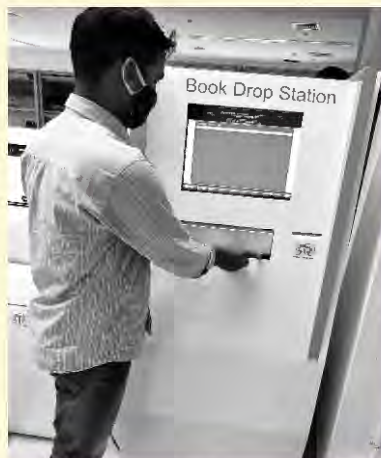


Figure 3: Book Dropper



Figure 4: Shelf Checkout Kiosk

Infrastructure Facilities:

- AC Reading area with a seating of 200 users at a time
- CCTV Surveillance
- Conference Room
- Cashless Payment (Late fee collection)
- Computers for e-resource access
- Wi-Fi Connectivity

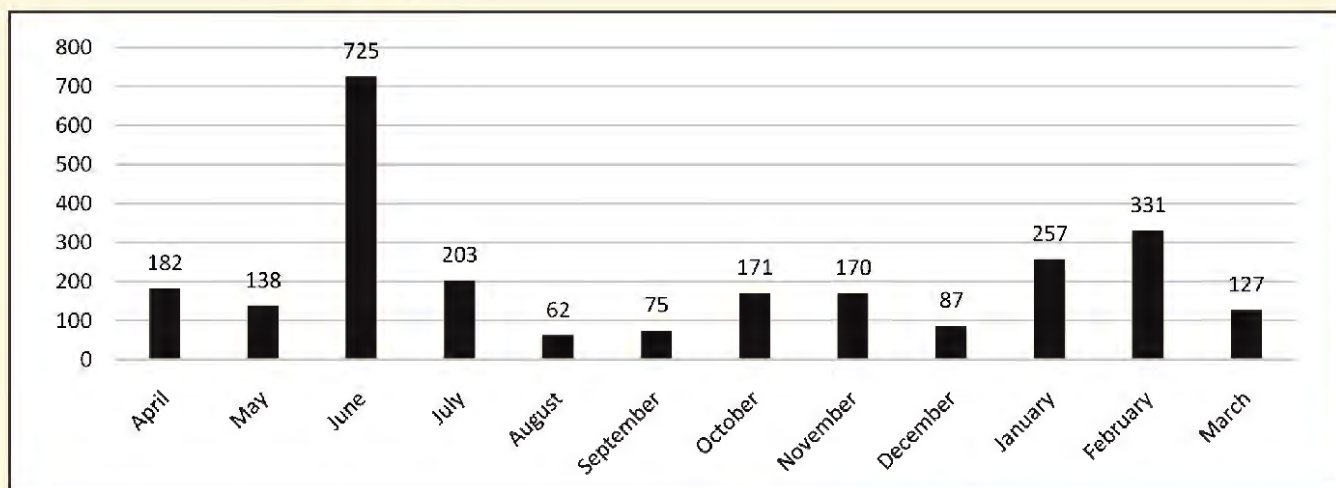


Figure 5: iThenticate Usage Statistics FY 2020-21

Library Website: <https://www.niser.ac.in/library/>

Koha ILMs: <http://10.0.8.40:8001/>

Digital Repository (Dspace): <http://10.0.8.41:8080/jspui/>

NISER Library's response to COVID-19:

Worldwide, Government authorities have implemented public safety measures to curb the spread of the COVID-19 virus in respective countries. Academic institutions quickly responded and modified operations, services,

procedures which included libraries quickly closing their physical space and moving to offer library services virtually.

1. NISER Library offered virtual access to all its print and electronic resources via RemoteXS Software. It encouraged the user community to avail of off-campus access to resources using RemoteXS credentials. New login credentials issued from the library to users i.e., Students / Faculties / Researchers who didn't have RemoteXS access earlier.

2. Library also provided a subscription to the E-book package on priority during lockdown to assist students, researchers, and faculties in the semester and online learning assistance.
3. Library also waived off the late fees of all its users from March 2020 – December 2020

Research Support Initiative was taken by Library:

RSCVD (Resource Sharing During COVID19) initiative taken from the Document Delivery and Resource Sharing (DDRS) section of IFLA during the pandemic. RSCVD is a well-thought initiative from IFLA's DDRS section to help libraries globally with book chapters/full-text articles to meet the research support requests from the Nonprofit libraries user community. Only ILL professionals can put requests from libraries globally, and volunteering libraries will share their resources.

NISER Central Library could arrange around 35 articles /book chapters in 2020 from Princeton University, University of Connecticut, IISc Bangalore, NITR, IIT Bhubaneswar, IISER Mohali, ISIK, IOP Library, and from publishers on request via email.

Future Plan:

The initiative and services proposed are given below:

1. IRINS (Faculty Profile)
2. Library MobileApp
3. A-Z list of E-Journals (Title/ Publisher/ Subject)
4. NewArrivalsAlert (Books and print journals)
5. Subject Guides for New library users
6. Faculty Publications (Books)
7. Document Request Form (Google Form)
8. DiscoveryTools
9. Special Collection (Hindi Collection, Odia Collection, Government Publication, NBHM, etc.)

Library Committee:

1	Dr. Praful Singru	Chairman
2	Prof. A. Srinivasan	Member
3	Prof. Bedangadas Mohanty	Member
4	Dr. Bishnu Prasad Biswal	Member
5	Dr. Guneshwar Thangjam	Member
6	Dr. Anupam Pal Choudhury	Member
7	Dr. Kush Saha	Member
8	Dr. Mohammed Saleem	Member
9	Dr. Joe Varghese Yeldho	Member
10	Dr. Manoj Mishra	Member
11	Scientific Officer (Library)	Member-Secretary

Library Team:

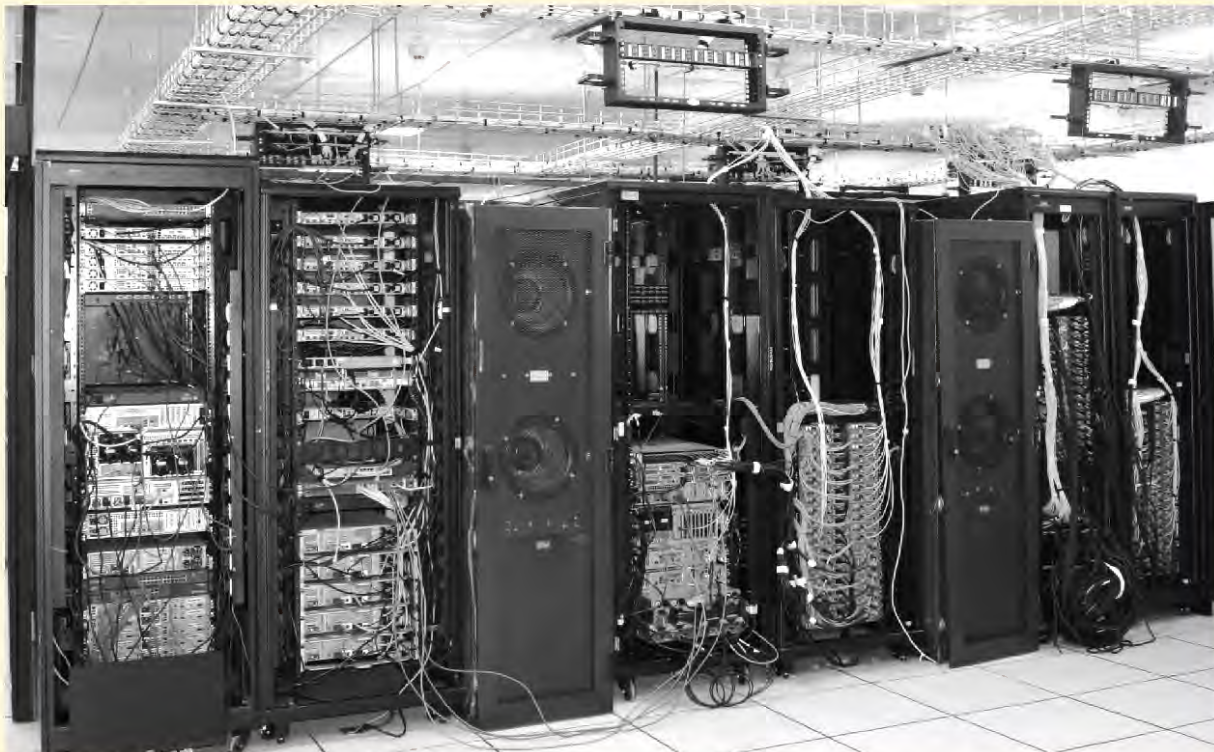
Name	Designation
Dr. Praful S. Singru	Chairman, Institute Library Committee
Mr. Kapil Kumar Gupta	Scientific Officer - C
Mr. Jitendra Narayan Dash (on deputation)	Scientific Assistant - D
Mr. Bidyut Siba Sankar Mohanty	Scientific Assistant-C
Mr. Rabindra Kumar Maharana	Technician – F
Ms. Suchismita Dash	Technician – F
Mr. Sk Safatulla	Technician - D

COMPUTER CENTRE

“Man is still the most extraordinary computer of all.”

- John F. Kennedy

Data Centre of Tier-II Standard is constructed for the conventional IT Infrastructures of the entire campus and also to host the HPC facilities. For cooling, in-row PACs are used inside cold aisle containment. Modular UPS of 120KVA in n+n redundancy have been used. Datacenter has a dedicated 600 KVA DG.



Right now the first bay is completely populated with conventional IT infrastructures and 02 HPC. Remaining 2 bays are available for future expansion with High-Power Density racks. Entire infrastructure is monitored through an advanced BMS system.



Redundant Firewalls (NGFW) at service

Deployment of NGFW

A new network perimeter security setup was procured and installed. This includes two FG501e Next Generation Firewall (NGFW) appliances in high availability (HA) mode which is providing the first level of security of our campus network at perimeter level as well as load balancing through the Internet Service Providers (ISPs).

Public IPv4 and IPv6 addresses were acquired from IRINN (Indian Registry for Internet Names and Numbers) for NISER which removed the unwanted dependency on the ISPs for these resources and is providing enhanced accessibility of our public websites and other resources through the internet.

High-Performance Computing Cluster: KALINGA

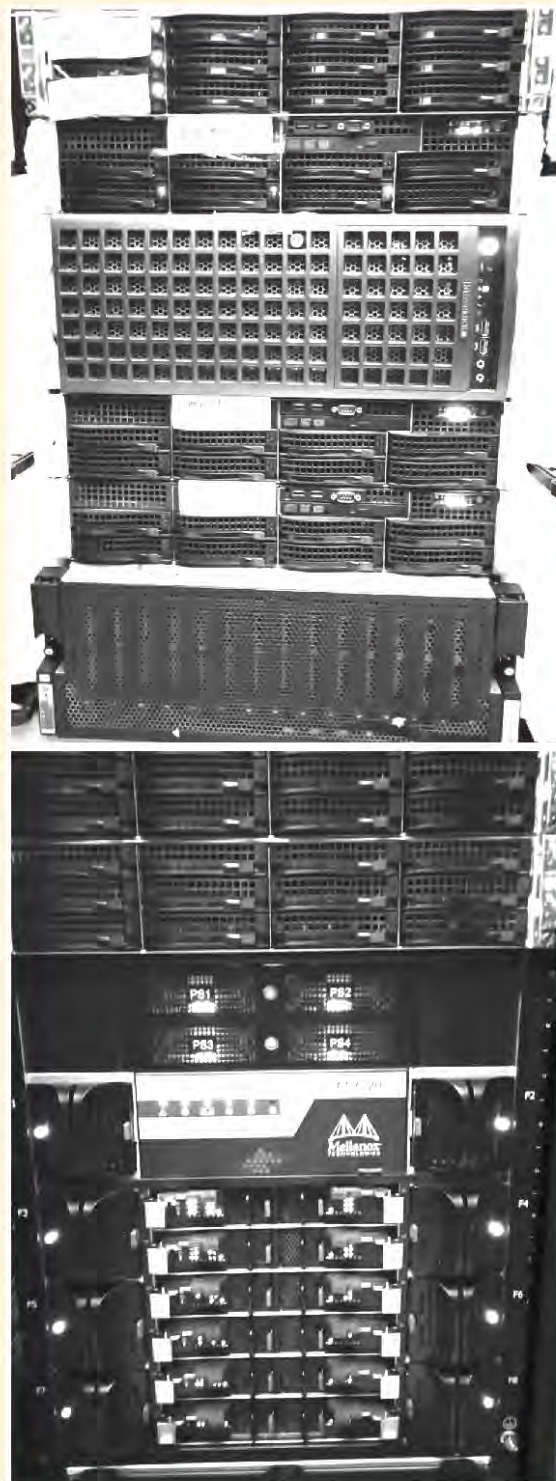
“With great computational power comes great algorithmic responsibility” - David Keyes

An HPC of 64 new compute nodes, 32 old compute nodes and 01 GPU nodes with 04 nos. of NVIDIA Tesla K40c and Dual Master Nodes in HA has been named KALINGA. It has 205TB of storage with Luster Parallel File System and interconnected with 216-Port EDR 100Gb/s Infiniband Smart Director Switch populated with 108 ports.

This cluster has been listed in the Jan-2021 top-supercomputer list in India maintained by C-DAC, Bangalore.

Total cores: 3584 cores

<http://topsc.cdacb.in/topsc.php/submission?id=163&slug=January2021>



Old compute nodes:

Based on Intel® Xeon® CPU E5-2698 v3 @ 2.30 GHz.
Two sockets for each node (32-cores per node) with
Memory: 512 GB (8 * 64 GB) per node.

New compute nodes:

Based on Intel® Xeon® Gold 6248 CPU @ 2.50 GHz.
Two sockets for each node (40-cores per node) with
Memory: 192 GB (12 * 16 GB) per node.

High-Performance Computing Cluster: HARTREE

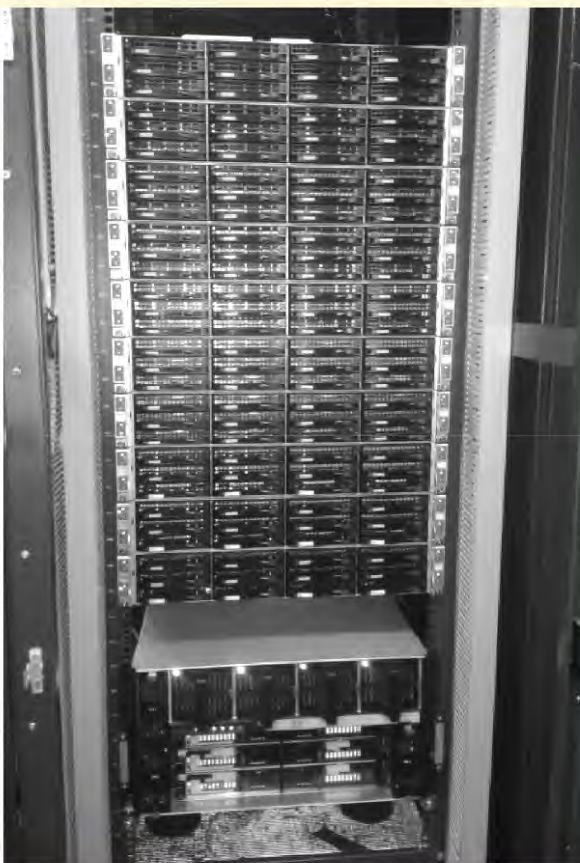
An HPC of 40 compute nodes has been named as HARTREE. This cluster has been listed in 29th position

in the July-2018 top-supercomputers list in India maintained by C-DAC Bangalore.

Total cores: 1280 cores

<http://topsc.cdac.in/topsc.php/submission?id=145&slug=July2018>

It has 230 TB of storage with Luster Parallel File System and is interconnected with 108-Port FDR 56Gb/s Infiniband Director Switch.



Entire HPC is installed inside the Smart-Row solution.

Compute nodes:

Based on Intel® Xeon® CPU E5-2697A v4 @ 2.60GHz.
Two sockets for each node (32-cores per node) with Memory: 64 GB per node.

Apart from these two huge HPCs, there are several other small HPCs running under the supervision of Computer Centre.

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 and pre-employment 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, five staff nurses, one physiotherapist, one radiographer, one medical laboratory technician and one pharmacist. During the year 2020-21 three new staff nurses were recruited and facilities for Obstetrics and Gynaecological Ultrasound, Pulmonary Function Test, Neuropathy Analyser were added to the Health Centre. At present Health Centre has facilities for OPD treatment, Laboratory Investigation, X-ray, Pulmonary Function Test, ECG, Obstetrics and Gynaecological Ultrasound, 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 LV 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-E
3.	N Bharati Reddy, Nurse-A
4.	Sibani Bhuyan, Nurse-A
5.	Smrutirekha Behera Nurse-A
6.	Susama Pachalasingh, Nurse-A
7.	Binodini Behera, Nurse-A
8.	Adhikari Suryakanta Dash, Pharmacist-B
9.	Ram Jeet, Radiographer
10.	Bholanath Karmali, Medical Lab Technician
11.	Jyotiranjana Sahoo, Physiotherapist

Facilities

- OPD consultation
- Minor OT and Dressing room
- Laboratory Investigations
- Emergency ward
- X-ray
- Pulmonary Function Test
- Ultrasound
- Physiotherapy
- ECG
- Pharmacy

Statistics

OPD patients	6208
Diabetes	599
Laboratory Investigations	3804
Hypertension	500
Pre-employment examination	55
Antenatal Check up	291
Physiotherapy	1116
X-Ray	209

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. PalokAich, Associate Professor	Systems Biology
10.	Dr.PankajVidyadhar Alone, Associate Professor	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	Mechanisms of membrane deformation in cellular trafficking, neurodegeneration and host-pathogen interactions. Reconstitution of biologically relevant protein mediated membrane shaping and remodeling.

School of Chemical Sciences		
Sl.	Name & Designation	Field of Specialization
1.	Prof. Alagar 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.Bishnu Prasad Biswal, Assistant Professor	Physical Chemistry, Physical and Materials Chemistry
6.	Dr.Chandra Sekhar Purohit, Associate Professor	Organic Chemistry Bio-organic and Organic Synthesis
7.	Dr.Chidambaram Gunanathan, Associate Professor	Organic Chemistry Organometallic Chemistry and Catalysis
8.	Dr.Dipak Samanta, Assistant Professor	Inorganic Chemistry, Inorganic and Materials Chemistry
9.	Dr.Himansu Sekhar Biswal (Chairperson) Associate Professor	Laser Spectroscopy and Instrumentation
10.	Dr. Jogendra Nath Behera, Associate Professor	Inorganic Chemistry, Low temperature multiferroics from single source precursors and Porous Magnetic Materials
11.	Dr. Krishnan Venkatasubbaiah, Associate Professor	Inorganic Chemistry Catalysis and Materials Synthesis
12.	Dr.Moloy Sarkar, Associate Professor	Physical Chemistry, Fluorescence Spectroscopy
13.	Dr.Nagendra K Sharma, Associate Professor	Inorganic Chemistry Bio-Organic and Organic Synthesis
14.	Dr. P. C.Ravikumar, Associate Professor	Inorganic Chemistry, Organic Synthesis and catalysis
15.	Dr.Prasenjit Mal, Associate Professor	Inorganic Chemistry Supramolecular chemistry and Photochemistry
16.	Dr. S.Peruncheralathan, Associate Professor	Organic Chemistry, Synthetic Organic chemistry and Catalysis
17.	Dr. Sanjib Kar, Associate Professor	Inorganic Chemistry Bio-inorganic chemistry: Metals in Medicine
18.	Dr. S.Nembenna, Associate Professor	Inorganic Chemistry Main Group Organometallic chemistry and Low oxidation state metal chemistry

19.	Dr. Subhadeep Ghosh, Associate Professor	Physical Chemistry Single Molecule Spectroscopy, Molecular Dynamics
20.	Dr. Sudip Barman, Associate Professor	Physical Chemistry Synthesis and Functionalization of Graphene
21.	Prof. T.K. Chandrashekar, Sr.Professor	Inorganic Chemistry Bio-Inorganic Chemistry-Expanded porphyrin Chemistry
22.	Prof. V.Chandrasekhar, Adjunct Professor	Inorganic Chemistry Synthetic Inorganic Chemistry
23.	Dr. U Lourderaj, Associate Professor	Physical Chemistry Theoretical and Computational Chemistry
School of Mathematical Sciences		
Sl.	Name & Designation	Field of Specialization
1.	Prof.Mudumbai Seshachalu Narasimhan, Honorary Fellow	Algebraic and differential geometry
2.	Dr. 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. Sanjay Parui, Associate Professor	Harmonic Analysis
8.	Dr. Deepak Kumar Dalai, Reader-F	Cryptography
9.	Dr. Kamal Lochan Patra (Chairperson), Reader-F	Algebraic Graph Theory
10.	Dr. Nabin Kumar Jana, Reader-F	Probability Theory
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.	Dr. K.Senthil Kumar, Reader-F	Number Theory

19.	Dr. Krishanu Dan, Assistant Professor	Algebraic Geometry
20.	Dr. Anupam Pal Choudhury, Assistant Professor	Differential Equations
21.	Dr. Kaushik Majumder, Assistant Professor	Discrete Mathematics
22.	Dr. Ramesh Manna, Assistant Professor	Harmonic Analysis
23.	Dr. Chitrabhanu Chaudhuri, Assistant Professor	Algebraic Geometry
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, Reader 'F'	High Energy Physics (Theory)
33.	Dr. Ashis Kumar Nandy, Assistant Professor	Condensed Matter Physics (Theory)
34.	Dr. Kush Saha, Reader 'F'	Theoretical Condensed Matter Physics
35.	Dr. Satyaprasad P Senanayak, Assistant Professor	Device Physics, Semiconductors, Charge Transport, Field Effect Transistors, Photovoltaics, Light emitting Diodes, Medical Diagnostic Devices

School of Earth and Planetary Sciences

Sl.	Name & Designation	Field of Specialization
1.	Prof. Edward Cloutis, Adjunct Professor	Planetary Sciences
2.	Dr. Murthy S. Gudipati, Visiting Professor	Astrochemistry, Astrobiology, Planetary Sciences
3.	Dr. Guneshwar Singh Thangjam Chairperson, Assistant Professor	Planetary Geology
4.	Dr. Liton Majumdar, Assistant Professor	Astrochemistry, Radio/sub-mm/infrared astronomy, Astrobiology, Star and Planet formation Exoplanetary Atmospheres
5.	Dr. Jaya Khanna, Assistant Professor	Land - atmosphere interaction, Regional climatology, Boundary layer processes
6.	Dr. Pathikrit Bhattacharya, Assistant Professor	Geophysics, Earth Sciences

School of Humanities and Social Sciences		
Sl	Name & Designation	Field of Specialization
1.	Dr. Pranay K.Swain, Associate Professor	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 (Chairperson)	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, Reader - F (Chairperson)	Cryptography
3.	Dr. Subhankar Mishra, Reader - F	Graph Theory, Cyber Security, Smart Grid
4.	Dr. Aritra Banik, Reader - F	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 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 Computer Sciences

Programming and Data Structures Lab I,
Programming and Data Structures Lab II

Theory of Computation:

Discrete Structures and Computation - Introduction to Programming, Theory of Computations, Discrete Structures and Computations, Design and Analysis of Algorithms, Modern Cryptography, Algorithmic Coding Theory, Complexity Theory, Linear Programming and Combinatorial Optimization, Distributed Network Algorithms.

Computational Geometry - Parameterized Algorithms, Approximation Algorithms, Algorithmic Game Theory, Machine Learning.

Advanced Machine Learning, Introduction to Computational Number Theory, Advanced Computational Number Theory, Secure Multiparty Computations.

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 for approval. Minor degree in Earth and Planetary Sciences is planned to start 2021-2022 session.

A five year PhD program has been initiated in January 2021 and is offering research works in Earth, Atmospheric and Planetary Sciences.

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

Mechanism and Regulation of Nuclear Expansion

Dr. Abdur Rahaman, Reader – F

Nuclear remodeling is a universal process that occurs in all eukaryotes including humans. 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 a potential means for therapeutic intervention.

Tetrahymena undergoes closed mitosis and nuclear envelope expands to 10 folds during specific stage in cell conjugation. Gene manipulation, Knockout generation 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 on nuclear remodeling, specifically understanding the mechanism and cell cycle regulation of nuclear envelope expansion.

In our recent findings we have shown how a nuclear localizing dynamin related protein, Drp6, involved in nuclear expansion in Tetrahymena, is recruited to nuclear envelope through specific lipid interaction.

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.

Understanding the Mechanism of Gastric Cancer 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 tumors, 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.

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 thermo-gating 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 channel gating.

Understanding the Molecular pathogenesis of age-related neurodegenerative disorders

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 pathomechanism 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

- (i) Functional significance of membrane proteins.
- (ii) 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 and Hormone Signaling integrating Flowering Time Control in Plants

Dr. Kishore CS Panigrahi, Associate Professor

We are Interested in understanding the molecular mechanism underlaying the photoperiodic control of flowering time and circadian clock in model flowering plants. Towards this aim we use *Arabidopsis thaliana* and Rice as model systems and try and find common as well as unique set of molecules that can integrate light, hormone and temperature signals. We attempted to show the molecular mechanism of Evening complex function in *Arabidopsis* and we also showed for the first time that, inclusion of Carbon Nano Particles in growth media or soil altered flowering responses in model plants. These Nano particles further shown to alter the thermal sensing in both *Arabidopsis* and Rice plants, resulting in a significant enhancement in productivity. This work is now being emphasized its application in the area of Plant Biotechnology. we are currently investigating the detailed underlaying mechanism exerted by CNPs for enhancement in productivity in Rice and *Arabidopsis*. We also work on a model non-flowering plant moss, *Physcomitrella Patens* that aims to understand the cross talk between light and phytohormone Auxin, cytokinin shaping the patterning of root like and shoot like structures which is of evolutionary importance.

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).

Angiogenesis and Tumorigenesis Regulation

Dr. Manjusha Dixit, Associate Professor

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 and in vivo models. In breast cancer, we found that FRG1 affects tumorigenesis irrespective of molecular subtype. We identified EEF1A2 and IQGAP2, as FRG1's interacting partners. In breast cancer we identified that IQGAP2 functions as tumor suppressor. IQGAP2 interacts with IQGAP1 and possible sequesters IQGAP1 mediated oncogenic effect in breast cancer by modulating ERK signalling. Moreover, IQGAP2 also affects angiogenesis. Other interactant of FRG1, namely EEF1A2, functions as an oncogene and affects angiogenesis in positive manner by affecting HIF1A levels. We found a positive feedback loop between EEF1A2 and HIF1A. Our current research focuses on if it is three protein complex which affects multiple molecular signalling and on the basic role of FRG1.

Mechanisms of membrane deformation in neurodegeneration and host-pathogen interaction

Mohammed Saleem, Reader – F

The ongoing work focusses on deciphering the role of lipid packing defects in amyloid beta mediated neuronal membrane deformation. We particularly, focussed on myelin model membrane as it has been never explored before and largely ignored. The work also attempts to capture the degree membrane deformation during various time scales of the amyloid beta aggregation and correlate the same with the degree of lipid packing defects.

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.

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. I have also initiated planning to understand human's diseases like Inflammatory Bowel Disease and Non-Alcoholic Fatty Liver Disease (NAFLD).

Neural Circuits, Neuropeptides and Behavior

Dr. Praful Singru, Associate Professor

The neural basis of regulation of reproduction and energy balance is being investigated. While neural circuitries regulating these functions are well segregated in the brain, evidence suggest their interaction at different levels of the neuraxis. We aim at probing the mechanisms and neural components of the shared neural pathways controlling reproduction and energy balance. The studies will help understanding the nourishment associated infertility and ways to treat. Some part of the work has already been published in journals like the Journals of Comparative Neurology, Journal of Neuroendocrinology, Brain Structure and Function, and Neuroscience. For the first time we have identified significance of TRH in the regulation of neuroendocrine regulation of DA neurons and reproduction in teleosts. We demonstrated that the NPY and CART systems in the hypothalamus is rapidly responsive to changes in energy balance and their distinct nature in birds as compared to those in mammals.

Cell cycle and Cytoskeletal Dynamics

Dr. Ramanujam Srinivasan, Reader – F

Cytokinesis is the terminal step in the formation of two daughter cells from a mother cell and is essential in almost all life forms. In most bacteria cell division is initiated by the self-assembly of a tubulin homologue, FtsZ into a constrictive ring-like structure at the division site. This ring-like structure, the so-called Z-ring then recruits more than a dozen proteins that are involved in cell wall synthesis and cell separation. Despite the major progress made during the last decade or so in our understanding of bacterial cell division processes, the

precise molecular mechanisms by which Z-rings assemble and constrict remain enigmatic particularly because molecular motors have not been identified in bacteria so far. Our research is aimed at studying the molecular mechanisms by which the bacterial cell division protein FtsZ self-assembles into a ring-like structure and generates the constrictive force for cytokinesis given the absence molecular motors.

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 followed in order to construct the final structure. In biology the complex forms of the organs and tissues are of critical importance as the form directly relates to function. At the foundation of the shapes is the highly flexible basic unit, the cell and the myriads of shapes it can take. However, unlike inanimate units, the cell has a complex network of processes inside; the sub-cellular activities that control its shape. We are interested in how cells control their shapes, how these shapes organise to generate higher order tissue and organ architectures and the mechanisms that maintain these complexities against degenerative forces.

Protein crystallography, and De novo protein design Structural basis for the functioning of viral ion channels, histidine kinases, and polysaccharide Lyases

Dr. Rudresh Acharya, Reader – F

Proteins are workhorses of a cell, engaged in a wide range of task comprising structural stability, cell signalling, 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.

Viral ion channels: Cation selective channels are present in several enveloped pathogenic viruses (example: Influenza viruses, Hepatitis C virus, 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.

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.

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.

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, 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 CMI, Chikungunya virus (CHIKV) infection driven inflammatory pathways, a critical requirement of Toll like receptor 4 (TLR4) responses during 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.

Structural Biology of Viral Molecular Machines

Dr. Tirumala Kumar Chowdary, Reader – F

Viruses enter cells and replicate their genomes using specialized protein complexes. One of my lab focus is understanding structure-function relationship of viral envelope proteins (spike proteins) of Chikungunya virus, herpesviruses and SARS-CoV-2, and explain mechanism of viral cell-entry. Based on our studies, we proposed a mechanism for acid pH-induced conformational change in Chikungunya virus spike protein, E1. Another focus area in the lab is to understand complex and dynamic interactions amongst the non-structural proteins in the genome replication complex of Dengue virus, with specific emphasis on Nsp3 helicase-cum-protease interactions with other Ns proteins

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47. Inhibition of transient receptor potential vanilloid 1 (TRPV1) channel regulates chikungunya virus infection in macrophages. Sanjai Kumar P, Nayak TK, Mahish C, Sahoo SS, Radhakrishnan A, De S, Datey A, Sahu RP, Goswami C, Chattopadhyay S, **Chattopadhyay S*** Arch Virol. 2020 Oct 30. doi: 10.1007/s00705-020-04852-8. Online ahead of print. PMID: 33125586 (*Corresponding author).
48. Sahoo B, Gudigamolla NK, **Chowdary TK**. Acidic pH-Induced Conformational Changes in Chikungunya Virus Fusion Protein E1: a Spring-Twisted Region in the Domain I-III Linker Acts as a Hinge Point for Swiveling Motion of Domains. *J Virol*. 2020 Nov 9;94(23):e01561-20. doi: 10.1128/JVI.01561-20. PMID: 32938768; PMCID: PMC7654277.
49. R Dasgupta, Arpit Kumar Pradhan, **S Ghosh Sr**. First report of an insilico study of Luciferase in *Mycobacterium*. sp. EPA45 bioRxiv 2020.10.30.362764; doi: <https://doi.org/10.1101/2020.10.30.362764>
50. Anirban Mitra, Garima Hore, Sanjima Pal, **S Ghosh** Association of air pollution parameters and natural calamity with COVID-19: A study from metropolitan kolkata, West Bengal, India, *J. Appl. Zool. Res.* 2021, 32(1):22-39.
51. **Ghosh S**, Sadhukha M, Rout S, Mallick B, Hasan MN and Mandal C. Elemental analysis on the new species of earthworm from Orissa. *Explor Anim Med Res.*, 2020, 10(1), 65-69.
52. R Bhattacharjee, D Banerjee, **S Ghosh**, Chronology of appearance pattern and colonization of nutrient recycling forensic flies on house rat carcasses (*Rattus rattus*) in urban and semi-urban habitats of southern part of West Bengal *IJER*, 2021, 6(2), 148-156.
53. C.K. Mandal, H Tariyal, P. Naiwal, D. Thakur and **S Ghosh** *Haemadipsa satyanarayanai* sp. nov. (Hirudinea: Haemadipsidae): A New Leech from Nagaland, India *J. Appl. Zool. Res.* 2020, 31(2), 149-155.

54. C.K. Mandal, H Tariyal, P. Naiwal, D. Thakur and **S Ghosh** *Theromyzon jaleswarensis* sp. nov. (Hirudinea: Glossiphoniidae): A New Leech from Uttar Pradesh, India, J.Appl. Zool. Res. 2020, 31(2), 163-168.
55. **S Ghosh** Structural functional insights into earthworm lysenin as potential antimicrobial agent, IJER, 2020, 5(6), 57-65.

Preprints:

1. Majhi R K, Kumar A, Giri SC, **Goswami C.** (2020) Differential expression and localization of thermosensitive Transient Receptor Potential Vanilloid (TRPV) channels in the mature sperm of white pekin duck (*Anas platyrhynchos*). bioRxiv.
<https://www.biorxiv.org/content/10.1101/2020.02.10.941732v1>
2. Somdatta Saha, Rashmita Das, Divyanshi Divyanshi, Nikhil Tiwari, Ankit Tiwari, Ritesh Dalai, Abhishek Kumar, **Chandan Goswami.** (2020) Ratio of hydrophobic-hydrophilic and positive-negative residues at lipid-water-interface influences surface expression and channel-gating of TRPV1. doi: <https://doi.org/10.1101/2020.09.04.272484>.

Books:

1. **Book by Dr. S. Ghosh:** Clinical significance of CRP: 2020 December, Springer, Nature.

Book Chapters:

1. Sushama Mohanta and **Chandan Goswami** (2020) TRP channels at gut: effect of probiotics and phytonutraceuticals on gut-brain-immune axis. Book Chapter. Springer.
2. Screening of novel potential anti-cancer agents using *Drosophila* tumour models. Sulava Sushree and **Alone Debasmita P.** in "Experiments with *Drosophila* for Biology Courses" An e-resource book for laboratory experiments at under- and post-graduate levels and for research projects in Biology Courses Published by: Indian Academy of Sciences, Bengaluru, India (2021) Mar; 409-418.
3. **S Ghosh**, N Roy, S Behera and W Ansar Climate change and medicinal plants, India: An Overview, Chapter 49, Ozturk M, Khan SM, Altay V, Efe R,

Egamberdieva D, Khassanov F (2021) Biodiversity, Conservation and Sustainability in Asia: Volume II: Prospects and Challenges in South and Middle Asia. Springer Nature Switzerland AG.

Recognitions, Awards & Honors

1. Dr. Aniruddha Datta Roy and his research team has discovered a new species of skink from the Nilgiri Hill region that was published in the reputed journal Zootaxa. This description was covered by an article in THE HINDU Science & Technology section:
<https://www.thehindu.com/sci-tech/energy-and-environment/new-species-of-skink-found-from-western-ghats/article34567454.ece>
2. Dr. Aniruddha Datta Roy has become an invited member of International Union for Conservation of Natural resources (IUCN) Species Survival commission (SSC) and a representative from India for the Skink-specialist group.
3. Dr. KV Badireenath has become the reviewer of SERB Project Proposals.
4. Dr. Chandan Goswami is serving as the "DAAD Research Ambassador for 2018-2022.
5. Dr. Debasmita P Alone has become an Expert Committee Member in SERB for NPDF and Early Career Grants.
6. Dr. Debasmita P Alone has become a reviewer for Journal on Investigative Ophthalmology & Visual Science, Experimental Eye Research, Journal of Genetics, PLOS One and Clinical Ophthalmology, European Journal of Ophthalmology.
7. Dr. Harapriya Mohapatra has become a reviewer for several national and international journals such as International Journal of Antimicrobial Agents, Open Microbiology, Current Microbiology, Environmental Monitoring and Assessment, Frontiers in Microbiology, ACS Nanomaterials.
8. Dr. Harapriya Mohapatra is serving as a Member Board of Studies (Life Sciences) HBNI, DAE.
9. Dr. Manjusha Dixit has become the Editorial Board Member for "Scientific reports" & "BMC cancer"
10. Dr. Renjith Mathew has become the Member of Local Research Advisory Committee (LRAC) for Multidisciplinary Research Unit (MRU), SCB Medical College, Cuttack.

11. Dr. Palok Aich has become the Editorial Board Member for Medicine in Microecology (Elsevier), 2020.
12. Dr. Palok Aich has become the Review Editor for Frontiers in Cellular and Infection Microbiology (section: Microbiome in Health and Disease) 2020.
13. Dr. Palok Aich has become the Member, Board of Advisors, Bencos Research Solution, Mumbai / Bengaluru, India, 2020.
14. Dr. M. Saleem has been awarded with the DBT-Wellcome Trust Intermediate Fellowship.
15. Dr. S. Chattopadhyay has served as an invited judge for the topic "Exploring and understanding the COVID19 pandemic" for class XI and XII students, organized by DAV Public School, Chandrasekharapur, Bhubaneswar, dated 28/11/2020.
16. Dr. S. Ghosh has been awarded with Scientist Award 2020 in Pharmaceutical Sciences by Dr. B. Vasantharaj David Foundation Excellence Awards - 2020.
17. Dr. S. Ghosh has become the Editorial Board member for J. Appl. Zool. Res for 2020-2025 in 2020.
18. Dr. S. Ghosh has chaired a Technical Session on Effective Scientific and Technological Approach in combating COVID-19 Across the world, Hiralal Mazumdar Memorial College for Women, West Bengal, India, 27th June 2020.

Awards and Honors by the SBS Students

1. **An invited review article in Curr Opin Physiol on COVID-19** is under review. Primary authors of this article are the MSc students from Dr. Asima Bhattacharyya's Lab.
2. **Best Poster Award** in the following Conferences by Ms. Sohini Mukhopadhyay a student under the guidance of Dr. Palok Aich:
 - Conference Name- 5th Biennial Virtual Conference of PAi and International Symposium on "Probiotics and Immunity: Way Forward to Microbial Therapy" Date- 19th & 20th November, 2020, Title of the Poster- Akkermansia muciniphila- A Potent Upcoming Probiotic to Reduce Colitis Related Disease Severity.
 - Conference Name- BIOSPECTRUM 2020- International Conference on Biotechnology & Biological Sciences. Date- 19th to 21st November

2020, Title- Colitis Leads to Neurophysiological Changes and Impede Normal Behaviour Due to Impairment of Gut-Brain Axis

3. C-terminus of SopA- A key player in mediating segregation. Mishra D a student under Dr. R. Srinivasan Selected for a Flash Talk in the Boston Bacterial Meet (BBM) 2020, 16th July-17th July, 2020. (Virtual).
4. Dissecting the role of SopA C-terminus in F plasmid maintenance. Mishra D a student under Dr. R. Srinivasan awarded as a Best Talk in the National seminar on "Advances and challenges in Biological sciences" [ACBS-2020], 12th Feb-13th Feb, 2020.

Conferences, Seminars, Workshops, Webinars Attended

1. Dr. Aniruddha Datta Roy has organized, took lead and instructed in an online international workshop titled "Workshop of molecular phylogenetics", August 2020.
2. Dr. Aniruddha Datta Roy has organized, took lead and instructed in an online international workshop titled "Applications of molecular phylogenetics", October 2020.
3. Dr. Asima Bhattacharyya has attended and delivered a talk in a webinar organized by the Department of Microbiology and Biotechnology Centre, The Maharaja Sayajirao University of Baroda, Mysteries of Microbes Series. Webinar 5: Helicobacter pylori pathogenesis- nothing short of magic. 3 July 2020.
4. Dr. Debasmita P Alone has attended and delivered a talk on "Natural products as regulators of tumour suppressor genes" at International Webinar Series on "Food, Chemical and Nanomaterial Toxicity" organized by Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum and Central University of Kerala with association with Kerala Academy of Sciences, 26th-28th November, 2020.
5. Dr. Debasmita P Alone has attended and delivered a talk on "Multiple Facets of Gene Regulation: Through the Eyes of Pseudoexfoliation" at National Webinar organized by G N Ramachandran Science Club, affiliated with Vigyan Prasar, Govt. of India at MACFAST, Kerala.

6. Dr. Debasmita P Alone has attended and delivered a talk on “Repurposing of an Anti-malarial drug as a potential Anti-Cancer Drug for brain tumour” at One Day National Webinar organized by Department of Biotechnology, GIET University, Gunupur, Odisha.
7. Dr. Harapriya Mohapatra has attended a webinar and delivered a talk on The Medley of Stochastic Heterogeneity in bacteria, conducted by IMSc, 8th December 2020.
8. Dr. Palok Aich has delivered a talk on “Concurrent development of gut microbiota and mucosal barrier integrity in postnatal mice: A longitudinal study”. Uday Pandey and Palok Aich. A Keystone symposium on The Microbiome: From Mother to Child. January 18-20, 2021.
<https://virtual.keystonesymposia.org/ks/live/614/page/4944>
9. Dr. Palok Aich has delivered a talk on “Akkermansia muciniphila- A potent upcoming probiotic to reduce colitis related disease severity”. Sohini Mukhopadhyay and Palok Aich. 5th Biennial Virtual Conference, Probiotic Association of India. Nov 19-20, 2020.
10. Dr. Palok Aich has delivered a talk on “Understanding the temporal changes in visceral adiposity caused by diet induced cecal microbiota dysbiosis using mouse model”. Raktim Mukherjee and Palok Aich, 5th Biennial Virtual Conference, Probiotic Association of India. Nov 19-20, 2020.
11. Dr. Tirumala Kumar Chowdary has delivered an invited talk in a virtual international conference "A Virtual Conference on Infectious Disease, Microbiome, and Public Health in the Current Scenario" - conducted by SBS, NISER - August 10-11, 2020. Title of the talk: "Structure Biology of Pandemic Viruses – Lessons Learnt on Biology, Pathomechanism and Spread".
12. Dr. S. Ghosh has delivered a talk on “Effective Scientific and Technological Approach in combating COVID-19 Across the world”, HZMM College For Women, West Bengal, India, June 2020.
13. Dr. S. Ghosh has attended a Virtual Conference on infectious disease, microbiome, and public health in the current scenario, 10-11 Aug 2020.

Invited Talks Delivered

1. Dr. Aniruddha Datta Roy has been invited as a Resource person at Webinar titled “National Webinar on Herpetology” organized by Zoological Survey of India, Kolkata, January 20, 2021. Talk Title: “Diversity and distribution of skinks in Indian subcontinent”
2. Dr. KV Badireenath has delivered an invited talk in the webinar on “Hepatitis Virus – Noble cause and Nobel Prize”. Nov 10, 2020. “World Science Day”. Regional Science Centre. Bhubaneswar, India.
3. Dr. KV Badireenath has delivered an invited talk in the webinar on “Novel Coronavirus - mutations and beyond”. Sept 18, 2020. “31st Anniversary Week celebrations”. Regional Science Centre. Bhubaneswar, India.
4. Dr. KV Badireenath has delivered an invited talk in the webinar on “Effect of ultraviolet radiation on the health and ecosystem - Significance of ozone layer”. Sept 16, 2020. “World Ozone Day”. Regional Science Centre. Bhubaneswar, India.
5. Dr. Chandan Goswami has delivered a talk in the roundtable discussion on “Research and Career Opportunities in Bio Sciences with relevance to Germany!” Organized by DAAD. 3rd Feb 2021.
6. Dr. Chandan Goswami has delivered a talk in the roundtable discussion on New Education Policy 2020-5th March 2021, Organized by DAAD. Title: New education policy in India and Germany as an academic destination.
7. Dr. Renjith Mathew has delivered a talk in the National Webinar Series, Department Of Zoology, Rajdhani College, Bhubaneswar.
8. Dr. Renjith Mathew has delivered a talk in the UGC Human Resource Development Program, at Utkal University, Bhubaneswar, 2021.
9. Dr. Palok Aich has delivered a talk on “Innate Mucosal Immunity and microbial milieu. 5th Biennial Virtual Conference, Probiotic Association of India (Pai). Nov 19-20, 2020.
10. Dr. Palok Aich has presented a series of six (6) lectures. A BENCOS Education Initiative. Metagenomics Webinar Series, Sep 01-Sep 17, 2020. Bencos Ed, Mumbai/Bengaluru:
 - Sep 01: Introduction to Metagenomics
 - Sep 03: Microbiome & Health: How do we address?

- Sep 08: Technological advances and Model systems
 - Sep 10: Approaches to relate microbiome and physiology
 - Sep 14: Data acquisition and analysis
 - Sep 17: How is biology deciphered and what is next
11. Dr. Palok Aich has delivered a talk on "Influence of COVID on future learning and teaching: Will it be furloughed or a novel exigency? National Webinar series on Future of Institutional Education, Economy and Society in the Post-Covid Era, May 20, 2020. Jointly organized by IQAC, Gokhale Memorial Girls' College, Kolkata and Vijaygarh Jyotish Ray College, Kolkata, WB, India.
 12. Dr. M. Saleem has delivered an invited talk on "Mechanics of Cells and Tissues: Membranes, Cell and Tissue Mechanics and Biophysics" at the Complex Fluids 2020, an international online symposium jointly organized by IIT Bombay and Indian Rheological Society, held on 10-12th Dec, 2020. (<https://complexfluids.isr.org.in/schedule/>)
 13. Dr. R. Srinivasan has delivered an invited talk in a SYMPOSIUM - a virtual mini-symposium on Synthetic Biology, IISER Trivandrum, 21 - 22 November, 2020.
 14. Dr. R. Srinivasan has delivered a Guest Lecture Series - Amity Institute of Biotechnology, Amity University, Kolkata, 5th November, 2020.
 15. Dr. S. Ghosh has delivered a talk in a Webinar on Effective Scientific and Technological Approach in combating COVID-19 Across the world, Hiralal Mazumdar Memorial College for Women, West Bengal, India, 25th June 2020.

Sponsored Projects:

1. **Dr. Asima Bhattacharyya:** SERB POWER GRANT - Identification of extracellular vesicle (EV) protein biomarkers released by gastric epithelial cancer cells and decoding the functional significance of EV proteins in macrophage polarization. Recommended by SERB, India, under the scheme of SERB POWER GRANT to "emerging and eminent women researchers for individual-centric and competitive mode of research funding" (fund not released yet).
2. **Dr. Chandan Goswami:** Title of the project: "Modified polysaccharide based hydrogels for cost-

effective bone tissue engineering", Duration: 2019-2022 Grant number: ICMR: ITR/AD-HOC/16/2019-20 DT 26.8.19.

3. **Dr. Debasmita P. Alone:** Project title - Proteostasis impairment in the progression of Pseudoexfoliation Syndrome and Glaucoma (PI), SERB, 75.68 Lakhs, 2019-2022.
4. **Dr. Manjusha Dixit:** Project title - 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. Rudresh Acharya:** Project title - Mechanistic insights into functioning of polysaccharide lyases (PLs) belonging to class 5 (PL 5) from pathogenic bacteria such as *Ralstonia pickettii*, *Pseudomonas aeruginosa*: Funded by DBT.
6. **Dr. M Saleem:**
 - DBT-Wellcome Trust Intermediate Fellowship, a research grant to start from Sep, 01, 2021 for the duration of 5 years.
 - Grant Title: "Role of host membrane modulation by mycobacterial membrane vesicles in evading phagosome maturation". Sponsor: DBT-Wellcome Trust India Alliance.

Conferences & Seminars organized by the SBS Faculty Members:

1. **Dr. Palok Aich** has organized a virtual conference on Infectious disease, microbiome and public health in the current scenario during August 10-11, 2020.
 Day 1 (Aug 10, 2020)-
<https://www.youtube.com/watch?v=fKv6tHxkQ4&t=583s>
 Day 2 (Aug 11, 2020)-
https://www.youtube.com/watch?v=W1_wSc8KCwU&t=93s
2. **Dr. Aniruddha Datta Roy** has organized an online international workshop on "Molecular phylogenetics", in August 2020.
3. **Dr. Aniruddha Datta Roy** has played a lead role in organization of an online international workshop titled "Applications of molecular phylogenetics", in October 2020.

SCHOOL OF CHEMICAL SCIENCES

Methodology development for NMR spectroscopy

Dr. Arindam Ghosh, Reader-F

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

1. Tetrakis-(N-methyl-4-pyridinium)-Porphyrin as a Diamagnetic Chemical Exchange Saturation Transfer (diaCEST) MRI Contrast Agent, Subhayan Chakraborty, Mainak Das, A Srinivasan* and Arindam Ghosh* New Journal of Chemistry, 45, 1262 (2021).
2. Paracetamol and other Acetanilide analogs as inter-molecular hydrogen bonding assisted diamagnetic CEST MRI contrast agents, Subhayan Chakraborty, S. Peruncheralathan* and Arindam Ghosh*, RSC Advances, 11, 6526 (2021).

Syntheses, spectral and structural analyses Contracted and Expanded Carbaporphyrinoids. Applications of (a) dipyrromethane as sensor and (b) water soluble porphyrinoids as diaCEST reagents.

Prof. A Srinivasan, Professor

Our research interests are: (1) Syntheses, spectral and structural characterization of Isosmaragdyrin with N3C2 Core and exploited their coordination chemistry by stabilizing Rh(I) and organo-Pt(II) complexes; (2) PtCl₂ mediated peripheral transformation of carbatriphyrin (3.1.1) into a meso-

fused β - β' dimer and its monomer analogue. Metal assisted template strategy played an important role to synthesize such dimer and its monomer analogue; (3) Demonstrated the synthesis of various dipyrromethanes and explored its application as a molecular keypad lock and (4) Also, synthesized a water soluble porphyrinoid such as tetrakis-(N-methyl-4-pyridinium)-porphyrin and by collaboration exploited its diaCEST property.

Publications

- Isosmaragdyrin with an N3C2 core: Stabilization of Rh(I) and Organo-Pt(II) complexes. M. Das, S. Chitranshi, M. Murugavel, B. Adinarayana, C. H. Suresh and A. Srinivasan. Chem. Commun. 2020, 56, 3551-3554.
- PtCl₂ mediated peripheral transformation of carbatriphyrin (3.1.1) into a meso-fused β - β' dimer and its monomer analogue. M. Murugavel, B. Adinarayana, M. Das, S. Peruncheralathan, N. R. Palepu and A. Srinivasan. Chem. Commun. 2020, 56, 12809-12812.
- Engineering diformyl diaryldipyrromethane into a molecular keypad lock. K. C. Gowri Sreedevi, A. P. Thomas, B. Adinarayana and A. Srinivasan. New J. Chem. 2020, 44, 11768-11776.
- Tetrakis-(N-methyl-4-pyridinium)-porphyrin as a diamagnetic chemical exchange saturation transfer (diaCEST) MRI contrast agent. S. Chakraborty, M. Das, A. Srinivasan and A. Ghosh. New J. Chem. 2021, 45, 1262-1268.

Invited Talks

- (1) Invited talk; Title: Porphyrinoids with Polycyclic Aromatic units; VIT, Chennai, Tamilnadu, 21st August 2020 (virtual platform).
- (2) Institute Foundation Day Lecture; Title: Metals in Medicines and Therapy; 6th September 2020.
- (3) Invited talk: Contracted and Expanded Porphyrin Analogues; University of Kerala, Trivandrum, 18th March 2021 (Virtual Platform)

Sponsored Projects:

Title: Contracted & Expanded Porphyrin Analogues with Polycyclic Aromatic Units: Synthesis and Applications.

Budget: ₹49.97 Lakhs; Project Code: EMR/2017/2932;
Funding Agency: SERB, New Delhi. Status: On-going

Organometallic Chemistry and Catalysis

Dr. Bidraha Bagh, Assistant Professor

1. We performed selective hydrosilylations of esters to alcohols by a well-defined manganese(I) complex with a commercially available bisphosphine ligand. These reactions are easy alternatives for stoichiometric hydride reduction or hydrogenation, and employing cheap, abundant, and nonprecious metal is attractive. A large variety of aromatic, aliphatic, and cyclic esters bearing different functional groups were converted into the corresponding alcohols.
2. We synthesized an air-stable iridium(III) complex which catalyzed α -alkylation of arylacetonitriles using secondary alcohols. The α -alkylations were efficiently performed under solvent-free conditions with very low catalyst loading. Various cyclic and acyclic secondary alcohols and a wide variety of arylacetonitriles bearing different functional groups were converted into the corresponding α -alkylated products.
3. We synthesized ruthenium complexes with 1,2,3-triazoles. Air-stable ruthenium complex was an active catalyst for the transfer hydrogenation of a wide variety of aromatic and aliphatic aldehydes and ketones bearing various functionalities. Transfer hydrogenations were performed using challenging primary alcohols methanol and ethanol as well as commonly used isopropanol as hydrogen source. The sustainable and green credentials of these catalytic protocols were compared with the help of the CHEM21 green metrics toolkit.

Publications

- Behera, R. R.; Ghosh, R.; Panda, S.; Khamari, S.; Bagh, B. Hydrosilylation of Esters Catalyzed by Bisphosphine Manganese(I) Complex: Selective Transformation of Esters to Alcohols. *Org. Lett.* 2020, 22, 3642–3648.
- Panda, S.; Saha, R.; Sethi, S.; Ghosh, R.; gh, B. Efficient α -Alkylation of Arylacetonitriles with Secondary Alcohols Catalyzed by a Phosphine-Free Air-Stable Iridium(III) Complex. *J. Org. Chem.* 2020, 85, 15610–15621.

- Ghosh, R.; Jana, N. C.; Panda, S.; Bagh, Transfer Hydrogenation of Aldehydes and Ketones in Air with Methanol and Ethanol by an Air-Stable Ruthenium–Triazole Complex. *ACS Sustainable Chem. Eng.* 2021, 9, 4903–4914.

Conferences and Seminars Attended

5th International Conference on Catalysis and Chemical Engineering (CCE 2021)

Computational Modeling of Condensed Phase Systems

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- α amyloid - Phenol soluble modulin α 3 Mitradip Das, Sandeep Dash and B.L. Bhargava *Chemical Physics* 535, 110777 (2020)
- Aqueous solutions of hydroxyl-functionalized ionic liquids: Molecular dynamics studies. Amol Chandrakar and B.L. Bhargava *Journal of Molecular Graphics and Modelling* 101, 107721 (2020)
- Exploring the candidates for a new protein folding -- cross- α amyloid -- in available protein databases.
- Mitradip Das and B.L. Bhargava *Physical Chemistry Chemical Physics* 22, 23725-23734 (2020)
- Molecular dynamics simulations of ionic liquids B.L. Bhargava *Theoretical and Computational Approaches to Predicting Ionic Liquid Properties*, Elsevier, 87 - 104 (2020)

Development of Advanced Organic Frameworks and Composite Membranes Materials for Energy Storage, Conversion and Water Purification

Dr. Bishnu Prasad Biswal, Assistant Professor

Considering the world's growing demand for energy, supercapacitor (SC) based energy storage technology plays a pivotal role in high-power delivery applications with long-term durability. Based on the charge storage mechanism, SCs are classified into electrical double-layer capacitors (EDLCs) and pseudocapacitors (PCs). Among various active materials explored for SCs, two-dimensional (2D) materials and their composites have shown great potential owing to their tailorable porous structures, and excellent mechanical and electronic properties. Surprisingly, most of the reports known for SCs are dedicated to developing 2D composites by integrating EDLC materials (e.g. graphene) and pseudocapacitive materials. Preparing composites of pseudocapacitive materials remains a bottleneck due to their poor compatibility and solvent processability issues. Hence, we aim to develop low cost, safer high performing next generation energy-storage devices using novel 2D hybrid nanocomposites.

Publications

- Construction of MXene-coupled nitrogen-doped porous carbon hybrid from conjugated microporous polymer for high-performance supercapacitors; Jensheer Shamsudeen Seenath* and Bishnu P. Biswal*; **Adv. Energy Sustainability Res., 2021, 2000052.** DOI:10.1002/aesr.202000052

Awards and Honours

Received DST-INSPIRE Faculty Award (Research Grant: Rs.35 Lakh for 5 years)

Invited Talks

- Invited speaker in "EFCS-2021" at Hindol Degree College, Dhenkanal, Odisha.
- Invited speaker in "RAEM-2021" at Centurion University, Bhubaneswar, Odisha.

Sponsored Projects

- DST-INSPIRE faculty award "Conversion of CO₂ to renewable fuels using photocatalytic membrane reactor composed of crystalline, porous polymers"

- Submitted a CRG proposal to SERB on "Development of Organic Frameworks and Composite Membranes towards Solar Fuel Production and Water Purification"

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.

We have developed the following catalytic transformations based on amine-amide metal ligand cooperation (AAMLC): (1) selective mono-deuteration of terminal alkynes using D₂O, (2) highly selective α - and $\alpha\beta$ -deuteration of alcohols using D₂O, (3) selective α -deuteration of aliphatic nitriles using D₂O, (4) facile α -alkylation of arylmethyl nitriles using primary alcohols, (5) direct α -olefination of nitriles using secondary alcohols, (6) ketazines synthesis directly from secondary alcohols, (7) unprecedented direct cross-coupling of secondary alcohols (a new reaction discovered by us), (8) α -alkylation of ketones using secondary alcohols, (9) direct N,N-dialkylation of acylhydrazides using alcohols, (10) urea synthesis by N-H activation of amines using DMF as a carbonyl source, and (11) highly regioselective hydrogenation of epoxides to secondary alcohols. Remarkably, these reactions are efficient, require only a catalytic amount of base, and produce no hazardous waste. The only byproducts being water and/or molecular hydrogen, these catalytic protocols provided highly atom economical and green synthetic methodologies. Overall, these recent developments in the topic of AAMLC will ensure sustainability and provide future advancement for the atom-economical and green catalytic transformations.

Significantly, involvement of monohydrido bridged dinuclear Ru intermediate $[(\eta^6\text{-p-cymene})\text{RuCl}]_2(\mu\text{-H}-\mu\text{-Cl})$ in hydroelementation reaction was hitherto unknown and uncovered by us, which enhanced the fundamental understanding of the reaction mechanism. (1) selective hydrosilylation of aldehydes,

(2) selective hydroboration of carbonyl compounds, (3) selective hydroboration of nitriles and imines, (4) anti-Markovnikov selective hydroboration of alkenes, (5) hydroboration of carboxylic acids to borylethers, and (6) hydroboration of ethers to alkanes and boronate esters in which the addition of B–H bond over the C–O single bond was established for the first time.

Publications

- Behera, D.; Thiagarajan, S.; Anjalikrishna, P. K.; Suresh, C. H.; Gunanathan, C. Ruthenium(II)-Catalyzed Regioselective 1,2-Hydrosilylation of N-Heteroarenes and Tetrel Bonding Mechanism. *ACS Catal.* 2021, 11, 5885–5893. [Impact Factor: 12.35]
- Kaithal, A.; Kalsi, D.; Krishnakumar, V.; Pattanaik, S.; Bordet, A.; Leitner, W.; Gunanathan, C. Ruthenium-Catalyzed Selective Hydroboronolysis of Ethers. *ACS Catal.* 2020, 10, 14390–14397. [Impact Factor: 12.35]
- Thiagarajan, S.; †Sankar, R. V.; Gunanathan, C. Ruthenium-Catalyzed α -Alkylation of Ketones Using Secondary Alcohols to β -Disubstituted Ketones. *Org. Lett.* 2020, 22, 7879–7884. [Impact Factor: 6.091]
- Thiagarajan, S.; Gunanathan, C. Direct Catalytic Symmetrical, Unsymmetrical N,N-Dialkylation and Cyclization of Acylhydrazides Using Alcohols. *Org. Lett.* 2020, 22, 6617–6622. [Impact Factor: 6.091] Highlighted in Organic Chemistry Portal <https://www.organicchemistry.org/abstracts/lit/7501.shtm>
- Chatterjee, B.; Kalsi, D.; Kaithal, A.; Bordet, A.; Leitner, W.; Gunanathan, C. One-pot dual catalysis for the hydrogenation of heteroarenes and arenes. *Catal. Sci. Technol.* 2020, 10, 5163–5170. [Impact Factor: 5.721]
- Pattanaik, S.; Gunanathan, C. Cobalt-Catalysed Selective Synthesis of Aldehydes and Alcohols from Esters. *Chem. Commun.* 2020, 56, 7345–7348. [Impact Factor: 5.996]

Awards and Honours

- Thieme Chemistry Journals Award 2020.
- CRSI Bronze medal 2020.
- Appeared among top 1% in the list of top 2% scientists worldwide for the year 2019.

Invited Talks

- (1) Green Catalysis Facilitated by Amine-Amide Metal-Ligand Cooperation. International

Conference on Recent Development in Organic and Applied Chemistry (RDAOC-2020), KIIT Bhubaneswar, 6-7th July 2020.

- (2) Green Catalysis Enabled by Metal-Ligand Cooperation. Delivered the lecture on 27th July 2020 at Webinar Series on “Modern Trends in Organic Synthesis” conducted by School of Chemistry, Bharathidasan University, TN during July 27-31, 2020.
- (3) Green Catalysis Enabled by Metal-Ligand Cooperation. Delivered the lecture on 6th Nov. 2020 at International Live Webinar Series on “Next Generation Material Chemistry-NGMC2020” conducted by St. Joseph's College, Trichy, TN during Nov. 5-6, 2020.
- (4) Amine-Amide Metal-Ligand Cooperation in Catalysis. Delivered the lecture on 10th Dec. 2020 at “RSC Sponsored Chemical Science Virtual Symposium-ChemSci2020” in IISER Kolkata during December 7-10, 2020
- (5) Green Catalysis Enabled by Metal-Ligand Cooperation. Delivered the lecture on 8th March 2021 at National seminar on “Recent Advances in Material Chemistry-RAMC2021” conducted by Utkal University, Bhubaneswar during 8-9 March, 2021.

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. Sanctioned amount: 49,89,600/-

Completed in 4th Feb. 2021.

Additional information, if any:

- Invited and acted as External Expert in a SRF assessment, CSIR-CSMCRI, Bhavnagar (6th May 2021).
- Invited and acted as External Examiner for Ph. D Viva-Voice examination at Department of Chemistry, IISER Pune (18th December 2020).
- Invited and acted as External Examiner in a Ph. D Viva-Voice examination at Department of Chemistry, NIT-Kurukshetra (29th December 2020).

- Invited and acted as External Expert in selection of Project Associate – I., CSIR-CSMCRI, Bhavnagar (30th September 2020).
- Invited and acted as External Examiner in a Ph. D Viva-Voice examination at University of Hyderabad, Hyderabad (18th August 2020).

Mr. Deepak Behera completed his Int.MSc project work in the group and he has recently accepted Ph.D. position from the prestigious research group of Prof. Dr. Lutz Ackermann, Georg-August-Universität Göttingen, Germany.

Two students completed Ph.D.:

1) Dr. Suhas S. Gawali

Current Position: Assistant Professor, Sunderrao Solanke Mahavidyalaya, Majalgaon, Maharashtra.

2) Dr. S. Thiagarajan

Recipient of HBNI-Outstanding Doctoral Student Award-2021

Current Position: Accepted Post-Doctoral Position at Weizmann Institute of Science, Israel.

Adviser: Prof. David Milstein

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 in normal ways of synthesis. We are in a process of preparing catenane polymers and other molecular architecture which are useful as special material for different purposes.

Invited Talks

- Genesis of molecular machine: synthesis and application at Jawaharlal College, Patnagarh, Odisha.

Chemistry inside the nanoconfinement of a self-assembled coordination cage

Dr. Dipak Samanta, Assistant Professor

Confining molecules can profoundly alter their chemical and physical properties. Interest in using confined spaces to develop strategies to stabilize reactive chemical species, to perform reaction with accelerated rate and excellent selectivity has increased exponentially in recent years. Our research focuses on the design and synthesis of molecular architectures with internal cavities suitable for encapsulation of varieties of different guest molecules. We also investigate photochromism, photosensitization, catalysis and stabilizing reactive intermediates in the cavities of these cages. We believe that the studying chemistry in the confinement is a unique way of performing chemical reactions, paving the way to discovery of new phenomena.

Awards and Honours: DST-Inspire Faculty Award

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 photo-dynamic 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.

Publications

1. "Implication of Threonine-Based Ionic Liquids on the Structural Stability, Binding and Activity of Cytochrome c" D. K. Sahoo, K. D. Tulsian, S. Jena, **H. S. Biswal***; **ChemPhysChem** (2020), 21, 2525-2535.
2. "Hydrogen-bond-driven thiouracil dissolution in aqueous ionic liquid: A combined microscopic, spectroscopic and molecular dynamics study" D. K. Sahoo, A. Chand, S. Jena, **H. S. Biswal***; **J. Mol. Liq.** (2020), 319, 114275.
3. "Non-conventional Hydrogen Bonding and Aromaticity: A Systematic Study on Model Nucleobases and Their Solvated Clusters" S. Jena, K. D. Tulsian, A. Rana, S. S. Choudhury, **H. S. Biswal***; **ChemPhysChem** (2020), 21, 1826-1835.
4. "The prodigious hydrogen bonds with sulfur and selenium in molecular assemblies, structural biology, and functional materials" A. Chand, D. K. Sahoo, A. Rana, S. Jena, **H. S. Biswal***; **Acc. Chem. Res.** (2020), 53, 1580-1592.
5. "In silico identification of potential natural product inhibitors of human proteases key to SARS-CoV-2 infection" RP Vivek-Ananth, A. Rana, N. Rajan, **H. S. Biswal***, **A. Samal***; **Molecules** (2020), 25(17), 3822.
6. "Unravelling the electronic nature of C-F...O-C non-covalent interaction in proteins and small molecules in the solid state" A. Rana, B. Galmés, A. Frontera*, **H. S. Biswal***, **D. Chopra***; **Phys. Chem. Chem. Phys.** (2020), 22, 25704-25711. (7) "Non-covalent interactions with inverted carbon: a carbo-hydrogen bond or a new type of hydrogen

bond?" J. Dutta, D. K. Sahoo, S. Jena, K. D. Tulsian, and **H. S. Biswal***; **Phys. Chem. Chem. Phys.** (2020), 22, 8988-8997.

7. "Hydrogen Bonds with Chalcogens: Looking Beyond the Second Row of the Periodic Table." A. Chand, and **H. S. Biswal***; **J. Ind. Inst. Sci.** (2020), 100, 77-100. (Invited article for Centenary Year of the Hydrogen Bond)
8. "Characterization of (Boc-Cys/Sec-NHMe)₂ and (Boc-Cys/Sec-OMe)₂ : Evidence of local conformational difference between disulfide and diselenide." A. Dolle, K. K. A. Reddy, S. S. Gunaga, K. Krishnamurthy, D. K. Senapati, A. Rana, K. Sindogi, **H. S. Biswal***, S. Raghothama, and K. H. Gowd*; **J. Pept. Sci.**, (2020), 26, 3245.
9. "Doubling Förster Resonance Energy Transfer Efficiency in Proteins with Extrinsic Thioamide Probes: Implications to Thiomodified Nucleobases" S. Jena, K. D. Tulsian, R. K. Kar, H. K. Kisan, **H. S. Biswal*** **Chem. Eur. J.** (2021), 27, 4373.
10. "Nominal Effect of Mg Intercalation on the Superconductivity Properties of 2H-NbSe₂, S. Naik, S. Kalaiarasan, R. Nath, S. Sarangi, A. Sahu, D. Samal, **H. S. Biswal**, S. Samal*; **Inorg. Chem.**, (2021), 60, 4588.
11. "Redox active conopeptide derived from venom duct transcriptome of Conus lividus assists the oxidative folding of conotoxin, A. Dolle, M. Vijayasathy, S. Shekh, Y. Hunashal, K. K. A. Reddy, S. Prakash, A. Rana, **H. S. Biswal**, S. Raghothama, K. Gowd*; **Biochemistry**, (2021), Accepted.

Awards and Honours

Affiliate member of the Royal Society of Chemistry, UK

Invited Talks

- (1) "Hydrogen Bonds with Sulfur and Selenium in Materials Chemistry" August 10-12, 2020, "Webinar on "Emerging Smart Materials in Applied Chemistry (ESMAC-2020)" KIIT Deemed to be University, Bhubaneswar, INDIA
- (2) "Non-covalent Interactions in the Last Decade: A Voyage through Hydrogen Bond, Carbon Bond and Carbo-hydrogen Bond" November 4, 2020, "Webinar Series (LOQUITOR 2020)." IISER, Berhampur, INDIA
- (3) "Hydrogen Bond, Carbon Bond and Carbo-hydrogen Bond in Biomolecules" January 23, IISER, Tirupati, 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: Rs, 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 MOF-Based 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.
- 3 Electroactive material for electrochemical energy conversion and storage application:** Layered composite materials of metal chalcogenides with reduced graphene oxide are being prepared and their supercapacitor capacity is being tested, as these materials shows potential applications in storage devices.
- 4 Organic-Inorganic hybrid materials:** New organic-inorganic hybrid materials using different metal ions and ligands like 4,5-dihydroxy-1,3-benzenedisulfonic acid disodium salt have been used to obtain different architectures and characterized. The short interatomic interactions in the crystal structures were evaluated by mapping Hirshfeld surfaces process using pseudo-mirrored 2D fingerprint plots. The major short interatomic interactions H...H, O...H and C...H cover the Hirshfeld surfaces.

Publications

1. A. Ghosh, H. Saini, A. Sarkar, P. Guha, R. Thapa; S. Mandal, A. Mandal, S. K. Ray, A. K. Samantara, J. N. Behera and D. K. Goswami, Nitrogen Vacancy and

Hydrogen Substitution Mediated Tunable Optoelectronic Properties of g-C₃N₄ 2D Layered Structures: Applications towards Blue LED to Broad-band Photodetection, *Applied Surface Science*, **2021**, <https://doi.org/10.1016/j.apsusc.2021.149773>.

2. S. Konduri, V. Pogaku, J. Prashanth, V. S. Krishna, D. Sriram, S. Basavoju, J. N. Behera and K. P. Rao, Sacubitril Based Urea and Thiourea Derivatives as Novel Inhibitors for Anti-tubercular against Dormant Tuberculosis, *ChemistrySelect*, **2021**, **6**, 3869.
3. R. K. Tiwari, I. Shruti and J. N. Behera, Synthesis, structure and Hirshfeld surface analysis of three novel metal-tiron coordination complexes, *RSC Adv.*, **2021**, **11**, 10767.
4. R. K. Tripathy, A. K. Samantara and J. N. Behera, Metal Organic Framework (MOF) derived Amorphous Nickel Boride: An electroactive material for electrochemical energy conversion and storage application, *Sustainable Energy Fuels*, **2021**, **5**, 1184.
5. R. Samal, A. K. Samantara, S. Mahalik, J. N. Behera, B. Dash and K. Sanjay, Anionic and cationic surfactants-assisted hydrothermal synthesis of cobalt oxide nanoparticles as the active electrode material for supercapacitor, *New J. Chem.*, **2021**, **45**, 2795.
6. S. Mondal, N. Jaiswal, P. Bera, R. Tiwari, J. N. Behera, N. Chanda, S. Ghosal and T. K. Saha, Cu(II) and Co(II/III) complexes of N,O-Chelated Schiff base Ligands: DNA Interaction, Protein binding, Cytotoxicity, Cell Death Mechanism and ROS Generation Studies, *Appl Organometal Chem.*, **2021**, **35**, e6026.
7. A. K. Samantara, J. K. Das and J. N. Behera, Supercapacitors based on graphene and its hybrids, **Book Chapter**, "Fundamentals and Supercapacitor Applications of 2D Materials" Elsevier, **2021**, Paperback ISBN: 9780128219935.
8. A. K. Samantara, R. K. Tripathy and J. N. Behera, Hybrid Nanocomposites Based on Graphene and Gold Nanoparticles: From Preparation to Applications, **Book Chapter**, Springer, **2021**, Paperback ISBN: 978-981-334-987-2.
9. M. K. Sahoo, A. K. Samantara and J. N. Behera, In-situ Transformed Cobalt Metal-Organic Framework Electrocatalysts for Electrochemical Oxygen Evolution Reaction, *Inorg. Chem.*, **2020**, **59**, 12252.
10. K. Srihari, P. Jyothi, S. K. Vagolu, S. Dharmarajan, J. N. Behera, S. Dionicio and K. P. Rao, Design and Synthesis of Purine Connected Piperazine Derivatives as Novel Inhibitors of Mycobacterium tuberculosis, *Bioorg. Med. Chem. Lett.*, **2020**, **30**, 127512.

11. J. K. Das, A. Samantara, S. Satyarthi, C. S. Rout and J. N. Behera, Three dimensional NiCoP hollow spheres; efficient electrode material for hydrogen evolution reaction and supercapacitor application, *RSC Adv.*, **2020**, *10*, 4650.

Awards and Honours

- **Contribution to the Powder Diffraction File in Release 2020 (ICDD). (Certificate awarded)**
- Inspire Award-Manak, has served as reviewer of innovative ideas/innovations received under the **INSPIRE Awards-MANAK** for the year **2020-21**.

Understanding the behaviour of some new liquid and solid nanostructured materials through steady state and time resolved fluorescence spectroscopy

Dr. Moley Sarkar, Associate Professor

During this period, we have mainly concentrated on understanding the behavior of materials through various spectroscopic investigations. Inorganic-Organic Hybrid Materials comprising of less toxic water soluble inorganic semiconductor (Cd free) metal nano particles and organic-J aggregates has been fabricated. It has been shown that energy transfer from water soluble QD to Organic J-aggregates is very high. Outcome of these studies will be useful for research on green quantum dots. We have also shown for the first time that energy transfer from fluorescent metal nanoparticle to J aggregates is highly efficient. On the mechanism we have shown that Dexter mechanism is not responsible for the ensuing FRET Event. We have also recently demonstrated that as compared to usual monocatinic ionic liquids, DILs would be a better medium for biomacromolecules. Microscopic properties of deep eutectic solvents have also been studied.

Publications

1. Highly efficient energy transfers from a water soluble zinc silver indium sulphide quantum dot to organic J-aggregates. N. Preyanka, H. Dey, S. Seth, A. Rahamana and **M. Sarkar**, *Physical Chemistry Chemical Physics*, **2020**, *22*, 12772.

2. Gajula, R. K.; Mohanty, S.; Chakraborty, M.; **Sarkar, M** and Jaya Prakash, M. An imine linked fluorescent covalent organic cage: the sensing of chloroform vapour and metal ions, and the detection of nitroaromatics. *New J. Chem.*, **2021**, *45*, 4810-4822.
3. Probing the Interaction of Bovine Serum Albumin with Copper Nanoclusters: Realization of Binding Pathway Different from Protein Corona. A. Akhuli, D. Chakraborty, A. Agrawal, and **M. Sarkar**, *Langmuir*, **2021**, *37*, 1823-1837

Awards and Honours

Selected as an associate member (**AMRSC**) of Royal Society of Chemistry.

Conferences and Seminars attended

1. International Conference on Non-Covalent Interaction: Basic and Application, Bajkul Milani Mahavidyalaya, West Bengal, India. 14th December 2020.
2. Arranged one online workshop (**Authors Workshop**) in our department by Wiley-VCH. Presentations were made by Wiley Editors.

Invited Talks

Acted as resource person for judging various presentations on research methodologies organized by Uktal University, Bhubaneswar.

Sponsored Projects

“Understanding the photophysics of molecular (organic) aggregates Towards finding new hybrid nanoscale materials for optoelectronic applications”, Funding Agency SERB, Amount: Rs. 58, 00010/-. (On going Project)

Syntheses and Biochemical Evaluations of Modified Peptides and Nucleic acid (DNA/RNA) Analogues

Dr. Nagendra K. Sharma, Associate Professor

Nucleic acid (DNA/RNA) and protein/peptides interactions play critical roles for the regulation of gene expressions in living systems. The regulation of target specific gene are new avenue for the development therapeutic drug candidates. However, many challenges persist for employing as drugs from

native DNA, RNA and peptides molecules such as site specific delivery, stability and off target effects. Thus the structural modifications of DNA/RNA/Peptides are attempted to improve the major hurdles using as drugs. My research group emphasizes on the synthesis of rationally designed DNA/RNA/peptides analogues and biochemical evaluations using NMR/UV-Vis/Fluorescence/ESI-Mass techniques. Recently my group synthesised various amino acids/peptides/DNA/RNA analogues for tuning the peptide and nucleic acids structural conformations to improve binding affinity and other biochemical features which are essential to prepare the potential drug candidates.

Publications

1. The 2'-**caged-tethered**-siRNA Shows Light-Dependent Temporal Controlled RNAi activity for GFP gene into HEK293T cells; Bollu, A., Hassan, M. K., Dixit, M. **Sharma, N. K.** *Bioorg. Med. Chem.* **2021**, *30*, 115932
2. N-Arylated peptide: troponyl residue influences the structure and conformation of N-troponylated-(di/tri)-peptides; Palai, B. B.; **Sharma, N. K.*** *CrystEngComm*, **2021**, *23*, 131-139
3. Biased Photo Cleavage of N1-/N6-Nitrobenzyl from 2'-hydroxyethyl-Adenosine and their DNA/RNA Caged-Analogues, Bollu, A. **Sharma, N. K.** *Journal of Photochemistry and Photobiology A: Chemistry*, **2021**, *440*, 112864.
4. Instability of Amide Bond With TFA (20%): Synthesis, Conformational Analysis and Mechanistic Insights of Cleavable Amide Bond Comprising β -Troponylhydrazino Acid; N. Dalabehera, N.; Meher, S; Palai, B. B.; **Sharma, N. K.*** *ACS Omega*, **2020**, *5*, 26141-26152.
5. Synthesis and biochemical evaluation of Aminopropanolyl-Thymine tri-Phosphate (ap-TTP), Gade, C. R. and **Sharma, N. K.**, *Nucleosides, Nucleotides, and Nucleic Acid*. **2020**, *39*, 730-743

Conferences and Seminars Attended

1. CHEMBIOSIS 2020, IISER-Tirupati, Tirupati (AP)-India.
2. "WOMEN IN ORGANIC CHEMISTRY" (WOC-2020), Aug 28, 2020, Department of Chemistry, Ravenshaw University, Cuttack, Odisha 753003, India.

3. Hands-on Training on Product Validation and Quality Control Sponsored by: BIRAC & National Biopharma Mission, 2nd-6th March 2020

SAIS SYMPOSIUM 2020 (WEBINAR), Organized by the School of Applied and Interdisciplinary Sciences, IACS, Kolkata, Date: 04-05 December, 2020

Invited Talks

1. Hands-on Training on Product Validation and Quality Control Sponsored by: BIRAC & National Biopharma Mission, 2nd-6th March 2020
2. SAIS SYMPOSIUM 2020 (WEBINAR), Organized by the School of Applied and Interdisciplinary Sciences, IACS, Kolkata, Date: 04-05 December, 2020

Sponsored Projects

1. Department of Biotechnology (DBT), Ministry of Science & Technology, Govt. of India, New Delhi; CRISPR-RNA-Cas9 System: Syntheses and Biochemical Evaluations of Nucleobase Modified tropolonyl-Ribose Nucleoside in CRISPR-RNA.
2. Science and Engineering Research Board (SERB)-Department of Science and Technology, Government of India, New Delhi (Title: Synthesis of Functional DNA Comprising Aminotroponyl 2'-deoxyuridine Analogues For Cross-linking with Peptides.

Additional information, if any

We are also involved in the synthesis of unnatural amino acid and their peptides through the Pd-catalysed C-H activation.

Functionalizations of arene and heteroarenes. Application of three membered strained ring systems as 3C synthons for the synthesis of heterocycles

Dr. P. C. Ravikumar, Associate Professor

C-C bond is generally considered as an inert bond due to the following reasons

1. High bond energy (90 kcal/mol)
2. High energy barrier for cleavage of C-C bond

3. Highly non-polar & inert to a variety of polar reaction conditions

Therefore, **C-C bond** cleavage process was traditionally considered as ineffective strategy for the formation of new bonds such as **C-C, C-N, C-O, C-X** etc., However strained cycloalkanes/cycloalkenes (Figure 1) such as cyclobutanes, cyclopropanes and cyclopropenes are used as substrates wherein cleavage of **C-C** bonds leads to multiple bonds forming events under the influence of transition metals.

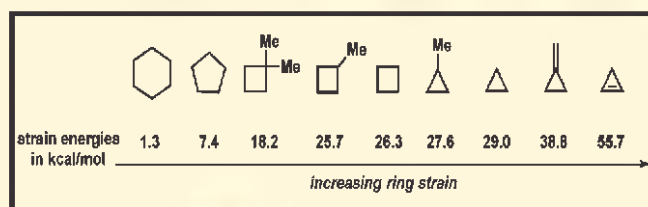


Figure: Strain energies of cycloalkanes.

The inherent strain in such systems largely offsets the thermodynamic barrier for **C-C bond** cleavage process and hence wide range of interesting organic skeletons can be synthesized.

The cleavage and reorganization of the **C-C bonds** are the key processes in petroleum cracking process of crude oil refineries. In contrast **C-C bond** cleavage as a strategy for the production of fine chemicals is still in its infancy.

Strained carbocyclic systems provide an excellent opportunity to harness the potential of **C-C bond** cleavage process for the synthesis of useful organic molecules. We have utilized this approach for the synthesis of new heterocyclic and useful organic molecules.

Publications

1. Tanmayee Nanda, Pragati Biswal, Bedadyuti Vedvyas Pati, Shyam Kumar Banjare, and Ponneri Chandrababu Ravikumar, Palladium-Catalyzed C-C Bond Activation of Cyclopropenone: Modular Access to Trisubstituted α,β -Unsaturated Esters and Amides, *J. Org. Chem.*, **2021**, 86, 2682.
2. Namrata Prusty, Lakshmanakumar Kinthada, Rohit Meena, Rajesh Chebolu and Ponneri Chandrababu Ravikumar, Bismuth (III)-Catalyzed Regioselective Alkylation of Tetrahydroquinolines and indolines

towards the synthesis of Bioactive core-Biaryl oxindole and CYP19 inhibitor, *Org. Bio. Chem.*, **2021**, 19, 891.

3. Smruti Ranjan Mohanty, Bedadyuti Vedvyas Pati, Shyam Kumar Banjare, Gopal Krushna Das Adhikari, and Ponneri Chandrababu Ravikumar, Redox-Neutral Cobalt(III)-Catalyzed C-H Activation/Annulation of α,β -Unsaturated Oxime Ether with Alkyne: One-Step Access to Multisubstituted Pyridine, *J. Org. Chem.*, **2021**, 86, 1074.
4. Pragati Biswal, Shyam Kumar Banjare, Bedadyuti Vedvyas Pati, Smruti Ranjan Mohanty, and Ponneri Chandrababu Ravikumar, Rhodium-Catalyzed One-Pot Access to N-Polycyclic Aromatic Hydrocarbons from Aryl Ketones through Triple C-H Bond Activation, *J. Org. Chem.*, **2021**, 86, 1108.
5. Shyam Kumar Banjare, Tanmayee Nanda, Bedadyuti Vedvyas Pati, Pragati Biswal, and Ponneri Chandrababu Ravikumar, O-directed C-H functionalization via cobaltacycles: A sustainable approach for C-C and C-heteroatom bond formations, *Chem Comm.* **2021**, 57, 3630.
6. Bedadyuti Vedvyas Pati, Prateep Singh Sagara, Asit Ghosh, Smruti Ranjan Mohanty, and Ponneri Chandrababu Ravikumar, Ruthenium-Catalyzed Cross Dehydrogenative Annulation of N-(7-Azaindole) benzamides with Maleimides: One-Step Access to Highly Functionalized Pyrroloisoquinoline, *J. Org. Chem.* **2021**, 86, 6551.
7. Gopal Krushna Das Adhikari, Rajesh Chebolu, Ponneri Chandrababu Ravikumar. Regio- and Stereoselective Synthesis of the Core Structure of Hexahydrobenzo[c]phenanthridine Alkaloids via Redox-Neutral $\text{Cp}^*\text{Rh(III)}$ -Catalyzed C-H/N-H Annulation of Cyclic Alkenes with Benzamides, *ACS Omega*, **2020**, 5, 24033.

Sponsored Projects

Title: Development of first-row transition metal catalyzed C-H activation approach for the enantioselective synthesis of complex tri- and tetra-cyclic alkaloid natural product and their hybrid structures.

Funding Agency: SERB, New Delhi

Amount: Rs. 57,00,000.00

Tenure: 2018-2021

Weak Interactions to Control C-S Bond Formation Reactions

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 low-energy and low-level 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

1. M. Pramanik, A. Mathuri and **P. Mal**, Sulfur...oxygen interaction-controlled (Z)-selective anti-Markovnikov vinyl sulfides, *Chem. Commun.*, **2021**, *57*, 5698-5701.
2. M. Das, D. Maity, T. K. Acharya, S. Sau, C. Giri, C. Goswami and **P. Mal**, Lowest aqueous picomolar fluoride ions and in vivo aluminum toxicity detection by an aluminum(III) binding chemosensor, *Dalton Trans.*, **2021**, *50*, 3027-3036.
3. 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**, *56*, 10211-10214.
4. M. Pramanik, K. Choudhuri and **P. Mal**, Metal-free C-S coupling of thiols and disulfides, *Org. Biomol. Chem.*, **2020**, *18*, 8771-8792.
5. 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.
6. A. Mandal, A. Choudhuri, 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.
7. A. Mandal, A. Choudhuri, 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.

8. K. Choudhuri, M. Pramanik and **P. Mal**, Noncovalent Interactions in C-S Bond Formation Reactions, *J. Org. Chem.*, **2020**, *85*, 11997-12011.
9. K. Choudhuri, M. Pramanik and **P. Mal**, Direct C-S Bond Functionalization of Benzyl Mercaptan, *Eur. J. Org. Chem.*, **2020**, 3906-3913.
10. A. Bal, S. Maiti and **P. Mal**, Intermolecular C-Arylation of 2-Amidobiphenyls Overcoming Intramolecular N-Arylation, *Asian J. Org. Chem.*, **2020**, *9*, 1783-1786.
11. A. Bal, S. Maiti and **P. Mal**, Strategies to Control Hypervalent Iodine - Primary Amine Reactions, *Chem. Asian J.*, **2020**, *15*, 624-635.

Awards and Honours

CRS Bronze Medal 2021 (Chirantan Rasayan Sanstha, Vidyasagar University, West Bengal)

Conferences and Seminars Attended

- 1) Webinar; organized by NIT Manipur, 4th Nov 2020
- 2) 57th Annual Convention of Chemists (ACC), Indian Chemical Society (ICS); December 27, 2020, Dept. of Chemical Sciences, IISER Kolkata

Invited Talks

- 1) "Weak Interactions in C-Hetero Bond Formation Reactions" CRS Medal Lecture: Third webinar on Science beyond Boundary: Invention, Discovery, Innovation and Society "RASAYAN 7" by Chirantan Rasayan Sanstha: February 20, 2021
- 2) "Weak Interactions in C-Hetero Bond Formation Reactions" in -National E-Workshop on Advancements in the Molecular World: Materials and Catalysis (AMWMC-2021) 15-19 February 2021, NIT Karnataka, Surathkal Srinivasnagar, Mangaluru
- 3) "Weak Interactions to Control C-S Bond Formation Reactions" in -The Present and Future of Excellence in Organic Synthesis (PFEOS-2021), January 7-8, 2021, Department of Chemical Sciences, Tezpur University, Assam

- 4) “**Supramolecular Catalysis in C-Hetero Bond Formation Reactions**” Online webinar entitled “Catalysis in Synthesis” at National Institute of Technology, Manipur during 1-5 November, 2020.

Nanostructured Materials for energy conversion and storage

Dr. Sudip Barman, Associate Professor

Development of new electrode materials for electrochemical energy conversion and energy storage are of great importance because of the growing energy demand. Supercapacitors are important energy storage devices because of their high power density and long cycle life. We developed a simple solvothermal method to synthesize a cobalt vanadium oxide/carbon composite (Co₃V₂O₈/C) for superior supercapacitor performance. Earth-abundant and noble-metal free are highly desirable for efficient alkaline overall water splitting. We synthesized Cobalt Aluminium hydroxide [CO₁Al₂(OH)_m] supported on carbon sheets for superior oxygen evolution reaction in alkaline media. We also developed a facile synthesis method of Pd-based electrocatalyst for hydrogen evolution reactions. These works may provide an opportunity to design Pt-free oxide-based catalysts for renewable energy technologies.

Publications

1. Tanmay Bhowmik, Ranjit Mishra and **Sudip Barman*** *Energy & Fuels* 2021, **35**, 6, 5206-5216.
2. Ranjit Mishra, Prjanshree Panda and **Sudip Barman*** *New J. Chem.*, 2021, **45**, 5897-5906.
3. Rajib Samanta, Ranjit Mishra, **Sudip Barman***, *ChemSusChem* 2021, **14**, 9, 2112-2125.

Ultrafast and Single Molecule Spectroscopy Study of Nanomaterials

Dr. Subhadip Ghosh, Associate Professor

Fast exciton-exciton annihilation occurring at a few 10s ps time scale possesses a potential hurdle to the successful utilization of a multiple exciton generation (MEG) process. MEG produces over 100% quantum efficiency of exciton generation and thereby a

dramatic improvement in device performance. Successful implementation of MEG would require a faster charge separation than the exciton annihilation time. In this work we showed < 1 ps photoinduced electron transfer (PET) time scale at graphene quantum dot (GQD)/N,N-dimethylaniline (DMA) interface that would probably allow electron-hole separation much before it annihilates. Modern experimental techniques, including ensemble-based femtosecond fluorescence upconversion and single molecule sensitive fluorescence correlation spectroscopy (FCS), are employed for an in-depth study of PET kinetics. Former technique asserts the ultrafast nature of interfacial PET kinetics, while FCS reveals weak molecular interactions resulting in short-lived (~4–6 μs) GQD-DMA complex formation in water. A few microseconds binding time allowed us to measure accurately the much faster.

Publications

Krishna Mishra, Ayendrila Das, **Subhadip Ghosh*** Subpicosecond Charge Separation Time Scale at Graphene Quantum Dot Surface. *J. Phys. Chem. C* 2020, **124**, 24115-24125

Conferences and Seminars Attended

RECENT TRENDS IN NANOMATERIALS & NANO BIOMATERIALS (RTNN), Narajole Raj College Narajole, Paschim Medinipur, West Bengal, India

Invited Talks

Delivered one invited talk on 14th June at Narajole Raj College

Sponsored Projects

1. Ultrafast and Single Molecule Spectroscopy Study of Polymers Organometallic Compounds and Bio-Macromolecular Assemblies, Funded by CSIR
2. Research in Basic Sciences funded by DAE

Bioinorganic Chemistry

Dr. Sanjib Kar, Associate Professor

Inspired by the natural photosynthetic light harvesting antenna, chemists have investigated the use of various porphyrin arrays in order to mimic nature. Porphyrin

arrays are considered to be indispensable components in various energy- and electron-transfer processes, redox catalysis, and in photonic devices. Therefore, it is absolutely essential to understand the electronic communication among the porphyrin units in various porphyrin arrays. The electronic communication between the porphyrin units can be easily tuned by changing the distance, geometry and the orientations of the interacting units. Corrole, a contracted porphyrin analogue is recently gaining lot of research interest. One possible reason for choosing corrole over porphyrin is that, corrole stabilizes metals in one-unit higher oxidation state than its porphyrin analogue, and it can in principle “store” more number of electrons than the porphyrin unit. Corroles are trianionic, however retain their aromaticity fully. All these properties have led to an intense research interest in corrole chemistry. The knowledge of the redox properties and the electronic structures of these metal complexes will enrich our fundamental understanding of these intriguing classes of molecules. Additionally, these studies might provide new materials for the opto-electronic industry. The investigations of the metal-oxo species will generate important knowhow for all branches of oxidation catalysis, a process that is highly sought after in the chemical industry. If an efficient copper-based C-H oxygenation catalyst is found, this will be a big breakthrough in this field.

Publications

1. 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
2. Sruti Mondal, Antara Garai, Pratyush Kumar Naik, Jogesh Kumar Adha and **Sanjib Kar*** Synthesis and characterization of Antimony(V)–oxo corrole complexes, *Inorganica Chim. Acta.*, **2020**, *501*, 119300 (Invited Article).
3. 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

4. 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**, DOI: <https://doi.org/10.1002/9781119951438.eibc2729>

5. 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, and Lawrence Que, Jr., Eds.: Pergamon Press: Oxford, **2020**; DOI: <https://doi.org/10.1016/B978-0-08-102688-5.00008-8>

6. Synthesis, Characterization and Application of oxomolybdenum(V)- Corrolato complexes in Epoxidation reactions, Manisha Nayak, Panisha Nayak, and **Sanjib Kar***

J. Org. Chem. **2020**, *85*, 11654–11662.

7. Photocatalytic C–H Thiocyanation of Corroles: Development of Near-Infrared (NIR)-Emissive Dyes. Sahu, K., Mondal, S., Mobin, S. M. and **Sanjib Kar***,

J. Org. Chem. **2021**, *86*, 3324–3333.

8. An oxo (corrolato) chromium(V) complex selectively kills cancer cells by inducing DNA damage Nitika Pradhan, Antara Garai, Bratati Patra, **Sanjib Kar***, Prasanta K. Maiti*,

Chem. Commun., **2021**, *57*, 4851–4854.

9. Making Graphene-type Material via Polymerization of Porphyrin. Mondal, S., Sahu, K., Hasina, D., Som, T., Dosche, C. and **Sanjib Kar***,

Chem Rxiv, **2020**, DOI: 10.26434/chemrxiv.13041785

Conferences and Seminars Attended

Our group members have delivered couple of oral presentations through online mode.

Sponsored Projects

Particulars	Current Funding
Title of the Project	High valent Metallo–Corroles: Synthesis, characterization and applications to catalysis
Period	2017-2021
Funding Agency	SERB-India
Amount	₹54,09,820/- (sanctioned)

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 β -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

- Zinc Hydride Catalyzed Chemoselective Hydroboration of Isocyanates: Amide Bond Formation and C=O Bond Cleavage R. K Sahoo, N. Sarkar and **S. Nembenna*** *Angew. Chem. Int. Ed.* **2021**, *60*, 11991-12001
- Conjugated Bis-guanidines (CBGs) as Diketiminato Analogues: Synthesis, Characterization of CBGs / Their Lithium Salts and CBG Li Catalyzed Addition of B-H and TMSCN to Carbonyls T. Peddarao, A. Baishya, N. Sarkar, R. Acharya, and **S. Nembenna*** *Eur. J. Inorg. Chem* **2021**, DOI:10.1002/ejic.202100141R1
- Zinc hydride catalyzed hydrofunctionalization of ketones R. K. Sahoo, M. Mahato, A. Jana, and **S. Nembenna*** *J. Org. Chem* **85**(17) 11200-11210 **2020**
- Palladium-Catalyzed Selective Reduction of Carbonyl Compounds N. Sarkar, M. Mahato, and **S. Nembenna*** *Eur. J. Inorg. Chem* **2020** 2295-2301

Conferences and Seminars Attended

Nobel Lecture series at NISER Bhubaneswar Webinar December 2020

Inorganic chemistry webinar December 2020

CRSI Lecture by Prof. Maheswaran Shanmugam-Kanpur Lucknow Chapter - Oct 03 2020

Synthetic Organic Chemistry

Dr. S. Peruncheralathan, Associate Professor

Our group is currently focused on selective functionalisation of C—X and C—H bonds to synthesise heterocycles with potential applications in biological and photophysical properties.

Publications

1. Arpita Chatterjee, Chudamani Murmu, **S. Peruncheralathan**, Copper-catalysed N-arylation of 5-aminopyrazoles: a simple route to pyrazolo[3,4-b]indoles, *Org. Biomol. Chem.*, **2020**, *18*, 6571-6581.
2. M. Murugavel, B. Adinarayana, Mainak Das, **S. Peruncheralathan**, Narasinga Rao Palepu and A. Srinivasan, PtCl₂ mediated peripheral transformation of carbatriphyrin(3.1.1) into a meso-fused b-b₀ dimer and its monomer analogue, *Chem. Commun.*, **2020**, *56*, 12809—12812.
3. Subhayan, Chakraborty, **S. Peruncheralathan** and Arindam, Ghosh, Paracetamol and other Acetanilide analogs as inter-molecular hydrogen bonding assisted diamagnetic CEST MRI contrast agents, *RSC Advances*, **2021**, *11*, 6526 – 6534.

Invited Talks

Deliver two talks in a Refresher Course in Chemistry for the University and College Teachers on 21.12.2020

Sponsored Projects

Ongoing SERB project, which is sanctioned on October 2018 (42.19 Lakhs)

Theoretical and Computational Chemistry

Dr. Upakarasamy Lourderaj, Associate Professor

The mechanisms and dynamics of various chemical reactions in the gas phase were investigated using ab initio chemical dynamics simulations. Simulations reveal that for the reactions considered in the present study, the dynamics was nonstatistical in nature and followed non-minimum energy pathways. New mechanism involving second-order saddle was also identified.

Publications

1. **Second-order Saddle Dynamics in Isomerization Reaction**

- R. Rashmi, K. Yadav, **U. Lourderaj**, and M. Paranjothy Regul. Chaotic Dyn. *Special Issue (Eds. G. Ezra and S. Wiggins)* (2021)
2. **Mechanism and Dynamics of CH₂NO₂- + CCl₄ Halophilic Reaction**
S. Mitra, S. S. Dutta, N. Sharma, and **U. Lourderaj** *Int. J. Mass Spectrom.* 459, 116470 (2021)
 3. **Dynamics of a gas phase SNAr reaction: Non-concerted mechanism despite the Meisenheimer complex being a transition state**
N. Sharma, R. Biswas, and **U. Lourderaj** *Phys. Chem. Chem. Phys.* 22, 26562 (2020)
 4. **Transition between [R]- and [S]-Stereoisomers without Bond Breaking**
S. Ragunathan, K. Yadav, V. C. Rojisha, T. Jaganade, V. Prathyusha, S. Bikkina, **U. Lourderaj** and U. D. Priyakumar *Phys. Chem. Chem. Phys.* 22, 14983 (2020)

Invited Talks

1. Quantum Chemical Approaches for Experimentalists, VIT Chennai, June 2020
2. Unusual Reaction Mechanism: Insights from Dynamical Studies, Beijing Institute of Technology, December 2020
3. Computational Studies of the Mechanisms of Chemical Reactions, Kerala University, March 2021

Sponsored Projects

Computational Studies on the Mechanisms and Dynamics of Substitution Reactions (2018-21), SERB, DST

Main-group materials chemistry

Dr. Krishnan Venkatasubbaiah, Associate Professor

My group has developed fused organic-inorganic hybrid fluorophores using boron and silicon as main group elements. These materials were used for the detection of fluoride ion and picric acid with high selectivity and sensitivity furthermore we also made boron embedded fluorophore for OLED and NLO applications.

Publications

- [1] B. P. R. Aradhyula, R. V. R. N. Chinta, K. Dhanunjayarao, **Krishnan Venkatasubbaiah***, Synthesis and characterization of poly(tetraphenylimidazole)s and their application in the detection of fluoride ions, *RSC Advances*, 2020, 10, 13149–13154.
- [2] V. Mukundam, S. Shreenibasa, K. Anupa, A. C. Murali, P. Nayak, R. Das*, **Krishnan Venkatasubbaiah*** Synthesis of π -extended B N coordinated phenanthroimidazole dimers and their linear and nonlinear optical properties *Dalton Trans.* 2020, 49, 7737–7746. (Selected as one of the HOT articles)
- [3] P. Dudhe, **Krishnan Venkatasubbaiah**, B. Pathak, V. Chelvam, Serendipitous base catalysed condensation–heteroannulation of iminoesters: a regioselective route to the synthesis of 4,6-disubstituted 5-azaindoles, *Org. Biomol. Chem.* 2020, 18, 1582–1587.
- [4] P. Kalita, P. Nayak, N. Ahmed, J. M. Herrera, **Krishnan Venkatasubbaiah*** E. Colacio, * and V. Chandrasekhar* Seven-coordinate Ln(III) Complexes Assembled from a Bulky MesAcac Ligand: Synthesis, Structure, Photoluminescence and SMM behavior, *Dalton Trans.* 2020, 49, 15404–15416.
- [5] S. Samser, P. Biswal, S. K. Meher, and **Krishnan Venkatasubbaiah*** Palladium mediated one-pot synthesis of 3-aryl cyclohexenones and 1,5-diketones from allyl alcohols and aryl ketones *Org. Biomol. Chem.* 2021, 19, 1386–1394.

Awards and Honours

Selected as CRSI-convenor for Bhubaneswar chapter.

Sponsored Projects

Imidazole containing polymers for the selective detection of fluoride ion and synthesis of boron-complexes, (EMR/2017/000620); Sanctioned amount: Rs. 5888845. Funding Agency: SERB-DST.

SCHOOL OF EARTH AND PLANETARY SCIENCES

ACADEMIC ACHIEVEMENTS AND RESEARCH OVERVIEW

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 astrochemistry, planetary science, exoplanetary science and observational astronomy- mostly focussed on understanding the physical and chemical origins of planetary systems such as our own. In the last one year, we have worked on few aspects related to this topic:

- (a) We have studied the physical and chemical evolution of several cold cores, low and high-mass young stellar objects. These works helped us understand the evolutionary sequence of interstellar material that eventually forms stars and planets.
- (b) We developed a Simplified Cometary Concentration Model to investigate the evolution of the interior of comets considering the evaporation process of water followed by the concentration of nonvolatile species.

Planetary composition: Understanding the planetary processes in the early solar system

Dr. Guneshwar Thangjam, Assistant Professor

Understanding planetary formation and evolution, including our unique home - the planet Earth's, 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 -

1. Climate modulation by large swaths of forests and deforestation in the Amazon rainforest and Himalayan forests.
2. Regional climatic impacts and modulation by atmospheric water vapor and its role specifically in near surface heat stress.
3. Impacts of global warming in mountainous regions.

The following process based studies are conducted to study the above research objectives.

1. Boundary layer dynamics and vegetation-climate coupling through numerical modeling and direct field observations.
2. Convective processes and their coupling with the larger scale dynamics.

Physics and mechanics of earthquakes and landslides

Dr. Pathikrit Bhattacharya, Assistant Professor

Research in this group focuses on theoretical and experimental analysis of the physics of shear failure across scales in earth sciences. Over the last year, the group has worked on a variety of problems spanning

the cm-scale probed in the laboratory to the 10s-of-km scale accessed through observations of fault deformation in nature. I list some of them below:

- A. Characterisation of the 'correct' constitutive phenomenology of fault friction in response to extreme changes in shear and normal loading conditions.
- B. Development of analytical and numerical models of fluid-induced aseismic slip in the context of injection-induced fault deformation.
- C. We are combining high spatial resolution InSAR data with physics-based models of earthquake ruptures to understand the role of aseismic slip in triggering earthquake swarms in continental interiors.
- D. We are examining the extent to which observed time delays between rainfall-induced landslide occurrence and peak precipitation can be explained by assuming laboratory-derived, time-dependent variations in the shear strength of soil columns.

Publications (Journals)

1. A. Nathues, N. Schmedemann, G. Thangjam, J. H. Pasckert, K. Mengel, J. Castillo-Rogez, E.A. Cloutis, H. Hiesinger, M. Hoffmann, L. Le Corre, J.-Y. Li, C. Pieters, C.A. Raymond, V. Reddy, O. Ruesch & D.A. Williams, 2020. Recent cryovolcanic activity at Occator crater on Ceres. *Nature Astronomy*, 4, 794–801.
2. K. Taniguchi, L. Majumdar*, S. Takakuwa, M. Saito, D. C. Lis, P.F. Goldsmith, E. Herbst, *ApJ*, 2021, 910, 141
3. T. Suzuki, Y. Shinnaka, L. Majumdar*, T. Shibata, Y. Shilbaike, H. Nomura, H. Minamoto, *A&A*, 2021, 645, 10
4. K. Taniguchi, E. Herbst, L. Majumdar, P. Caselli, J. Tan, Z. Li, T. Shimoikura, K. Dobashi, F. Nakamura, M. Saito, *ApJ*, 2021, 908, 100
5. E. Mullikin, H. Anderson, N. O'Hern, M. Farrah, C. R. Arumainayagam, E. F. van Dishoeck, P.A. Gerakines, A. I. Vasyunin, L. Majumdar, P. Caselli, C. N. Shingledecker, *ApJ*, 2021, 910, 72
6. V. Wakelam, P. Gratier, M. Ruaud, R. Le Gal, L. Majumdar, J.-C. Loison, K. M. Hickson, *A&A*, 2021, 647, A172

Research Highlights

Recently active dwarf planet Ceres: Key results from NASA Dawn XM2 were collectively reported in *Nature Astronomy*, August 2020 issue (vol. 4, issue 8). The findings were reported in more than 1400 press outlets (as per NASA/JPL report). One of the key findings by Nathues A, Schmedemann N, Thangjam G. et al., is geologic evidence for cryovolcanic eruptions until a million years ago on dwarf planet Ceres in the asteroid belt. The finding of geologically active processes in such a small solar system body that was believed to be inactive brought new insights and paved the way for future exploration to revisit and understand the rather complex geologic and physico-chemical conditions. The work was also highlighted in the cover page ('Image credit: N. Schmedemann/WWU, G. Thangjam/NISER, A. Nathues/MPS, on behalf of NASA/JPL-Caltech/UCLA/MPS/DLR/IDA Cover Design: Allen Beattie').

Conference/Workshop

1. Primary Convener, Down the ice road, The journey of ices from interstellar clouds to planetary systems, American Geophysical Union (AGU) Fall Meeting 2020, Session: P0111, San Francisco, 7 to 11 December 2020 (Dr. Majumdar)
2. Member, Scientific Organizing Committee, 2nd Indian Planetary Science Conference, February, 25-26, 2021, organized by PRL/ISRO (Dr. Thangjam)

Projects from Non-DAE schemes:

1. Project: SERB Start-Up Research Grant (SRG/2020/002490)

Research Project Title: Theoretical and computational investigations on the physical origins of rate-state friction - insights from a diverse set of normal stress step laboratory friction experiments.

PI - Dr. Pathikrit Bhattacharya

Funding Agency: Science and Engineering Research Board

Budget: Rs. 30,82,000 for 2 years

2. Project: Max Planck India Partner Group (Sept, 2020-Aug, 2025)

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)

3. Project: MHRD STARS 766

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: Jaya Khanna, NISER, Bhubaneswar, Co-PI: IIT, Roorkee; ATREE, Bangalore.

Funding Agency: Ministry of Human Resources and Development

Sanctioned: 15th May 2020

Budget: INR 97.08 lacs

4. Project: (TE-11015/1/2019-TECH5 NMCG)

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

PI: Abhayanand Singh Maurya, IIT, Roorkee, Co-PI: Jaya Khanna, NISER, Bhubaneswar; IIT, Roorkee; HNB, Garhwal University; NIH, Roorkee

Funding Agency: Ministry of Water Resources

Sanctioned: February 2020

Budget: INR 135.75 lacs, NISER share: 6.5 lacs.

Talks (invited and contributory)

1. From Molecular Clouds to Planetary Systems: A new era of ALMA and JWST, February 23, 2021, XXXIXth Meeting of the Astronomical Society of India 2021, India (Plenary Talk; Dr. Majumdar)
2. Astrochemistry in the modern era of mm/sub-mm astronomy, February 19, 2021, XXXIXth Meeting of the Astronomical Society of India 2021, Workshop: Sub-Millimeter Astronomy: The Indian Perspective, India (Invited Talk; Dr. Majumdar)

3. The physical and chemical origins of planetary systems such as our own, September 9-11, 2020, Australasian Astrobiology Meeting, Virtual International Astrobiology Conference (Contributed Talk; Dr. Majumdar)
4. Are we alone in this Universe? September 5-6, 2020, Two Days National Level Webinar on 'We and Our Universe', Barasat College (Affiliated to West Bengal State University), India (Invited Talk; Dr. Majumdar)
5. Dwarf planet Ceres: Inner or outer solar system origin? 2nd Indian Planetary Science Conference, February, 25-26, 2021, organized by PRL/ISRO (Contributed Talk; Dr. Thangjam).

Popular Talks

1. Talk at Regional Science Center, Bhubaneswar, April 2021 (Dr. Khanna).

Major teaching and research facilities built

SEPS is on a mission building the first and unique department of its kind in India in the Earth, Atmospheric-Ocean, and Planetary Sciences. 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 repute and recognition.

1. Computational atmospheric science facility funded by DAE and Ministry of Water Resources (grant number TE-11015/1/2019-TECH5 NMCG).
2. Under development - Hydroclimate observatory in the middle Himalayas funded by the Ministry of Human Resources and Development (grant number MHRD STARS 766).

Awards and Honors and Recognitions

1. Visiting Associate, Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, India, 2020 (Dr. Majumdar)
2. Fellow of Royal Astronomical Society (FRAS), 2020 (Dr. Majumdar)

SCHOOL OF MATHEMATICAL SCIENCES

Ordered Functional Analysis

Dr. Anil Kumar Karn, Associate Professor

- Quantization of $A_0(K)$ -Spaces;
- Absolutely compatible pairs in a von Neumann algebra;
- Isometries of Absolute order unit spaces;
- Partial isometries in an absolute order unit space;
- Orthogonality: an antidote to Kadison's anti-lattice theorem;
- K_0 -group of absolute Matrix order unit spaces.

Number Theory

Dr. Brundaban Sahu, Associate Professor

- We construct Rankin-Cohen type differential operators on the spaces of Hilbert-Jacobi forms generalising the work of Choie-Eholzer in the case of Jacobi forms.
- We construct a basis for the space of modular forms of weight 2 on $\Gamma_0(48)$ and use this basis to find formulas for the number of representations of a positive integers n by certain quaternary quadratic forms.

Blocking sets in projective spaces

Dr. Binod Kumar Sahoo, Associate Professor

Study of minimal blocking sets of external/ tangent/ secant lines in $PG(3, q)$ with respect to a nondegenerate quadric.

Weighted inequality in Dunkl setting, Strichartz estimates for orthogonal functions

Dr. Sanjay Parui, Associate Professor.

I am interested to extend different classical Weighted inequality in the Dunkl setting. I am also studying Strichartz estimates associated to Hermite and Special Hermite operator for orthogonal functions.

Cryptography and Boolean function

Dr. Deepak Kumar Dalai, Reader-F

- Cryptanalysis of stream ciphers

- Studying and designing cryptographically significant Boolean functions
- Algebraic cryptanalysis

Modular forms

Dr. Jaban Meher, Reader-F

We have classified all the cases for which the Rankin-Cohen brackets of two quasimodular eigenforms on the full modular group is an eigenform.

Power graphs of finite groups & Centrality in connected graphs

Dr. Kamal Lochan Patra, Reader-F

- Power graphs of finite groups: We study the vertex connectivity and minimal degree of the power graphs of different finite groups.
- Centrality in connected graphs: We study different central parts of connected graphs and their relations. We also look for the graphical indices associated with different central parts of connected graphs.

Partial Differential Equations

Dr. Manas Ranjan Sahoo, Reader-F

I have solved the following important problems along with my collaborators.

- System of non-strictly balance laws arising from 1D Saint-Venant model

For this important system we constructed solution using vanishing viscosity approach which extends the work E. Hopf and Ding et. al. In particular, we extended the Hopf-Cole transformation for non-homogeneous Burgers equation and Passing to the limit we obtained an explicit formula in terms of a variational formulation which is easy to solve.

- Scalar conservation laws with discontinuous flux function

For the scalar conservation laws with discontinuous flux (for overcompressive flux pair), first we used vanishing viscosity method to obtain an explicit formula for a special type of flux function. For general overcompressive flux pair, a weak formulation is proposed which allows concentration along t -axis and

an explicit formula is constructed satisfying the weak formulation which is an extension of the work Adimuthi, et. al. A numerical scheme is proposed which effectively captures the solution and its convergence analysis is carried out.

- *Solutions to viscous Burgers equations with time dependent source term*

We studied the existence and uniqueness of weak solutions for a Cauchy problem of a viscous Burgers equation with a time dependent reaction term involving Dirac measure. After applying a Hopf like transformation, we investigate the associated two initial boundary value problems by assuming a common boundary. The existence of the boundary data is shown with the help of Abel's integral equation. We then derive explicit representation of the boundary function. Also, we prove that the solutions of associated initial boundary value problems converge uniformly to a nonzero constant on compact sets as t approaches infinity.

- *Initial value problem for the nonconservative zero-pressure gas dynamics system.*

We studied the initial value problem for the zero-pressure gas dynamics system and the associated adhesion approximation. We used adhesion approximation and modified adhesion approximation in the construction of solution. First we proved a general existence result for the adhesion model for bounded and H^1 initial data. Then we focused on the construction of explicit formula for the weak asymptotic solution and generalised solution for the plane wave initial data.

Enumerative Geometry and Gromov-Witten Invariants

Dr. Ritwik Mukherjee, Reader-F

Found formulas to enumerate curves in a fibre bundle (a moving family of P^2).

Geometric Similarity invariants of Cowen-Douglas Operators

Dr. Dinesh Kumar Keshari, Reader-F

M. J. Cowen and R. G. Douglas found a complete set of unitary invariants in terms of involving the curvature and its covariant partial derivatives for operators in Cowen-Douglas class of operators. 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.

Mathematical Modelling of PROUT & 2. Pure consciousness as the constituent of matter.

Dr. Nabin Kumar Jana, Reader-F

- Mathematical modelling of the distribution of wealth in the light of Progressive Utilisation Theory proposed by P. R. Sarkar through the power law distribution.
- What is 'matter'? This basic fundamental question needs a revisit as the physical science is struggling with the idea of 'dark matter'. In philosophy, it is said that everything is originated from 'pure conscience'. Hence according to philosophy 'conscience' can be the only substance in every objects and 'matter' is nothing but that of 'pure consciousness' acting through the difference planes of inferences. We are working on to make this idea theoretically consistent. Till now got the idea how the gravitational force can be interpreted from this concept.

Quantum groups and Noncommutative Geometry

Dr. Sutanu Roy, Reader-F

- We have constructed two new examples of braided quantum groups: braided free Orthogonal Quantum Groups and braided quantum $E(2)$ groups.
- We have also studied the classic Inonu-Wigner group contraction for braided quantum $SU(2)$ and braided quantum $E(2)$ groups, and for their bosonisations, respectively.
- We have developed a framework to estimate the systematic uncertainties in chemical freeze-out parameters extracted from χ^2 analysis of thermal models, using hadron multiplicity ratios in relativistic heavy-ion collision experiments using a well-known technique of graph theory.

Von Neumann algebra, Ergodic theory, Neveu Decomposition, Araki-Woods von Neumann algebras

Dr. Panchugopal Bikram, Reader-F

I study various structural properties of q -deformed Araki-Woods von Neumann algebras. I also work on non-commutative ergodic theory.

Transcendental Number Theory

Dr. K. Senthil Kumar, Reader-F

- Let L be a lattice in $\mathbb{C}$. A general problem in transcendental number theory is to find all the linear relations among the periods, quasi-periods of L with the numbers $1, 2i\pi$ over the rational numbers. This problem is completely solved by D. Masser in the case when L has algebraic invariants. Recently, I had classified all the lattices having linearly dependent quasi-periods over the rational numbers (without any conditions on the invariants of L).
- One of the long standing problem in algebraic number theory is the Lehmer's problem about Mahler's measure. Though this problem is solved for many class of algebraic numbers the general problem is remain unsolved. The best known lower bound for the Mahler's measure is due to P. Voutier. Using methods from transcendental number theory, joint with Gorekh Prasad Sena, we improved the lower bound of P. Voutier for a class of reciprocal algebraic 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 have submitted a work (for publication) in which we study 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 have been able to obtain bounded solutions in fractional BV spaces under optimal fractional regularity of the initial data. Currently, we

are trying to study more general systems in this framework.

Algebraic Geometry: Linear Series

Dr. Krishanu Dan, Assistant Professor

We are trying to compute multipoint Seshadri Constant on Grassmannian bundles over curves. As a special case we have computed single and multipoint Seshadri Constant on projective bundles over curves. In this situation we got some of the "expected results". Right now we are trying to improve the bounds that we obtained (at least in some "good" cases), and also trying to see if the same method can be used and/or adopted for Grassmannian bundles. This is an ongoing joint work with Dr. Praveen Kumar.

On the maximum number of blocks in a maximal intersecting family of sets

Dr. Kaushik Majumder, Assistant Professor

There is a new technique is developed called the "polynomial method" in Combinatorics. After studying these techniques, I have planned to use them to solve the above counting problem.

Publications (F.Y 2020-21)

Dr. Anil Kumar Karn, Associate Professor

- Quantization of $A_{\infty}(K)$ -Spaces, Anindya Ghatak and Anil Kumar Karn; Operator and Matrices, 14(2) (2020), 381-399.
- Absolutely compatible pairs in a von Neumann algebra-II, Anil Kumar Karn; Revista de la Real Academia de Ciencias Exactas, Físicas y Naturales. Serie A. Matemáticas (RCSM), 114(3), July (2020). Article 153, 7 pages.
- Isometries of Absolute order unit spaces, Anil Kumar Karn and Amit Kumar; Positivity, 24(5) (2020), 1263-1277.
- Partial isometries in an absolute order unit space, Anil Kumar Karn and Amit Kumar; Banach Journal of Mathematical Analysis, 15(1) (2021), 1-26.
- Orthogonality: an antidote to Kadison's anti-lattice theorem, Anil Kumar Karn; (Accepted for publication in the Conference Proceedings of Positivity X) (2020), 10 pages.
- K_0 -group of absolute Matrix order unit spaces, Anil Kumar Karn and Amit Kumar; Karn, Adv. Oper.

Theory 6, 40 (2021) 27 pages.
<https://doi.org/10.1007/s43036-021-00134-5>.
(Published online on March 17, 2021).

Dr. Brundaban Sahu, Associate Professor

- On the representations of a natural number by certain quaternary quadratic forms, Modular Forms and related topics, Springer Proceedings in Mathematics and Statistics, vol-340, pp-173-198, 2020 (with B. Ramakrishnan and Anup Kumar Singh).
- Rankin-Cohen type operators for Hilbert-Jacobi forms, Modular Forms and related topics, Springer Proceedings in Mathematics and Statistics, vol-340, pp-143-156, 2020 (with Moni Kumari).
- Representations of squares by certain quinary and septenary quadratic forms (with B. Ramakrishnan and Anup Kumar Singh) Preprint.

Dr. Binod Kumar Sahoo, Associate Professor

- B. De Bruyn, P. Pradhan and B. K. Sahoo, Minimum size blocking sets of certain line sets with respect to an elliptic quadric in $PG(3, q)$, Contributions to Discrete Mathematics 15 (2020), no. 2, 132-147.
- 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 20 (2021), no. 3, Article Id: 2150044, 18 pp.
- S. Chattopadhyay, K. L. Patra and B. K. Sahoo, Minimal cut-sets in the power graphs of certain finite non-cyclic groups, Communications in Algebra 49 (2021), no. 3, 1195-1211.

Dr. Sanjay Parui, Associate Professor

- Existence of Extremals of Dunkl-type Sobolev Inequality and of Stein-Weiss Inequality for Dunkl Riesz Potential Complex Analysis and Operator Theory 15 (2021), no. 2, Paper No. 28, 34 pp (with Anoop V. P. and Saswata Adhikari)
- Improved Fractional Hardy Inequalities for Dunkl gradient Math. Inequal. Appl. 24 (2021), no. 1, 129-155., (with Anoop V. P.)
- Weighted Hardy Sobolev Inequality for Upper Half Space Annales Mathematiques Blaise Pascal, 25 pages (with Anoop V. P.) to appear

Dr. Deepak Kumar Dalai, Reader-F

- Dibyendu Roy, Deepak Kumar Dalai. An Observation of Non-randomness in NFSR-Based Stream Ciphers with Reduced Initialization Round. Journal of Hardware and Systems Security, March 2021.
- Deepak Kumar Dalai, Pinaki Sarkar. Bidirectional

hash chains generically enhance resilience of key predistribution schemes. IET Wireless Sensor Systems, 10(4):154-165, April 2020.

Dr. Jaban Meher, Reader-F

- (With A. Kumar) Rankin-Cohen brackets and identities among eigenforms II, Modular Forms and Related Topics in Number Theory, 125--141, Springer Proceedings of Mathematics & Statistics, Vol. 340, 2020.

Dr. Kamal Lochan Patra, Reader-F

- 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 20(3) (2021), 2150044, 18pp.
- S. Chattopadhyay, K. L. Patra and B. K. Sahoo, Minimal cut-sets in the power graph of certain finite groups, Communications in algebra 49(3) (2021), 1195 – 1211.
- D. Pandey and K. L. Patra, Different central parts of trees and their pairwise distances, Linear and Multilinear Algebra, <https://doi.org/10.1080/03081087.2020.1856027>

Dr. Manas Ranjan Sahoo, Reader-F

- (With Satyarayana Engu and Venkatramana P. Berke) Solutions to viscous Burgers equations with time dependent source term, Electron. J. Diff. Equations, Vol. 2021 (2021), No. 02, pp. 1-16.
- (With Abhishek Das and K. T. Joseph) Adhesion approximations of the zero-pressure gas dynamics system, Adv. Pure Appl. Math., 12 (2021), no. 1, 16-49.
- (With Aekta Aggarwal, Abhrojyoti Sen and Ganesh Vaidya) Solutions with concentration for conservation laws with discontinuous flux and its applications to numerical schemes for hyperbolic systems. Stud. Appl. Math. 145 (2020), no. 2, 247-290.
- (With Abhrojyoti Sen) Vanishing viscosity limit for a system of balance laws with general type initial data arising from 1D Saint-Venant model. J. Math. Phys. 61 (2020), no. 5, 051507, 19 pp.

Dr. Ritwik Mukherjee, Reader-F

“Rational Cuspidal Curves in a moving family of P^2 ” published in Complex Manifolds in 2021, jointly with Rahul Kumar Singh.

Dr. Sutanu Roy, Reader-F

- Atibur Rahaman, Sutanu Roy, Quantum $E(2)$ groups for complex deformation parameters, Rev. Math. Phys. (online version)
<https://doi.org/10.1142/S0129055X21500215>

- Ralf Meyer, Sutanu Roy, Braided free orthogonal quantum groups, Int. Math. Res. Not. IMRN (online version) <https://doi.org/10.1093/imrn/rnaa379>
- Deeptak Biswas, Kishan Deka, Amaresh Jaiswal, Sutanu Roy, Nonconformal Solution of Viscous Landau Hydrodynamics, Internat. J. Modern Phys. E 30 (2021), no. 2, 213001 pp 59–64.
- Sumana Bhattacharyya, Amaresh Jaiswal, Sutanu Roy, Chemical freeze-out systematics of thermal model analysis using hadron yield ratios, Phys. Rev. C 103 (2021), no. 2, 024905
- Deeptak Biswas, Amaresh Jaiswal, Kishan Deka, Sutanu Roy, Quantum Viscosity, nonconformal equation of state, and sound velocity in Landau hydrodynamics, Physical Review C 102 (2020), no. 1, 014912

Dr. Panchugopal Bikram, Reader-F

- On the von Neumann algebras associated to Yang-Baxter Operators with Rahul K. R, R. Mohanta, K. Mukherjee and D. Saha, Proceedings of the Royal Society of Edinburgh, page 1 of 24, 2020, DOI:10.1017/prm.2020.62 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.

Dr. K. Senthil Kumar, Reader-F

Linear dependence of quasi-periods over the rationals, To appear in Comptes Rendus Mathématique, Paris.

Awards and Honours received

Dr. Sutanu Roy, School of Mathematical Sciences NISER, has been selected for the INSA Medal for Young Scientists - 2020.

Conferences and Seminars

Dr. Brundaban Sahu, Associate Professor

International Conference on Number Theory (online) December 22-23, 2020, IIT BHU

Dr. Binod Kumar Sahoo, Associate Professor

- Online Interactive Mathematics Training on Number Theory and Algebra, August 17-21, 2020.
- Online Mini-course in Finite Geometry and Ramsey Theory, January 11-22, 2021.

Dr. Jaban Meher, Reader-F

Online workshop on Modular forms (14–19 December, 2020), IIT Guwahati.

Dr. Kamal Lochan Patra, Reader-F

- International Conference on Graph Connections, 6-8 August 2020, Bishop Chulaparambil Memorial College, Kerala, India.
- International Conference on Recent Advances in Applied Sciences Technology and Health, 3-5 March 2021, SRM Institute Tamilnadu, India.

Dr. Nabin Kumar Jana, Reader-F

- International Webinar on Facets of Computational Mathematics, BKG, July 27, 2020
- Neohumanist Solutions for a World in Crisis, Neohumanist College, December 11-14, 2020
- National Webinar on Shrii Shrii Anandamurtijii's contribution contribution to Philosophy, Science, Neohumanism, Economics and Neohumanist Education, Renaissance Universal, Kolkata, November 05, 2020
- National Webinar on "Shrii Shrii Anandamurtijii's/ Shrii Prabhat Ranjan Sarkar's contribution to Philosophy, Ethics, Science and Neohumanist Education, Panjab University, November 17-18, 2020
- International Webinar on Philosophy of Sciences and Neohumanist ethics reflected in Shrii Shrii Anandamurtijii's / Shrii Prabhat Ranjan Sarkar's vision, Kurukshetra University, December 27-28, 2020

Dr. Sutanu Roy, Reader-F

- Virtual Math Fest 2020, Institute of Mathematical Sciences Chennai, India, July 2020.
- IISER-NISER Mathematics WebMeet 2020 (Operator Algebra/Theory session), Indian Institute of Science Education and Research Mohali, India, July 2020.

Dr. K. Senthil Kumar, Reader-F

Attended the lectures of the program 'Number Theory Web Seminar' organised by Mike Bennett, Philipp Habegger, and Alina Ostafe.

Dr. Anupam Pal Choudhury,

Assistant Professor

IISER-NISER MATHEMATICS WEBMEET 2020 (13th-17th July, 2020)

Online Symposium on Conservation Laws and Related Topics, TIFR-CAM (31st July, 2020)

Dr. Krishanu Dan, Assistant Professor

Indo-Japan Web-Workshop on Vector Bundles and Related Topics., February 22–24, 2021 (via online).

Invited Talks

Dr. Brundaban Sahu, Associate Professor

- Rankin-Cohen brackets on Jacobi forms of several

variables and special values of certain Dirichlet series (December, 2020) IIT- BHU

- Representations of integers as sums of squares and modular forms (Webinar), Anchal College, Padampur (November 16, 2020)
- Supercongruences (Webinar), GM University Sambalpur (November 20, 2020)
- Sums of squares and modular forms (Webinar), GIET, Gunupur (December 1, 2020)

Dr. Binod Kumar Sahoo, Associate Professor

Delivered five lectures during the Online Interactive Mathematics Training on Number Theory and Algebra, August 17-21, 2020.

Dr. Deepak Kumar Dalai, Reader-F

Introduction to Cryptography in a webinar organised by Mathematics Department, UN college, Soro, Balasore on 10.11.2020.

Dr. Jaban Meher, Reader-F

- Euler Phi-function, L. N. college, Jharsuguda, Odisha (online talk) (9 January, 2021).
- Mod p modular forms and simple congruences, International conference on Number theory and Algebra (online meeting), IIT (BHU), Varanasi, (22--23 December, 2020).
- Mod p modular forms and simple congruences, Chandrasekharan centenary symposium in number theory, 86th Annual conference of Indian Mathematical Society (online meeting), VIT Vellore, (17--20 December, 2020).

Dr. Kamal Lochan Patra, Reader-F

- Different central parts of trees and their pairwise distances, International Conference on Graph Connections (6-8 Aug 2020), Bishop Chulaparambil Memorial College, Kerala, India.
- Characteristic center of a tree, E-seminar on Graphs, Matrices and Applications, 11 Sep 2020, IIT Kharagpur, India.
- Laplacian eigenvalues of the zero divisor graph of the ring $\mathbb{Z}_n$, International Conference on Recent Advances in Applied Sciences Technology and Health, 3-5 March 2021, SRM Institute Tamilnadu, India.

Dr. Dinesh Kumar Keshari, Reader-F

- I gave a talk on the following topic to undergraduate and postgraduate students:

Relation between real and complex differentiable

functions, Department of Mathematics, Science & Technology, Mahatma Gandhi Kashi Vidyapith, Varanasi, January 28, 2021.

Dr. Ritwik Mukherjee, Reader-F

I gave the talk on 26th March, 2021 at IISER Bhopal on "Introduction to Caporasso-Harris formula".

Dr. Nabin Kumar Jana, Reader-F

- Analysing frustration through statistical physics, BKG, July 27, 2020
- Amplifying Voices from the Margins, Neohumanist College, December 11-14, 2020
- Cooperative movement of PROUT, Renaissance Universal, Kolkata, November 05, 2020
- Cooperative system of PROUT, Panjab University, November 17-18, 2020
- Some Illustrations of PROUT, Kurukshetra University, December 27-28, 2020

Dr. Sutanu Roy, Reader-F

- On braided compact quantum groups, Virtual Math Fest 2020, Institute of Mathematical Sciences Chennai, India, July 20, 2020.
- Quantum $E(2)$ groups and beyond, IISER-NISER Mathematics WebMeet 2020 (Operator Algebra/Theory session), Indian Institute of Science Education and Research Mohali, India, July 17, 2020.
- Contraction and bosonisation, Tokyo-Kyoto Joint Online Operator Algebra Seminar, November 12, 2020.
- Compact quantum groups and their semidirect products, Topological Groups Webinar, University of Hawaii, September 29, 2020.
- Quantum group contraction and bosonisation, Webinars on Operator Theory and Operator Algebras, September 16, 2020.

Dr. Panchugopal Bikram, Reader-F

I was an invited speaker on Annual conference of Ramanujan Mathematical Society, December, 27, 2020.

Dr. Anupam Pal Choudhury, Assistant Professor

- The equivalent media generated by bubbles of high contrasts (IISER-NISER MATHEMATICS WEBMEET 2020)
- A class of triangular systems in fractional BV spaces (Online Symposium on Conservation Laws and Related Topics)

Sponsored Projects

Dr. Anil Kumar Karn, Associate Professor

- MATRICS from SERB

Dr. Sanjay Parui, Associate Professor

- MT1902: Lacunary Maximal functions for Dunkl Operators.

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. Jaban Meher, Reader-F

- Structure of Hermitian modular forms modulo p and $\text{mod } p$ kernel of theta function (CRG/2020/004147), Funding Agency: Science & Engineering Research Board (SERB), Department of Science and Technology, Government of India, Amount: Rs.30,41,544, Duration: 2020-2023.

Dr. Manas Ranjan Sahoo, Reader-F

- 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 (2018-2021)

Dr. Sutanu Roy, Reader-F

- MATRICS by Science and Engineering Research Board (SERB), Department of Department of Science and Technology (DST), India ongoing from December 2020.
- Inspire faculty award by Department of Department of Science and Technology (DST), India ongoing from December 2016 (Session-I).
- Early Career Research Award (ECRA) by Science and Engineering Research Board (SERB), Department of Department of Science and Technology (DST), India from March 2017 to March 2021.

Dr. Panchugopal Bikram, Reader-F

- Early Career Research Awards, SERB, DST, India from 2019 to 2021 (6L).
- CEFIPRA, The Indo-French Centre for the Promotion of Advanced Research, Co- Pi, from 2019 to 2021 (Rs.101L).

Conferences and Seminars organized by the faculty in the School during 2020-21

Dr. Anil Kumar Karn, Associate Professor

Organized an online workshop entitled “Advanced Functional Analysis and its Applications-2020” in collaboration with Dr. Tanmoy Paul of IIT Hyderabad held during December 14-24, 2020.

Departmental Seminars

1. Speaker: Rekha Biswal

Affiliation: Max Planck Institute for Mathematics, Bonn
Title: Macdonald polynomials and level two Demazure modules for affine sl_{n+1}

2. Speaker: Amit Kumar

Affiliation: NISER
Title: Comparison of order projections in absolute matrix order unit spaces

3. Speaker: Dr. Manish Singh

Affiliation: TIFR Centre for Applicable Mathematics
Title: Structure theorems for balance laws

4. Speaker: Dr. Ranjan Kumar Das

Affiliation: IIT Guwahati
Title: Solving rational eigenvalue problems through strong linearizations.

5. Speaker: Dr. Anup Kumar Singh

Affiliation: IISER Berhampur
Title: Representation formulas for certain quadratic forms and a problem of constructing lifting maps between spaces of modular forms.

6. Speaker: Dr. Ranjan Kumar Das

Affiliation: IIT Guwahati
Title: Solving rational eigenvalue problems through strong linearizations.

7. Speaker: Dr. Anup Kumar Singh

Affiliation: IISER Berhampur
Title: Representation formulas for certain quadratic forms and a problem of constructing lifting maps between spaces of modular forms

8. Speaker: Rohit Kumar Mishra

Affiliation: University of Texas at Arlington
Title: Uniqueness and Injectivity questions for certain integral transforms

9.Speaker: Prajamitra Bhuyan

Affiliation: Imperial College London

Title: Analysing the causal effect of London cycle superhighways on traffic congestion

10.Speaker: Sazzad Ali Biswas

Affiliation: University of Copenhagen

Title: Non-abelian local root numbers and the Langlands' lambda functions

11.Speaker: Surojit Ghosh

Affiliation: University of Haifa

Title: Higher differentials in Adams spectral sequence

12.Speaker: Fouzul Atik

Affiliation: SRM University

Title: On equitable partition of matrices and some problems related to graph theory

13.Speaker: Ashish Mishra

Affiliation: Universidade Federal Do Pará

Title: On representation theory of partition algebras for complex reflection groups

14.Speaker: Ramesh Manna

Affiliation: Indian Institute of Science

Title: Fourier integral operator, unique continuation property (UCP) and momentum ray transforms

15.Speaker: Eshita Mazumdar

Affiliation: ISI Bangalore

Title: Two Extremal Problems on Set Addition

16.Speaker: Sudhir Pujahari

Affiliation: The University of Hong Kong

Title: Arithmetic and statistics of sums of eigenvalues of Hecke operators

17.Speaker: Kamalakshya Mahatab

Affiliation: University of Helsinki

Title: Application of The Resonance Method in Analytic Number Theory

18.Speaker: Mr. Archisman Bhattacharjee

Affiliation: SMS, NISER

Title: Unimodular rows and its uses to prove Quillen–Suslin theorem

19.Speaker: Ritwik Pal

Affiliation: IISc Bangalore

Title: On the magnitude and signs of Hecke eigenvalues of modular forms.

20.Speaker: Mr. A S Abdul Shabeer

Affiliation: SMS, NISER

Title: Hurwitz's Formula for Compact Riemann Surfaces

21.Speaker: Ritwik Pal

Affiliation: IISc Bangalore

Title: On the magnitude and signs of Hecke eigenvalues of modular forms.

22.Speaker: Mr. Archisman Bhattacharjee

Affiliation: SMS, NISER

Title: A proof of Horrocks' Theorem

23.Speaker: Mr. A S Abdul Shabeer

Affiliation: SMS, NISER

Title: Plücker Formula

24.Speaker: Devashish Sonowal

Affiliation: SMS, NISER

Title: Taylor's theorem from the viewpoint of heat equation

25.Speaker: Satish Pandey

Affiliation: Technion - Israel Institute of Technology

Title: Entanglement breaking rank and quantum majorization

26.Speaker: Manoj Kumar

Affiliation: IIT Delhi

Title: Harmonic analysis associated to vector measures on a compact group

SCHOOL OF COMPUTER SCIENCES

Efficient Reductions in Cryptography

Dr. Rishiraj Bhattacharyya, Reader F

The efficiency of a black-box reduction is an important goal of modern cryptography. We disprove Auerbach et al conjecture that a memory-tight reduction for IND-CCA security of Hashed-ElGamal KEM is impossible. We provide memory-tight reductions of IND-CCA security of two versions of Hashed-ElGamal KEM. We prove memory-tight reductions for FO transformation as well.

Private and Secure Machine Learning

Dr. Subhankar Mishra, Reader-F

- This year major focus was on building algorithms that could be used real-time by various industries for privacy. This included looking at Federated Learning as well as Differential Privacy (DP) with the goal of scaling them. Existing solutions were either computationally expensive (See Federated Learning) or had bad utility and privacy guarantee (See RAPPOR for DP). We will continue on this work to build more robust architectures.
- We also worked on the topics of Lottery ticket hypothesis which was the final year MSc thesis of Abhinav Raj, where we show and extend the importance of the smaller neural networks providing same accuracy. We are continuing on this work.
- We also looked at interdisciplinary sciences of working towards sentiment analysis of app reviews and happiness scores as well as cyber physical electrical grids. This work will be continued in behavioural analysis of consumers in electrical grids.

Fixed parameter tractable algorithms for geometric and graph problems

Dr. Aritra Banik, Reader-F

My research interest is broadly in the field of computational geometry with a special focus on the fixed-parameter tractability of computational

geometry problems. Computational geometry is an algorithmic study on discrete and combinatorial geometric structures and can also be regarded as the geometric version of Algorithm Design and Analysis. Computational Geometry is now considered the basis of robotics, computer-aided design and manufacturing (CAM and CAD), and geographic information systems (GIS). A parameterized problem is a language $L \subseteq \Sigma^*$, where Σ is a fixed, finite alphabet. For an instance $(x, k) \in \Sigma^* \times \mathbb{N}$, k is called the parameter [2]. A parameterized problem $L \subseteq \Sigma^* \times \mathbb{N}$ is called fixed-parameter tractable (FPT) if there exists an algorithm A (called a fixed-parameter algorithm), a computable function $f: \mathbb{N} \rightarrow \mathbb{N}$, and a constant c such that, given $(x, k) \in \Sigma^* \times \mathbb{N}$, the algorithm A correctly decides whether $(x, k) \in L$ in time bounded by $f(k) \cdot |x|^c$. The complexity class containing all fixed-parameter tractable problems is called FPT [2]. Although my main focus is on computational geometry but infrequently I do work in classical graph theory problems as well.

Distributed Hypothesis Testing with Privacy, Commitment Capacity with cost constraints

Dr. Manoj Mishra, Assistant Professor

- Distributed Hypothesis Testing with privacy is an ongoing work which aims to extend classical results such as the Neyman Pearson Lemma (amongst others) to the case where privacy is additionally desired.
- The bit commitment capacity of a DMC, with cost constraints on the inputs, was derived. A dual to this capacity result was also derived.

Verification of Graph Coloring in Streaming

Dr. Anup Kumar Bhattacharyya, Assistant Professor

Consider a graph being streamed, how easily you can verify whether it is properly colored or not. This is the question we ask in this paper. Even though a number of works studied efficient coloring algorithms in streaming, ours is the first to investigate the complexity of coloring verification in streaming.

Publications

Dr. Rishiraj Bhattacharyya, Reader-F

- Memory-Tight Reductions for Practical Key Encapsulation Mechanisms. Public Key Cryptography (1) 2020: 249-278

Dr. Subhankar Mishra, Reader-F

- Sudipta Paul, Poushali Sengupta, and Subhankar Mishra. Flaps: Federated learning and privately scaling. In 17th IEEE International Conference on Mobile Ad Hoc and Sensor Systems, MASS 2020, Delhi, India, December 10-13, 2020, pages 13-19. IEEE, 2020.
- Sudipta Paul and Subhankar Mishra. Lac: Lstm autoencoder with community for insider threat detection. In 2020 the 4th International Conference on Big Data Research (ICBDR'20), ICBDR 2020 page 71-77, New York, NY, USA, 2020. Association for Computing Machinery.
- Abhinav Raj and Subhankar Mishra. Lottery ticket hypothesis: Placing the k-orrect bets. In International Conference on Machine Learning, Optimization, and Data Science, pages 228-239. Springer, 2020.
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Dr. Aritra Banik, Reader-F

- Harel Yedidsion, Stav Ashur, Aritra Banik, Paz Carmi, Matthew J. Katz, Michael Segal: Sensor Network Topology Design and Analysis for Efficient Data Gathering by a Mobile Mule. Algorithmica 82(10): 2784-2808 (2020)
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- Aritra Banik, Ashwin Jacob, Vijay Kumar Paliwal, Venkatesh Raman: Fixed-Parameter Tractability of $(n - k)$ List Coloring. Theory Comput. Syst. 64(7): 1307-1316 (2020)
- Pranav Arora, Aritra Banik, Vijay Kumar Paliwal, Venkatesh Raman: List-coloring - Parameterizing from triviality. Theor. Comput. Sci. 821: 102-110 (2020)
- Aritra Banik, Pratibha Choudhary, Venkatesh Raman, Saket Saurabh: Fixed-parameter tractable algorithms for Tracking Shortest Paths. Theor. Comput. Sci. 846.

Dr. Manoj Mishra, Assistant Professor

- conference papers (ISIT, NCC) submitted, decision awaited

Dr. Anup Kumar Bhattacharya, Assistant Professor

- Even the Easiest (?) Graph Coloring Problem Is Not Easy in Streaming! in ITCS 2021 with Arijit Bishnu, Gopinath Mishra, Anannya Upasana.
- Disjointness Through the Lens of Vapnik-Chervonenkis Dimension: Sparsity and Beyond in RANDOM 2020 with Sourav Chakraborty, Arijit Ghosh, Gopinath Mishra, Manaswi Paraashar
- Noisy, Greedy and Not so Greedy k-Means++ in ESA 2020 with Jan Eube, Heiko Röglin, Melanie Schmidt.

- On Sampling Based Algorithms for k-Means in FSTTCS 2020 with Dishant Goyal, Ragesh Jaiswal, Amit Kumar.

Conferences and Seminars

Dr. Rishiraj Bhattacharyya, Reader-F

- IACR Public Key Cryptography, May, 2020

Dr. Subhankar Mishra, Reader-F

- IEEE MASSWorkshop – 2020.
- CCNT, 2020.

Dr. Manoj Mishra, Assistant Professor

- ISIT 2020

Invited Talks

Dr. Rishiraj Bhattacharyya, Reader-F

- Memory Tight Reduction, International Workshop on Cryptography, TCG Crest, September 2020.

Dr. Subhankar Mishra, Reader-F

November, 2020: Secure and Private Machine Learning, SRM University, AP.

Sponsored Projects

Dr. Rishiraj Bhattacharyya, Reader-F

- Property Testing using Conditional Sampling, SERB ECR.

Dr. Subhankar Mishra, Reader-F

- 2020-23: CRIAP - AI for Nutrition (Co-PI) @ DST-BRICS
- 2020-21: HBIM (Temples of Odisha) @ Dassault Systemes Foundation-India
- 2019-21: AutoBIM : BIM to GIS Integration @ DST-NRDMS

Conferences and Seminars organized by the faculty in the School during 2020-21

Dr. Subhankar Mishra, Reader-F

- Dec 11-13, 2020 Special Track: CSoNet 2020 University of Florida

Additional information

Dr. Subhankar Mishra, Reader-F

- Jul 13-31, 2020 Neuromatch Academy UPenn, Imperial College (as a Mentor)

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

Experimental High Energy Physics and Dark Matter Group

Prof. Bedangadas Mohanty, Professor

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, p_{00} . The p_{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 $p_{00} = 1/3$ 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 K^0 s in heavy-ion collisions, measurements with respect to random event plane

lead to $p_{00} = 1/3$. 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. These results are published in Physical Review Letter [Phys. Rev. Lett. 125 (2020) 012301] and appeared as Editors' Suggestion.

The strong initial magnetic field together with the presence of a non-zero electric and axial charge density in the matter formed in heavy-ion collisions leads to vector and axial currents called the Chiral Magnetic Effect (CME) and Chiral Separation Effect (CSE), respectively. Their coupling gives rise to a collective excitation of the QGP called the Chiral Magnetic Wave (CMW). The experimental signature of the CMW is an electric charge-dependent elliptic flow of hadrons. We propose to measure the normalized difference of elliptic flow of positive and negative charged hadrons as a function of charged hadron multiplicity asymmetry to search for CMW. Non-CMW mechanisms like Local Charge Conservation (LCC) may mimic the signal, hence we planned to also measure the normalized difference of triangular flow of positive and negative charged hadrons as a function of charged hadron multiplicity asymmetry to have a control measure for the backgrounds. The analysis is carried out using the data from Pb-Pb collisions at the centre of mass energy of $\sqrt{s_{NN}} = 5.02$ TeV with the ALICE detector. The results are approved as ALICE preliminary.

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 p_T . 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 f 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 [Phys. Lett. B 807 (2020) 135501], one paper published in Physical Review C [Phys. Rev. C 102 (2020) 024912], one paper is published in EPJC [Eur. Phys. J. C 81 (2021) 256] and two papers are 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. Results from the study of net-proton number fluctuations are published in PRL 126, 092301 (2021). A detailed paper on these measurements titled “Cumulants and Correlation

Functions of Net-proton, Proton and Antiproton Multiplicity Distributions in Au+Au Collisions at RHIC” recently appeared on arXiv [arXiv:2101.12413] which is currently under review by journal’s referee. The study on the net-proton number fluctuation is further extended onto even higher order, i.e. fifth and sixth order, with the motivation to understand the nature of quark-hadron phase transition. We have performed the measurements for Au+Au collisions at nine collision energies, $\sqrt{s_{NN}} = 7.7, 11.5, 14.5, 19.6, 27, 39, 54.4, 62.4$ and 200 GeV. Two paper draft based on the results from this study are under preparations.

We have also measured the higher order fluctuations of event-by-event deuteron number distribution in Au+Au collisions at eight collision energies, $\sqrt{s_{NN}} = 7.7, 11.5, 14.5, 19.6, 27, 39, 62.4$ and 200 GeV. 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.

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 are published in the CBM progress report 2019 published in June 2020.

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. Intensity limit for LIPs in the CDMS detectors has been calculated. This is the strongest constraint on LIPs with charges $< e/160$, the first limit on charges $< e/(3 \times 105)$ and is the first work to consider non-relativistic LIPs. The work has been submitted for publication in Physical Review Letters and is under review.
2. 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 has been shipped to Texas A & M University to install cold electronics and to take data for R&D related to MINER detectors. 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 CsI crystal based dark matter search experiment at JUSL has also been done.

1. The work on simulation estimates of neutron background for Jaduguda mine has been published in Journal of Instrumentation (JINST).

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. Modelling the response of liquid scintillator detector in GEANT4 we have been able to unfold the input neutron energy spectrum using simulated data. We will be applying the programs developed on real data to unfold the energy spectrum of neutrons being emitted from our Am-Be source. This will help us understand the whole Am-Be neutron spectrum up to 12 MeV in contrast to the TOF method which give us information only up to 7 MeV.

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 ~ 1010 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. Experiments on double gap RPCs are being done. We have also begun R & D on low resistivity bakelite RPCs for 3rd and 4th stations of the CBM Muon Chamber (MuCh) subsystem.

- 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. Cryogenic 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 undergoing upgrade at Texas A & M University, USA, 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.

1. The work on novel Silicon HV detectors with ~1 e-/h⁺ resolution has been published in Nuclear Instrumentation and Methods in Physical Research A.

Novel designs of these detectors like coin/veto and materials like sapphire have also been tested. It has been observed that the coin detector with a veto configuration allows us to reach a background level of 500 DRU without any shielding in the energy range of 50 to 250 keV. The sapphire detector shows excellent energy resolution of ~15 eV. All these detectors are have great promise as rare event search detectors.

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 energy loss of heavy quarks in the isotropic collisional hot QCD medium at a finite chemical potential is studied within the effective kinetic theory approach. This study lead to a publication in Eur. Phys. J. Plus 136, 130 (2021).

Prof. Sanjay Kumar Swain, Professor

My research has few parts:

B_s⁰ → μ⁺ μ⁻ Data analysis: The physics study of B-mesons was 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 measurements. One of the most important measurements in the area of B-physics (considered as golden channel) is finding the decay of B_s⁰ → μ⁺ μ⁻. 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 ~ 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.

Other B-physics analysis and building B-physics analysis group in India: Apart from the B_s⁰ → μ⁺ μ⁻, the other promising analysis are the angular analysis of B-mesons through their FCNC rare decay channels, such as B → K⁰ 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.

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.

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 2.5×10^{34} /cm²sec. 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).

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 domain and spin dynamics properties of magnetic thin films. A summary of research activities of the past one year has been given below.

Organic spintronics: The group 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 recently studied the effect of spinterface in perpendicularly magnetized Pt/Co/Pt system. It has been shown that the spinterface leads to enhancement of anisotropy and reduction in domain size. 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. The group reported for the first time the quantification of induced magnetic moment in Cu.

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). The group has recently demonstrated skyrmion nucleation and propagation in CoFeB/Pt bilayers in which the pinning landscape is very low. It has been shown that in such system the less current density is required to achieve high skyrmion velocity.

Antiferromagnetic spintronics: 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. The group is also working micromagnetic simulations of SAF in which both isotropic and anisotropic DMI have been taken to study the ground state of skyrmions and antiskyrmions. The group also studies exchange bias in ferromagnetic (FM)/antiferromagnetic (AFM) heterostructures. It has been found that an interfacial spin glass behavior leads to spin glass in NiMn/CoFeB heterostructures. The group also focuses on spin pumping and inverse spin Hall Effect with various antiferromagnets like Mn₂Au, Mn₃Ga, NiMn, IrMn etc.

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.

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. Recently the group reported the maximum spin mixing conductance and spin interface transparency in a

CFMS/Pt system. 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 La_{0.67}Sr_{0.33}MnO₃/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.

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. MoS₂, WS₂) heterostructures for fundamental studies like extraordinary Hall effect (EHE), magnetic proximity effect, magnetization dynamics and to explore their possible application in magnetic field sensing.

Dr. Subhasis Basak, Reader-F

Presently the group is working on the following.

(a) 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 .

(b) 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.

(c) 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

The group have been working on two main projects: (1) Constructing hair modes for CHL black holes (String theoretic black holes) in four and five dimensions and matching the number of microstates with microscopic string theory models. We showed how to construct hair modes in supergravity and did the microscopic matching between 4 and 5 dimensional black holes (2) Studying AdS-Milne spacetime in the context of gauge-gravity duality. We have derived correlators and stress tensor and matched them with boundary theory results.

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

Brief of Research Activity

My research group Density Functional Theory and Quantum Simulations Group (DFTQSG) explores the interplay between structural, electronic, and magnetic properties of functional materials using computational methods. The corresponding effects and materials are of great interest for basic science and in addition have the potential to trigger new technological developments. By elucidating the physical mechanisms behind potentially useful effects with the goal of identifying suitable materials for novel types of devices, our research attempts to bridge the gap between theoretical physics, basic materials science, chemical physics and technologically important research. The brief overview of the group research activity and expertise are given below;

1. Formalism-Accurate meta-GGA functionals for accurate ground state properties of finite and extended systems. Hybrid density functional. Orbital-dependent functionals.
2. Exchange-Correlation functionals in three-dimensions.

Long-range corrected hybrid functionals for molecular systems.

Screened meta-GGA hybrids for solids.
3. Development of the Pseudo-potential approach for meta-GGA functionals in plane wave basis set codes.
4. Development of the accurate semi-local exchange potential for band gap calculations.
5. Applying meta-GGA range-separated functionals in the time-dependent DFT.
6. TDDFT applied to molecules and solids with meta-GGA kernels.

7. Implementation of meta-GGA range-separated hybrid functionals in the all-electron codes.
8. Development of dielectric dependent meta-GGA level range-separated hybrid functionals.
9. Use of non-local van der Waals density functionals with semi-local exchange-correlation functionals.
10. Study of non-local electron correlation in biological molecules and their interaction with metal surfaces.
11. Study of the meta-GGA level hybrid functionals in the prediction of excited state properties: A comprehensive comparison with many body GW approximations.

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

Phase diagram of random field spin models: We have

formulated a new method to solve field disorder magnetic systems and have been using them to get the phase diagram and behaviour of these very important class of models, which have wide applicability in both condensed matter and high energy physics. Specifically: 1. we have been studying spin-1 models elucidating the multi-critical points in their phase diagrams. (With PhD student Soheli Mukherjee). Some parts are already published; 2. We have studied at $m=2$ vector spin models in the presence of magnetic and crystal field disorders and obtained the phase diagrams for different disorder distributions (with Mustansir Barma, TIFR Hyderabad). 3. We have studied a class of repulsive spin-1 models and studied the ensemble inequivalence in these systems (with PhD student Soheli Mukherjee and short term visitor Raj Kumar Sadhu). (Published).

Hysteresis response: We have studied hysteresis response in higher spin magnets, solving the model on tree graphs (with undergrad student B.E. Aldrin and former postdoc Dr. Abdul Khaleque)

New entropic cluster algorithm for extended hard core exclusions models: We have devised new algorithm for a class of hard exclusion models, for which existing algorithms are not very efficient due to hard core constraint (with Dr. Jetin Thomas (ex student and short term visiting scholar at NISER) and Dr. Asweel Ahmed and Prof. R. Rajesh (both IMSC, Chennai) and Dr. Dipanjan Mandal (postdoc Warwick university, UK).

Dr. Colin Benjamin, Associate Professor

The group work on 3 independent topics, following is the list of submitted manuscripts under each-

A. Theoretical nanoscale science

I have concentrated mainly on two aspects: 1. quantum heat engine with novel materials and 2. Pairing correlation in unconventional superconductors, how we either generate them or how can we check for them.

1. Magic angle twisted bilayer graphene as a highly efficient quantum Otto engine, Ayush Singh, Colin Benjamin, arXiv:2103.13172
2. A thermodynamic probe of the topological phase transition in a Floquet topological insulator,

Abhishek Kumar, Colin Benjamin, arXiv: 2012.02172

3. Josephson quantum spin thermodynamics, Subhajit Pal, Colin Benjamin, arXiv:2105.01726
4. Probing helical vs chiral character of topological superconductors via non- local Hanbury-Brown and Twiss correlations, Tusaradri Mohapatra, Subhajit Pal, Colin Benjamin, arXiv:2103.14920
5. Exciting odd frequency equal spin-triplet correlations at metal- superconductor interfaces, Subhajit Pal, Colin Benjamin, arXiv:2011.06906

B. Quantum information theory

In quantum information theory I have mainly confined myself to discrete time quantum walks and continuous time quantum walks.

1. Generating highly entangled states via discrete-time quantum walks with Parrondo sequences, B. Varun Govind, Colin Benjamin, arXiv:2008.00909.
2. Testing quantum speedups in exciton transport through a photosynthetic complex using quantum stochastic walks, Pratyush K. Sahoo, Colin Benjamin, arXiv:2004.02938

C. Game Theory

Finally, in Game theory we have shown that Nash equilibrium mapping can better model social dilemmas in the thermodynamic limit analytically than either Hamiltonian dynamics model or Darwinian evolution.

1. Nash equilibrium mapping vs Hamiltonian dynamics vs Darwinian evolution for some social dilemma games in the thermodynamic limit, Arjun Krishnan U M and Colin Benjamin, arXiv: 2103.00295.

Dr. Pratap Kumar Sahoo, Associate professor

The group led by Dr. Pratap K. Sahoo is devoted to experimental investigations in two major areas: (a) ion-matter interactions for new material engineering for optoelectronic and sensing applications, (b) multifunctional properties of nanomaterials such as ZnO nanorods, TiO₂ nanorods for device applications. The highlight of my research activities along these two directions are as follows:

(a) Ion matter interactions for materials engineering:

Ion-matter interactions are beneficial for various phase synthesis and materials engineering. The nuclear and electronic energy deposition in the materials is mainly responsible for such materials modifications. One can tune continuously of the implantation energy leading to various energy-dependent effects on the host material, ranging from nanoscale pattern formation, ion beam induced mixing, ion beam induced crystallization, and functionalization etc.

Intermetallic compounds NiBi₃ and NiBi are known to form spontaneously at the interface of Ni and Bi thin films, which become superconducting below ~ 4.2 K. We have synthesized NiBi and NiBi₃ phases using ion energy ranging from 200 KeV to 120 MeV and optimize the parameter for highest mixing rates. A molten-like surface morphology has been realized due to latent thermal spike along the ion track upon swift heavy ion irradiation and explained the co-existence of superconductivity and ferromagnetism properties. The Ni-Bi system also has found its potential applications in lead-free soldering technology, where the alloys of Ni-Bi was shown to improve the thermal fatigue and drop impact resistant.

Another thrust area is ion beam induced dewetting for composite nanodot for super-hydrophobic application. We have demonstrated the self-organized evolution of Au-Si and Au-Ge composite nanodots under medium keV energy ion irradiation on thin films of SiO₂/Si/Au. A new mechanism was developed to explain the phenomena, i.e a synergetic effect of dewetting, sputtering, and mixing results in the evolution nanodot arrays. Such metal-semiconductor hybrid nanostructures exhibit unique physiochemical properties for microelectronics and optoelectronics, sensors, catalysis, and photovoltaics applications.

(b) Multifunctional properties of nanomaterials:

Presently, research on nano particles and nanowires is largely driven by the possibility of useful functionalization of these nano-systems. In addition to their application in functional devices, the nanoscale systems also offer a possibility to do fundamental studies in the quantum regime. We have picked one of the most well established nanorod system i.e. ZnO for fundamental studies and for novel device fabrication.

A proposed phonon tunnel device and non-contact Nano-thermometry based on zinc oxide twin nanorod

junctions. We have demonstrated the phonon tunnel device between two crystalline ZnO nanorods with an amorphous junction. We have fabricated these structures by low cost hydrothermal techniques. We strongly believe that our result will motivate immediate theoretical and experimental efforts towards direct phonon tunneling measurements on single nanorod junctions using the combination of micro-Raman and AFM based techniques.

We also demonstrate that the individual ZnO NRs can be used as highly sensitive cryogenic temperature sensors below ~ 175 K.

We address another problem of tunable field emission properties by making a unique corrugated decoration of Au on densely packed vertical ZnO nanotapers. We have been able to demonstrate desirable field emission material with low turn-on potential and uniform spatial emission profile in one system using Kelvin probe force microscopy (KPFM) and Tunnelling Atomic Force Microscopy (TUNA) techniques.

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 energies. These Nanorods are also highly luminescence, which can be used as photodiodes and phototransistors.

Dr. Kartikeswar Senapati, Reader-F

We have been working on three projects during the last year. (a) Realizing spin-triplet superconducting junctions, (b) Spin-glass physics using superconducting devices and (c) Superconducting proximity effect in NiBi₃ nanoparticles and Ni 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 promises 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

Our group 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 40.0W Yb-fiber laser and 20.0W 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. Recently, we have added a super continuum source to this list which emits broadband (> 600 nm) bandwidth in the visible and near-infrared band of the electromagnetic spectrum.

Dr. Prolay Kumar Mal, Reader-F

Brief of Research Activity

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 particular his student immensely contributed to the very first CMS analysis on the photon associated top quark pair production using the Run II dataset. In the context of SM Higgs and beyond, his group members are quite involved in the Run II analysis with diphoton signature. Here, his group has led the tHq analysis (leptonic decay of top quark) and the Run II legacy paper has been published including the tHq analysis for the very first time. Presently, his students and group members are also pursuing precision measurements on some of the top quark properties.

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 branch 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. NISER-CMS has 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 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

a) We completed the analysis (commenced last year) of the physics of many body localisation (MBL) in a disordered fermionic chain using local density of states (LDOS) and single particle scattering rates.

We evaluated, using large scale exact diagonalisation calculations, eigenstate Green's function data for the whole energy band.

We showed that the transition between the delocalised and MBL phases can be analysed using the disorder averaged local density of states and single particle scattering rates.

We find that the ratio of the typical to the average values of both quantities show a clear increase with system size in the delocalised phase but become nearly independent of the chain length in the localised phase.

Furthermore, the critical disorder strength so obtained was shown to be in good agreement with that obtained using statistics of level spacing ratios. LDOS and scattering rates have in the past been used to characterize single particle Anderson localisation. In our work we provide an important link between the MBL and single particle Anderson localisation physics by presenting the MBL transition in terms of the same experimentally measurable quantities. This work was done in collaboration with

Mr. Atanu Jana (PhD student, NISER) and Prof. Arti Garg (SINP Kolkata) is currently under review as a letter in Physical Review B.

b) We have made further progress in our study of topologically non-trivial magnonic band structures on

the pyrochlore lattice started last year. We find that the interplay of the Dzyaloshinskii-Moriya interaction (DMI) and the spin-ice anisotropy in Heisenberg magnets on the lattice results in multiple three dimensional topological phases. We find that the continuously tunable Weyl points for ferromagnetic exchange get reduced to a discrete set on introduction of the spin-ice anisotropy. Furthermore, for antiferromagnetic exchange the triple point degeneracy (which appears because of the DMI) survives in the presence of spin-ice anisotropy. The edge state structure for the 111 and 100 terminations of the lattice show the presence of several edge states in most of the phases. Currently, we are in the process of correlating the edge state structure obtained with the nature of the Berry curvature and the symmetries of the underlying Hamiltonian. These results which are part of a developing manuscript have been obtained in collaboration with Mr. V.V. Jyothis (PhD student, NISER) and Mr. Bibhabasu Patra (Former MSc Student, NISER).

Preliminary results of this project have been presented at QMAT-2020, an annual conference on Quantum Matter in India. Another branch of the above project which has been initiated involves detailed evaluation of the transverse thermal conductivities for the different topologically non-trivial phases mentioned above. These calculations are being developed in collaboration with Mr. V.V. Jyothis (PhD student, NISER) and Mr. Somil Agarwal (Integrated MSc student, NISER).

Dr. Nishikanta Khandai, Reader-F

- Understanding the distribution of Neutral Hydrogen in the Post-Reionization Universe.
- Modeling the distribution of HI in the local Universe.
- Simulated X-ray maps of galaxy groups and clusters.
- Understanding the clustering of the IGM in the local Universe.
- Using the pair-velocities of galaxies as probe of cosmology.

Courses Taught

- A) Fall 2020 - P463 Astronomy and Astrophysics
B) Spring 2021 - P206 Quantum Mechanics-I

Student supervision

- A) Ashish Mishra- MSc Project (24 credits)
B) Pulkit Ojha - BSc Project (4 credits)

Dr. Anamitra Mukherjee, Reader-F

1. Developing recursion based technique for calculating Green's functions of interacting systems.
2. Understanding interplay of interaction and topology in strongly correlated materials.
3. Static path approximation based investigation of single and multi orbital Hubbard model at finite temperatures.

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:

In a recent work, we report the frequency-dependent ac-magnetic susceptibility study on the D2d symmetric Heusler system Mn-Pt(Pd)-Sn that hosts antiskyrmions over a wide temperature range. In contrast to the conventional skyrmion host compounds, the presence of high Curie temperature of the present system ensures shorter switching times, hence, higher frequencies are used to probe the relaxation dynamics. A non-monotonic variation in the characteristic relaxation time is obtained with distinct maxima at the phase boundaries. The present study is an important contribution towards the basic understanding of dynamical aspects of antiskyrmions for their potential application in racetrack based memory devices.

Pressure controlled Anomalous Hall effect:

In another work we present the pressure induced switching of anomalous Hall Effect (AHE) in the triangular antiferromagnetic (AFM) compound

Mn₃Sn. With the help of Hall Effect measurements, we have demonstrated that the AHE in Mn₃Sn drops to zero with application of pressure. Our pressure dependent magnetization study reveals that the conventional triangular AFM ground state of Mn₃Sn systematically transforms into the helical AFM phase. The pressure dependent x-ray diffraction (XRD) measurements rule out any role of structural.

Phase transition in the observed switching of anomalous Hall Effect. The present study makes an important contribution towards understanding the mechanism that stabilizes different magnetic ground states in Mn₃Sn and related materials for their potential applications pertaining to AHE switching in spintronic devices.

Design of Topological Hall effect:

Owing to the presence of non-trivial topological configurations, an additional component of Hall Effect, named as topological Hall Effect (THE), has been reported in many magnetic materials. In our work, we present the observation of a large robust THE in the multi-sublattice

Mn-Pt-In Heusler magnets. The topological Hall resistivity, which originates from the non-vanishing real space Berry curvature in presence of non-zero scalar spin chirality, systematically decreases with decreasing the magnitude of canting angle of the magnetic moments at different sublattices. With help theoretical calculations, magnetic and neutron diffraction measurements, we have established that the presence of a tunable non-coplanar magnetic structure arising from the competing Heisenberg exchanges and chiral DMI from the D2d symmetry structure is responsible for the observed THE. The robustness of the THE with respect to the degree of non-collinearity adds up a new degree of freedom for designing THE based spintronic devices.

Dr. Victor Roy, Reader-F

The present research of the group led by Dr. Roy focuses on developing a relativistic viscous causal magnetohydrodynamics framework and its application in high-energy heavy-ion collisions.

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. Our group research themes are the following:

We use the modeling framework of our group to fit the one- and two-point statistics of the observed dust polarization maps as seen by Planck at 353 GHz over selected low-column density regions in the northern Galactic cap. Our model uses the multiphase HI column density maps as a proxy for spatially varying dust intensity and a phenomenological model of Galactic magnetic field to account for the line of sight depolarization (Adak et al. 2020). This work has important applications in assessing the accuracy of the component separation methods, as needed for future CMB missions. We also apply the moment approach to the dust spectral energy distribution (SED) at the power spectrum level. Using simulations, we demonstrate the ability of high order moments to account for spatial variations in modified black body parameters. Neglecting these moments leads to poor fits to the data and bias the recovered dust spectral index (Mangilli et al. 2021).

It is often assumed that the CMB signal is statistically isotropic. We test this hypothesis by applying the two statistical methods: Contour Minkowski Tensors (CMT) and Directionality test. Through CMT we check for preferential alignment of CMB hotspots and coldspots towards a particular direction or not. The directionality test looks for the same preferential alignment at large angular scales through the gradient of the field. We have applied the method to CMB polarization map and found that the observed Planck data is consistent with the statistical isotropy

assumption (Kochappan et al. 2020). We analyse the statistical properties of one of the major foreground components, namely the Galactic synchrotron given by the full-sky 408 MHz Haslam map using the Scalar and Tensor Minkowski Functionals (Rahman et al. 2021).

We developed a new StackFirst approach to detect warm hot intergalactic medium (WHIM) from the gas filaments between the Luminous Red Galaxy (LRG) pairs with a detection significance of 10.2σ (Singari et al. 2020). We apply our method on 88000 LRG pairs identified in the SDSS DR12 catalog with an improved selection criterion that ensures minimal contamination by the Galactic CO emission as well as the thermal Sunyaev-Zeldovich signal from the cluster of galaxies. The detection of WHIM is crucial for answering the “missing baryon problem” in Cosmology. We are now extending the same method to search for evidence of the warm hot intracluster medium between galaxy cluster pair connected by a gas filament.

In one of the ongoing work, we have applied the two well-known component separation algorithms: Commander and NILC to test the capability of the proposed ISRO space mission called Exploring Cosmic History and Origins (ECHO) to detect the CMB B-mode signal (Adak et al. paper in preparation). In this work, we use the realistic dust polarization sky developed by our group with and without including the frequency decorrelation effect.

One of the main goal of the PASIPHAE survey is to measure the starlight polarization in R-band with an accuracy of 0.1% for 16.5 magnitude star or brighter in the diffuse low dust column density regions. To achieve this goal, we need to do photometry of each star on the CCD very precisely ($\sim 0.15\%$). Based on the optical model of the telescope, we expect deviations from the ideal two-dimensional Gaussian point spread function (PSF) for the entire field of view for seeing conditions between $1.5''$ – $3''$. It is well-known that the PSF photometry returns lower error bars (at least 40%) compared to the standard aperture photometry. We have determined the shape of the PSF as a function of CCD location and different atmospheric seeing conditions. To model the PSF, we employ the polar shapelets and identified the principal components that capture the shape of the PSF efficiently and filtered out the noise component (Shrish et al. in preparation).

Dr. Najmul Haque, Reader-F

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, Reader-F

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. Over the course of last few months, Dr. Saha has been involved in the following projects-

Mirror anomaly and Circular dichroism

We have been involved in studying optical activity of three dimensional Dirac semimetals (DSMs) using left and right circularly polarised light, namely 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 behaviour. In particular, for different orientations of the light field with respect to the mirror-symmetric plane, the CD in type-II DSMs (having only one Dirac point at a time-reversal invariant momentum) 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 from type-I DSMs which has a pair of Dirac points on the rotation axis of the crystals.

Berry Curvature Dipole in 2D Dirac Semimetals

Recently, we have also been interested in studying several interesting aspects involving Berry curvature. For example, it has been theoretically shown that the first-order moment of the Berry curvature, namely the Berry curvature dipole (BCD) can give rise to nonlinear current in a wide variety of time-reversal

invariant and non-centrosymmetric materials. While the BCD in two-dimensional Dirac systems is known to be finite only in the presence of either substantial spin-orbit coupling where low-energy Dirac quasiparticles form tilted cones or higher order warping of the Fermi surface, we argue that the low-energy Dirac quasiparticles arising from the merging of a pair of Dirac points without any tilt or warping of the Fermi surface can lead to a non-zero BCD. Remarkably, in such systems, the BCD is found to be independent of Dirac velocity as opposed to the Dirac dispersion with a tilt or warping effects. We further show that the proposed systems can naturally host helicity-dependent photocurrent due to their linear momentum-dependent Berry curvatures. Finally, we study an important byproduct of this work, i.e., nonlinear anomalous Nernst effect as a second-order thermal response.

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 within an 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 now 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 led 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.

Dr. Satyaprasad P. Senanayak, Assistant Professor

The research of my group is majorly focused on fundamental understanding of the charge transport and photo-physics of organic semiconductors, perovskites, self-assembled nano-structures and 2D materials. These unconventional semiconductors exhibit a rich variety of transport phenomena and disorder mechanisms which are not exhibited by inorganic semiconductors such as silicon. We utilize a range of electrical, spectroscopy, microscopy and structural characterization to obtain a microscopic understanding of the processes/instabilities in these

materials. Understanding developed from these studies is then applied into developing high efficient photovoltaic, ultra-bright LEDs, low power flexible electronics and improved medical diagnostic technology

Development of p-type perovskite nanocrystal FETs:

Since the invention of field effect transistors (FETs) in the mid-20th century, nanosheet (NS) transistors have been considered as the future towards overcoming Moore's law of scaling. Moving beyond conventional semiconductors, we develop thickness tunable CsPbBr₃ NSs with lateral dimension which can be extended close to 1 μm . Equipped with a minimum trap state density, a lower effective mass of charge carriers, and better carrier transport, the NSs enable an order of magnitude increase in the field effect mobility as compared to that of CsPbBr₃ nano-cubes, thus revealing the efficacy of designing the two-dimensional morphology. The p-type field effect mobility (μFET) of the photo-excited NSs reaches 10–5 cm² V⁻¹ s⁻¹ at 200 K upon partial mitigation of ionic screening and electronic tunneling probability across organic ligands.

Relating Mechanical Property of Semiconductor with Charge transport properties

Measurement of the mechanical properties of conjugated polymers can be a useful tool to reveal information linking optoelectronic properties to underlying microstructures. Moreover, the knowledge of different thermal properties such as glass transition temperature would be useful in deciding the processing condition and for interpreting the thermal stability of devices. Through a combination of different mechanical and thermal property measurement on a wide range of polymeric semiconductor we correlate the mechanical rigidity of the polymeric chain with the charge transport property and the sub-bandgap defect states. A universal comprehensive understanding which correlates the band structure with the interchain and intrachain transport is then developed for different class of polymeric semiconductors.

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 126. Solution of random field XY model on a fully connected graph, Sumedha and Mustansir Barma
 127. Arnab Mandal, Anima Ghosh, Satyaprasad P Senanayak*, Richard H Friend, Sayan Bhattacharyya*, "Thickness-Attuned CsPbBr₃ Nanosheets with Enhanced p-Type Field Effect Mobility", the Journal of Physical Chemistry Letters, 12, 1560, 2021.
 128. Jake L Greenfield, Daniele Di Nuzzo, Emrys W Evans, Satyaprasad P Senanayak, Sam Schott, Jason T Deacon, Adele Peugeot, William K Myers, Henning Sirringhaus, Richard H Friend, Jonathan R Nitschke; "Electrically Induced Mixed Valence Increases the Conductivity of Copper Helical Metallopolymers"; Advanced Materials, 2100403, 2021.
 129. Nikhil Tiwale, Satyaprasad P Senanayak, Juan Rubio-Lara, Abhinav Prasad, Atif Aziz, Yury Alaverdyan, Mark E Welland; "Solution-Processed High-Performance ZnO Nano-FETs Fabricated with Direct-Write Electron-Beam-Lithography-Based Top-Down Route"; Advanced Electronic Materials, 2000978, 2021.
 130. Mingfei Xiao, Remington L Carey, Hu Chen, Xuechen Jiao, Vincent Lemaire, Sam Schott, Mark Nikolka, Cameron Jellett, Aditya Sadhanala, Sarah Rogers, Satyaprasad P Senanayak, Iain McCulloch, Henning Sirringhaus et.al; "Charge transport physics of a unique class of rigid-rod conjugated polymers with fused-ring conjugated units linked by double carbon-carbon bonds"; Science Advances, eabe5280, 18, 7, 2021.
 131. Mingfei Xiao, Aditya Sadhanala, Mojtaba Abdi-Jalebi, Tudor H Thomas, Xinglong Ren, Tao Zhang, Hu Chen, Remington L Carey, Qijing Wang, Satyaprasad P Senanayak, Cameron Jellett, Ada Onwubiko, Maximilian Moser, Hailiang Liao, Wan Yue, Iain McCulloch, Mark Nikolka, Henning Sirringhaus; "Linking Glass-Transition Behavior to Photophysical and Charge Transport Properties of High-Mobility Conjugated Polymers"; Advanced Functional Materials, 31, 7, 2007359, 2021.
 132. Ankita Mohanty, Dhayanantha Prabu Jaihindh, Yen-Pei Fu, Satyaprasad P Senanayak, Lukas Schmidt Mende, Ananthakumar Ramadoss; "An extensive review on three-dimension architectural Metal-Organic Frameworks towards supercapacitor application"; Journal of Power Sources, 448, 229444, 2021.

Conference/Workshop proceedings:

1. "Probing thermal nature of matter formed at RHIC via fluctuation" by Debasish Mallick, Proceedings of QM 2019: Nucl. Phys.A 1005, 121987 (2021).
2. "Spin alignment measurements of vector mesons with ALICE at the LHC" by Sourav Kundu for the ALICE Collaboration, Proceedings of QM 2019: Nucl. Phys.A 1005, 121912 (2021).
3. "Feasibility studies of conserved charge fluctuations in Au-Au collisions with CBM" by Subhasis Samanta for the CBM Collaboration, Proceedings of QM 2019: Nucl. Phys.A 1005, 121896 (2021).
4. "Measurement of cumulants of conserved charge multiplicity distributions in Au+Au collisions from the STAR experiment" by Ashish Pandav, Proceedings of QM 2019: Nucl. Phys.A 1005, 121936 (2021).
5. "Measurement of Higher Moments of Net-Proton Distributions in Au+Au Collisions at $\sqrt{s_{NN}} = 54.4$ GeV at RHIC", by Ashish Pandav for the STAR Collaboration, Proceeding of SQM 2019: Springer Proc. Phys. 250, 355-359 (2020).
6. "Spin Alignment Measurements of Vector Mesons in ALICE at the LHC" by Sourav Kundu for the ALICE Collaboration, Proceeding of SQM 2019: Springer Proc. Phys. 250, 423-427 (2020).
7. Dr. V. Ravi Chandra- "3rd Annual Conference on Quantum Condensed Matter (QMAT 2020)", September, 2020
8. Simulated X-Ray Emission in Galaxy Clusters with AGN Feedback Rudrani Kar Chowdhury, Soumya Roy, Suchetana Chatterjee, Nishikanta Khandai, Craig L. Sarazin, Tiziana Di Matteo June 2020, Bulletin of the American Astronomical Society, Vol 52, No 3, AAS Meeting 236
9. Dr. Victor Roy- DAE HEP 2020
10. Dr. Kartik Senapati- Quantum matters and Heterostructures 2020
11. Dr. Satyaprasad P. Senanayak- "PMHP-2020 : Photophysics of Metal Halide perovskites: From

Materials to Devices", Organized by IIT Roorkee

12. Dr. Satyaprasad P. Senanayak Talk in International Conference on 'Advanced Polymeric Materials-2021'

Conferences /Workshop/Meeting organized:

1. Prof. Bedangadas Mohanty: - XXIV DAE-BRNS symposium on high energy physics: The DAE-BRNS High Energy Physics (HEP) Symposium is a premier event held every other year in India, supported by the Board of Research in Nuclear Sciences (BRNS), Department of Atomic Energy (DAE), India. The symposium consists of parallel & invited plenary sessions. Poster sessions were also held to provide an opportunity to young researchers to showcase their research. The deliberations, from both experimental & theoretical perspectives, covered a variety of topics in particle physics, astroparticle physics, cosmology, heavy-ion physics and related areas. The symposium was held ONLINE for the first-time during December 14-18, 2020. It was organized using the ZOOM (talk sessions) and FRAME (poster sessions) conferencing software. There were ~900 participants, ~540 abstracts, 22 plenary speakers and 24 Mini-review speakers from India and abroad. The symposium saw the largest participation till date.
2. Prof. Bedangadas Mohanty: - ALICE-STAR-INDIA collaboration meeting: The ALICE-STAR-INDIA collaboration meeting was organized from 9th to 12th March 2021 online using the ZOOM platform.
3. Dr. Tuhin Ghosh-LOC member of XXIV DAE-BRNS high energy physics symposium held at NISER between 14-18th December 2020.
4. Dr. V. Ravi Chandra -Co-Organiser (With A. Mukherjee, A. K. Nandy, K. Saha, at NISER) of "Young Investigator Meet on Quantum Condensed Matter Theory", December, 2020"
5. Dr. Kush Saha -Co-Organiser Young Investigator Meet on Quantum Condensed Matter Theory 2020, NISER, Bhubaneswar (host institute) Dec 15- Dec 18, 2020
6. Dr. Ritwick Das- Student conference in Photonics and Quantum Technology (Virtual meet), February 2021

7. Dr. Nishikanta Khandai-14-18 December 2020, DAE-BRNS Symposium Member of LOC, Member of Committee for selection of abstracts and posters for Cosmology and Astroparticle Physics
8. Dr. Nishikanta Khandai-Chair of one Parallel Session Cosmology and Astroparticle Physics March 2021, Generating realizations of distribution functions and mock catalogs Astronomical Society of India Workshop 5 (online). Jointly Organised with Jasjeet Singh Bagla (IISER Mohali), Aseem Paranjape (IUCAA)
9. Dr. Subhankar Bedanta- Webinar series on spintronics (W2S-2020)
10. Dr. Anamitra Mukherjee- 4th Young Investigators Meet on Quantum Condensed Matter Theory: (15-18 Dec 2020) online mode
11. Dr. Yogesh Srivastava- Member LOC, DAE-HEP symposium 2020

Projects from non-DAE schemes:

1. Early career research award, PI:- Dr. Tuhin Ghosh
Title: Modelling and simulation of polarized dust emission using the Planck data and external templates, source of funding: SERB DST Ongoing (2019-2022)
2. DAE-DST Mega-Science: India-CMS Phase 2 Upgrade proposal (under approval), co-PI from NISER-CMS group :-Dr. Prolay Kumar Mal
3. PI-Dr. Pratap Kumar Sahoo- Indo-Germany industrial project from Canostix GHBM, Germany, Title: Diagnosis of cancer in human blood through spectroscopy Source of funding: Canostix GHBM, Germany
Budget: 45 lakhs for 3 years, (2019-2022).
5. Title: "Topological Phase measurement in one-dimensional periodic and quasi-periodic photonic crystals"; Duration – January 2021 to December 2024; Agency: Core Research Grant, SERB; Project code - CRG/2020/000982. Role – Principal-Investigator-Dr. Ritwick Das; Sanctioned amount: Rs. 59.5 lakhs.

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

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).

7. Ramanujan Fellowship, Title: Designing Magnetic Anisotropy for Spintronics- Dr. Ajaya Kumar Nayak

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.

8. Early career research award, Title: Designing novel magnetic materials for exploring skyrmions at room temperature, Source of funding: DST

Budget: Rs. 39, 13056/ (2018-2021), Dr. Ajaya Kumar Nayak

9. 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), Dr. Ajaya Kumar Nayak

10. Tuning the interfacial Dzyaloshinskii-Moriya interaction in ultrathin magnetic films: toward the stabilization of skyrmions in spintronics devices funded by CEFIPRA for the period Jan 2018 to Dec 2021 (Total funding Rs. 73 lakhs) PI-Dr. Subhankar Bedanta.

11. Creating magnetic interface in non-magnetic organic thin films for spintronic applications funded by DST-SERB for a period of February 2018 to Feb 2021 – Total budget Rs. 60.75 lakhs PI-Dr. Subhankar Bedanta.

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

13. Dr. Colin Benjamin-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.

14. Dr.Sumedha- Simons associateship, ICTP Trieste, Italy (2020-2025): Providing financial support for travel and stay for PI and students and postdocs in the group

15. Dr. Satyaprasad P. Senayak-SERB-SRG grant: Perovskite based flexible thermoelectric power generators for portable power systems. (2020-2022)

16. Dr. Satyaprasad P. Senayak-Royal Society Alumni Award/Grant (2020-2021): 2D-3D perovskite based high performance integrated thermoelectronic devices

17. Dr. Satyaprasad P. Senayak-Industrial Funding from Peridot Technology (a subsidiary of Tektronix Ltd, USA) for Advanced Instrument Automation Project (2021-2022)

18. 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”.

19. 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.

20. Dr. Nalmul Haque- Project title: QCD thermodynamics using non-perturbative Dyson-Schwinger Equation approach, Agency: SERB, Amount: 16,38,714 INR

21. 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

22. Dr. Prasanjit Samal-Research proposal entitled “First Principle Simulations on Proximity Coupling Effects in Two Dimensional van der Waals Quantum Systems for Nanoelectronics” 2021 (submitted to SERB, DST, Govt. of India [File Number: CRG/2021/001033] and under active consideration for further processing)

Projects from DAE Sources: NIL

Talks (Invited and contributory):

1. “Spin alignment measurements of vector mesons with ALICE at LHC” by Bedangadas Mohanty on behalf of the ALICE Collaboration at 40th International Conference on High Energy Physics - ICHEP2020, July 28 - August 6, 2020.

2. “Collision energy dependence of C5 and C6 of net-proton distributions at RHIC-STAR” by Ashish Pandav on behalf of the STAR Collaboration at CPOD2021 - The International conference on Critical Point and Onset of Deconfinement, Germany, Mar.15-19, 2021.

3. “Search for the Chiral Magnetic Wave using the ALICE detector in Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV” on behalf of ALICE Collaboration at the VIth International Conference on the Initial Stages of High-Energy Nuclear Collisions (IS2021), Weizmann Institute of Science, Israel, January 10-15, 2021.

4. “Exploring the magnetic field in heavy-ion collisions through spin alignment measurements at ALICE” by Dukhishyam Mallick on behalf of the ALICE Collaboration at heVIth International Conference on the Initial Stages of High-Energy Nuclear Collisions (IS2021), Weizmann Institute of Science, Israel, January 10-15, 2021.

5. “Latest results on light flavour hadron production at LHC and RHIC” by Sourav Kundu at the XXIV DAE-BRNS high energy physics symposium, NISER, Jatni, Odisha, Dec.14-18, 2020.

6. “Cumulant measurement of net-kaon distributions in Au+Au collisions at $\sqrt{s_{NN}} = 27$ GeV from BES-II program at RHIC by Ashish Pandav (for the STAR Collaboration) at XXIV DAE-BRNS high energy

- physics symposium, NISER, Jatni, Odisha, Dec. 14-18, 2020.
7. "Search for the Chiral Magnetic Wave using the ALICE detector in
 8. Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV" by Protay Das on behalf of the ALICE Collaboration at the XXIV DAE-BRNS high energy physics symposium, NISER, Jatni, Odisha, Dec. 14-18, 2020.
 9. "Latest results on hadronic resonance production with ALICE at the LHC" by Dukhishyam Mallick on behalf of the ALICE Collaboration at the XXIV DAE-BRNS high energy physics symposium, NISER, Jatni, Odisha, Dec. 14-18, 2020.
 10. "Simulation of cosmogenic neutron backgrounds for a dark matter experiment at Jaduguda Underground Science Laboratory" by S. Banik, V.K.S. Kashyap, and B. Mohanty at the XXIV DAE-BRNS high energy physics symposium, NISER, Jatni, Odisha, Dec. 14-18, 2020.
 11. "The Mitchell Institute Neutrino Experiment at Reactor (MINER)" by Mouli Chaudhuri on behalf of the MINER Collaboration at the XXIV DAE-BRNS high energy physics symposium, NISER, Jatni, Odisha, Dec. 14-18, 2020.
 12. "Large mass single electron resolution detector for dark matter and coherent neutrino-nucleus elastic interaction searches" by Vijay Iyer on behalf of the MINER Collaboration at the XXIV DAE-BRNS high energy physics symposium, NISER, Jatni, Odisha, Dec. 14-18, 2020.
 13. Dr. Tuhin Ghosh, online Neem Seminar at IUCAA Pune (April 2020).
 14. Dr. Tuhin Ghosh, online contributed talk at Indian Association of General Relativity and Gravitational (IAGRG) 2020 at IIT Gandhinagar.
 15. Dr. Tuhin Ghosh, SPS day at NISER Bhubaneswar.
 16. Dr. Prolay K Mal "Aspect of Top Physics Analyses in CMS", Sept 22, 2020 India-CMS HEP lecture series, 2020
 17. Dr. V Ravi Chandra- Invited talk on Topological magnons on the Pyrochlore lattice: role of competing anisotropies (presented at "QMAT 2020")
 18. Dr. Pratap Kumar Sahoo-Invited talk in webinar: "Department of Physics, Institute of Science, and Shri Vaishnav Vidyapeeth Vishwavidyalaya Indore, on 25/05/2020.
 19. Dr. Pratap Kumar Sahoo Invited talk in international webinar: RIHS Bhograi, Baleswar, Online Seminar on 13/06/2020.
 20. Dr. Pratap Kumar Sahoo Invited talk in webinar: Amity institute of nanotechnology, U.P. on 25/04/2020
 21. Dr. Pratap Kumar Sahoo Talk on SPS Day 22nd January 2021, NISER Bhubaneswar
 22. Dr. Kush Saha- Title: Non-linear transport in anisotropic Dirac semimetals
 23. Quantum Condensed Matter Theory (QMAT 2020), S N Bose National Centre for Basic Sciences, Kolkata, July 16-18, 2020.
 24. Dr. Ritwick Das-Faculty Development Program at C.V.Raman Global University, Odisha (Invited)
 25. Dr. Ritwick Das-Faculty Development Program, GIET Gunupur, Odisha.
 26. Dr. Ritwick Das-Conference on Advances in Optics, Tata Institute of Fundamental Research, Mumbai.
 27. Dr. Ajaya Kumar Nayak-Invited talk in "CMP Webinar" organised by Shiv Nadar University, 2020. Dr. Ajaya Kumar Nayak-Invited talk in "3rd Q-MAT" conference held in S.N. Bose, Kolkata, 2020.
 28. Dr. Nishikanta Khandai-October 9 2020: Online Zoom Seminar, SKA India Post-EoR Working Group Discussion, Invited Speaker: Characterising the HI Distribution among Different Galaxy Populations.
 29. Dr. Nishikanta khandai November 21 2020: Online IUCAA Workshop, Contributed Talk: The ECT of HI-Halo Mass Scatter on the Clustering of HI Selected Galaxies
 30. Dr. Nishikanta khandai January 23 2021: SPS Day NISER, Dr. Nishikanta khandai Contributed Talk: Structure Formation in the Post-Reionization

Universe

31. Dr. Nishikanta khandai January 27 2021: IISER Mohali, Invited Seminar: The Distribution of HI in the Local Universe
32. Dr. Nishikanta khandai March 19, 2021: Online Astronomical Society of India Workshop, Lecture (2 lectures + 2 hands-on sessions): Generating realizations of distribution, functions and mock catalogs
33. Dr. Nishikanta khandai Invited Talk (online): SKA-India Post-Reionization Working Group Title of Talk: Characterizing the HI Distribution among Different Galaxy Populations
34. Dr. Nishikanta khandai Invited Talk: IUCAA Workshop (online) 20-21 November 2020, Title of Talk: The effect of HI-Halo Mass Scatter on the Clustering Properties of HI Selected Galaxies
35. Keynote speaker at IEEE Magnetism Symposium, Prof. Subhankar Bedanta, Spin pumping in heterostructures with heavy metals, topological insulators and antiferromagnets, 2020.
36. Invited lecture at ICEE, Prof. Subhankar Bedanta, Spin interface with Fullerene, 2020.
37. Panelist at VAIBHAV summit, Prof. Subhankar Bedanta, Quantum Materials and Devices, 2020.
38. Invited talk at ETRMCMSN, Prof. Subhankar Bedanta, Exploring Nanomagnetism via interactions, architecture and interface engineering, 2020.
39. Eminent Speaker at Webinar Series on Recent Advances in Physics (Department of Physics NIT Meghalaya), Prof. Subhankar Bedanta, 2020.
40. Invited talk at QMAT 2020, Prof. Subhankar Bedanta, Spin pumping and inverse spin Hall Effect with topological insulators and antiferromagnets, 2020.
41. Plenary talk at National e-seminar (discovering the small World), Prof. Subhankar Bedanta, Excitements in Nanomagnetism, 2020.
42. Invited talk at IEMPHYS international conference on advanced physics, Prof. Subhankar Bedanta, Inverse spin Hall Effect in system either heavy metals, topological insulators and antiferromagnets, 2021.
43. Invited talk at FMET, Prof. Subhankar Bedanta, 2021.
44. Invited talk at Online Refresher Course at Sambalpur University, Prof. Subhankar Bedanta, Interface magnetism, 2021.
45. Contributory talk at ICEE, Dr. Braj Bhusan Singh, Spin to charge conversion with topological insulators and antiferromagnetics, 2020.
46. Contributory talk at ICEE, Esita Pandey, Strain Engineered Domain Structure and Their Relaxation in Perpendicularly Magnetized Co/Pt Deposited on Flexible Polyimide, 2020.
47. Young scientist award talk at AFM, Dr. Sagarika Nayak, Static and dynamic magnetic properties of soft/hard ferromagnetic bilayers, 2020.
48. Contributory talk at MMM, Dr. Sagarika Nayak, Exchange bias in Fe/Ir₂₀Mn₈₀ bilayers: role of spin-glass like interface and 'bulk' antiferromagnet spins, 2020.
49. Contributory talk at QMAT, Dr. Sagarika Nayak, Role of spin-glass like frustration on exchange bias effect in Fe/Ir₂₀Mn₈₀ and Ni₅₀Mn₅₀/Co₄₀Fe₄₀B₂₀ bilayers, 2020.
50. Contributory talk at QMAT, Purbasha Sharangi, and Observation of inverse spin Hall Effect at CoFeB/C₆₀ interface, 2020.
51. Contributory talk at MMM, Abhisek Mishra, Inverse spin Hall effect in sputtered MoS₂/CoFeB bilayers, 2020.
52. Contributory talk at MMM, Purbasha Sharangi, Quantifying induced moment in non-magnetic Cu – C₆₀ interfaces via x-ray magnetic circular dichroism, 2020.
53. Contributory talk at MMM, Pushpendra Gupta, Simultaneous observation of anti-damping and inverse spin Hall effect in La_{0.67}Sr_{0.33}MnO₃/Pt bilayers system, 2020.
54. Contributory talk at MMM, Esita Pandey, Strain

- Engineered Domain Structure and Their Relaxation in Perpendicularly Magnetized Co/Pt Deposited on Flexible Polyimide.2020.
55. Contributory talk at CTMSE- 2021, Shaktiranjana Mohanty, effect of Ir spacer layer on perpendicular synthetic antiferromagnetic coupling in Co/Pt multilayers,2021.
 56. Contributory talk at QMH-2, Pushpedra Gupta, Simultaneous observation of anti-damping and the inverse spin Hall Effect in the La 0.67 Sr 0.33 MnO 3/Pt bilayer system,2021.
 57. Poster presentation at ICEE, Shaktiranjana Mohanty, Effect of Ir spacer layer on perpendicular synthetic antiferromagnetic coupling in Co/Pt multilayers, 2020.
 58. Dr. Colin Benjamin-Invited Talk delivered at Institute of Physics in Conference on "Emerging trends in Quantum Matter, Statistical and Biological Physics" on Nov.23,2020.
 59. Dr. Colin Benjamin Invited Talk on "Challenges and Progress towards Physical Realization of Quantum Computers" at AICTE ATAL FDP on Quantum Computing Thrust Area Quantum Computation and Information Science, Department of Electrical, Electronics and Communication Engineering, GITAM School of Technology, GITAM Deemed to be University, Bengaluru Campus, From 04.01.2021 to 08.01.2021
 60. Dr. Colin Benjamin Seminar on "Research in theoretical nanoscience, quantum information and game theory" at SPS, NISER, for SPS DAY, January 2021.
 61. Dr. Anamitra Mukherjee- Interplay of frustration and interaction at finite temperatures in the Hubbard model: 3rd Annual Conference on Quantum Condensed Matter (QMAT 2020).
 62. Dr. Anamitra Mukherjee- Metal Insulator transitions in the ANiO₃ Nickelates: Condensed Matter Physics Webinar Group (Organised by: IIT Kanpur, IIT Delhi, IIT Goa, SNU Delhi, and NISER)
 63. Dr. Victor Roy- Invited mini review talk in DAE HEP 2020
 64. Dr. Kartik Snapari- Invited talk at Quantum matters and Heterostructures 2020
 65. Dr. Sumedha- Tutored for quantum mechanics at the Vigyan Vidushi 2020 organised by TIFR Mumbai and HSCSE (June 2020)
 66. Dr. Satyaprasad P. Senanayak-Invited talk on: Charge transport Physics of Perovskite transistors at PMHP- 2020, IIT Roorkee
 67. Dr. Satyaprasad P. Senanayak-Invited Talk in International Conference on 'Advanced Polymeric Materials-2021'
- Poster presentations: Nil**
- Recognitions**
1. Prof. Bedangadas Mohanty was elected as Fellow of American Physical Society in the year 2020.
 2. Prof. Bedangadas Mohanty was elected as the spokesperson of ALICE-STAR-INDIA collaboration for the period January 2021 to December 2022.
 3. Prof. Bedangadas Mohanty endorsed as Conference Committee Member of ALICE Experiment.
 4. Dr. Ritwick Das- The Optical Society (OSA), USA senior membership.
 5. Dr. Sumedha- Simons associate, ICTP, Trieste, Italy (2020-2025).
 6. Dr. Satyaprasad P. Senanayak-Royal Society Alumni Award, UK (2020-2021).
 7. Dr. Satyaprasad P. Senanayak-Associate of Indian Academy of Sciences, Bangalore.
 8. Dr. Colin Benjamin-Resource person for ATAL FDP program of AICTE under MHRD, Govt. of India.
- Doctoral degree awarded to Ph.D. Students:**
1. Sourav Kundu, Thesis title: "Angular and momentum distribution of vector mesons produced in proton-proton and heavy-ion collisions at LHC energies" under Prof. Bedangadas Mohanty

2. Prof. Bedangadas Mohanty Co-supervised: Ashutosh Dash, Thesis title: "Influence of hadronic interactions and magnetic field on the bulk properties of matter produced in heavy-ion collision"
3. Sagarika Nayak under Dr. Subhankar Bedanta.
4. Deepali Mishra under Dr. Yogesh Srivastava.
5. Ashutosh Das under Dr. Victor Roy

Outreach Program:

1. Dr. Yogesh Srivastava Presented webinar on "Relativity and Black Holes" at Amity University on 3rd May 2020.
2. Dr. Yogesh Srivastava Presented webinar on Physics Nobel Prize 2020 at NISER on 3rd December 2020.
3. Dr. Yogesh Srivastava Presented a seminar on quantum black holes on SPS Day 2021 (23rd Jan).

Major research facilities added in School of Physical Sciences:

1. Dr. Ritwick Das- Supercontinuum source
2. Dr. Nishikanta Khandai- Saha Cluster: 16 nodes (640 cores) added to upgrade HPC facility.
3. Dr. Subhankar Bedanta- Cluster thin film deposition system comprising of dc/rf sputtering, effusion cells, and LEED attachment for in-situ characterization.
4. Dr. Satyaprasad P. Senanayak Semiconductor Parameter Analysis System
5. Dr. Satyaprasad P. Senanayak High frequency electrical characterization System

Other Additional Duties/Information

1. Dr. Nishikanta Khandai-Faculty in Charge, Computer Center
2. Dr. Nishikanta Khandai-Member, Institute Affairs Committee

3. Dr. Nishikanta Khandai-Chairman, Computer Advisory Committee
4. Dr. Colin Benjamin is referee for SERB projects of SERB, DST, and Govt. of India.
5. Dr. Colin Benjamin is referee for journals from Elsevier, AIP, Wiley, IOP, Springer and Nature Publishing group.
6. Dr. Colin Benjamin's paper "The emergence of cooperation in the thermodynamic limit" has been published as a Letter to the Editor in Chaos, Solitons & Fractals. AIP has found it newsworthy to accord our newly published article "Thermodynamic susceptibility as a measure of cooperative behavior in social dilemmas" in Chaos "Thermodynamic susceptibility as a measure of cooperative behavior in social dilemmas", C Benjamin, A Dash, Chaos 30, 093117 (2020), with a press release. The press release is interestingly titled "Betrayal or cooperation?"

Analytical investigation of behavior drivers" and comes with the following tag line- Using game magnetization and susceptibility in an analytic investigation of cooperation with infinite numbers of people. It has been picked up by some of the most prominent science news portals, like Eurek Alert
https://www.eurekalert.org/pub_releases/2020-09/aiop-boc090320.php also by PHYS.ORG
<https://phys.org/news/2020-09-betrayal-cooperation-analytical-behavior-drivers.html> news(wise)
<https://www.newswise.com/articles/betrayal-or-cooperation-analytical-investigation-of-behavior-drivers7thSpace>
http://7thspace.com/headlines/1302715/betrayal_or_cooperation_analytical_investigation_of_behavior_drivers.html sciencenewsnet.in
<https://sciencenewsnet.in/betrayal-or-cooperation-analytical-investigation-of-behavior-drivers/andScienceDaily> <https://www.sciencedaily.com/releases/2020/09/20200908113235.htm>

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

Postcolonialism, Speculative Fiction, Indian Literature, Popular Culture

Dr. Amarjeet Nayak, Reader-F

Gender Studies, Autobiography and Dalit Studies: My co-authored paper "Speaking and Speaking Differently: Language as Resistance, Liberation and Celebration in Dalit Women's Autobiographical Narratives" has been published in *Contemporary Voice of Dalit (SAGE)*, a leading journal in the field of Dalit studies. It explores how Dalit women use specific linguistic expressions as a symbolic way of claiming their distinct identity which in consequence results in an act of resistance against the dominant linguistic culture. This paper undertakes a close reading of Dalit women's autobiographical narratives to underline the folly of generalizing Dalit women as helpless exploited beings and to explore other important aspects of their lives. It is the intent of this paper to explore how Dalit women use specific linguistic expressions as a symbolic way of claiming their distinct identity which in consequence results in an act of resistance against the dominant linguistic culture of Brahminical inheritance. Gopal Guru states that Dalit women 'talk differently' (Guru, 2016, p. 2548), because their talking differently functions as a potential act of resistance against both casteism and patriarchy along with signifying a mark of distinct identity of their own. Furthermore, the paper locates different passive strategies used by Dalit women to resist the oppressor in their everyday life, because, in many conditions, an open resistance is found to be counterproductive for them. Finally, the paper investigates Dalit women's strategies to carve a space for enjoyment and avenues of entertainment amid the pain and suffering, mostly in their work space. It is instructive to see how the work field, which is generally seen to be a place of pain and hard labour, is often used by Dalit women as a place of freedom and enjoyment. ("Speaking and Speaking Differently: Language as Resistance, Liberation and Celebration in Dalit Women's Autobiographical Narratives". *Contemporary Voice of Dalit*, Vol. 12, Issue 2, 2020. pp. 138-148. SAGE Publications. <https://doi.org/10.1177/2455328X20924882>)

Folklore and Film Studies: My single-authored paper "Folklores in Words and Images: A Study of Folktales from North-East India and their Cinematic Adaptation" to be published by Sahitya Akademi, New Delhi will be a handy contribution to the fields of popular culture and north-east Indian literature. Through a study of select folktales from the richly textured story telling tapestry of North-East India, and their re-imagination in other popular media such as cinema, the contention of this paper would be not only to underline the importance of orality in story-telling, but also to see how folklores can be seen to play a pre-eminent role in highlighting pertinent issues that matter to the general populace of the region. While highlighting the traditional ways of life, as folklores often do, they also help in forging a non-rigid identity formation, especially in gendered terms, which is traditional yet non-stereotypical. They sometimes go against certain mainstream societal notions without coming across as unnecessarily confrontational. At other times, they tend to be reformist while talking about certain prevalent social evils, but they do so in a subtle manner without being preachy or propagandist. To discuss the above-mentioned issues, this paper makes an attempt at close-reading certain folktales from the North-East region, primarily from Assam, collected in Lakshminath Bezbaruah's *Burhi Aair Sadhu* (1911), which has been translated into English as *Old Mother's Wise Tales* (2017) by Nripen Dutta Baruah. It especially looks at four stories - "An Uncle's Story", "Tejimola", "Champabati" and "Elephant-Fruit Princess", found in this collection. The selection of these stories is necessitated not just because of the fascinating folklores on which they are based, but also because of the fact that the critically acclaimed 2015 Assamese film *Kothanadi (River of Fables)* draws inspiration from these folktales to tell a fascinating story of its own. Just as folklores have historically played their part in quenching the thirst of human beings' need to listen to the tales of their own as well as their ancestors' in an easily relatable way, cinema has in recent times played a similar role for the general populace, especially in a region such as India, and the North-East in particular, where there is a long and

rich tradition of listening to stories rather than reading 'written' texts. Thus, bringing together folklores and cinema is a natural thing to do, as both are very much in the domain of popular (and not elitist) culture. The paper also looks at certain interesting exclusions and additions during the process of cinematic adaptation of these folklores. ("Folklores in Words and Images: A Study of Folktales from North-East India and their Cinematic Adaptation". In *Critical Essays on Folktales from North-East India*. Ed. Bhaskar Roy Barman. Sahitya Akademi, New Delhi. Accepted.)

Indian Literature and Gerontology: My co-authored paper "Exploring Literary Representations of Ageism and Coping Mechanisms, through Fakir Mohan Senapati's Odia Short Story "Dak Muni" as a Case Study" to be published by Springer contributes both to the fields of gerontology and literature. This paper highlights the importance of literature in figurally exploring issues related to ageing, elderly abuse, and coping mechanisms. The apparatus that emerges to survive the twilight years has been explored in world literature, Indian Writing in English, and in certain sections of regional language literature within India. It primarily focuses on "Dak Muni" by Fakir Mohan Senapati, the Odia iconoclast, in an attempt to drive home, the point that the study of gerontology can gain deep insights by looking at literature produced in different languages from all over the world.

Speculative Fiction: My conference paper "The past is a palimpsest: South Asian Science Fiction and Its Dialectic Engagement with the Past – A Close Reading of "Sultana's Dream" and "Reunion" tries to explore the ways in which south Asian science fiction engages with the past in a dialectic manner. Science Fiction's engagement with the 'present condition', often seen in the creation of a dystopic or utopian future, is sometimes a product of one's longing for a 'better' human condition in an ameliorated past. The envisioning of a feminist utopia "Ladyland" in the Indian subcontinent, in Rokheya Shekhawat Hossain's short story "Sultana's Dream" (1905) has historically been seen by critics as a response to patriarchy. However, while reversing the power hierarchy between the genders in a future utopia, the *conte philosophique* also hearkens back to an Indian society of the past, where the 'subjects' often needed a

benevolent king, and sometimes a queen, as a prerequisite - an agent of their freedom and happiness. The fact that the utopia was all a dream, indicates both a desire and also a longing for the kind of political structure found in the often-glorified past instead of the then existing structure; the vilifying of the 'prime minister' and glorifying the 'queen' as a major plot point can be read in this light. This paper, through a close reading of the story, is interested in establishing the text's connection to the past as a dialectic one, and neither a rejection of the past nor a straight forward longing /nostalgia. The paper juxtaposes this story's take on the past with that of Vandana Singh's short story "Reunion" (2019). "Reunion" envisions an ecological dystopia /utopia and is set in the Indian subcontinent. But like the former, this too is not just a straight-forward response to the 'present condition' – the ongoing ecological destruction in the world, but also a longing for a distant past that valued a symbiotic relationship between humans and Nature. The paper intends to unpack how both the stories engage with the past in ways where "the past is a palimpsest" ("Reunion") and "history is not a straight line" ("Reunion"), and hence the engagement with a past, however ameliorated, needs to be a dialectic one if its wants to be productive.

Dwelling and the phenomenology of sound

Dr. Joe Varghese Yeldho, Reader-F

While previous work was more engaged with the materiality of sound and its representation in urban space, the current project seeks to focus more on the cultural phenomenon of listening or tuning in. The locale of the work moves on from fiction sited in early twentieth century Harlem to African American fiction that comes into prominence in the twenty first century.

Public Policy, Social Development, Science-Society Interface

Dr. Pranaya Kumar Swain, Associate Professor

Human and elephant relationship resonates with cultural significance, but with rapid changes there is increasing uncertainty over their harmonious coexistence. Since human settlements are expanding towards the elephant habitat fragmenting their migration corridor, there are increasing incidences of negative interactions between humans and elephants

foraging for food. Our research attempts to understand human dimensions of HEC by analysing perspectives of various stakeholders and to offer sustainable mechanisms for reducing HEC, conservation of elephants, and mitigating the damages to lives and livelihood.

Few 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. 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.

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. Our ongoing research seeks to explore the lifeworld of early career elementary teachers of governmental schools in Odisha.

Transgenders constitute one of the most marginalised communities in society. Issues and problems related to transsexualism cannot be ignored and people who fall under transsexuality feel that they fall in the trap of gender identity disorder. Despite the emphasis by the Government that the health policies must focus on the special requirements of LGBTQ community as a whole, the gap between the theory and practice has been noticeably reported by many social scientists, activists and academicians. Our ongoing study intends to systematically understand the sociological aspects of access to health services by the transgenders in general and to sex reassignment surgery in particular.

Rapid urbanization and population growth have resulted in unprecedented increase in the overall waste generation. Solid waste management falls short of the desired level as the systems adopted do not appear so efficient and adequate. 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 and by applying sociological imagination to the connections among people, institutions, technologies and ecosystems that make society possible.

With great deal of limitations and within the ever-changing scenario of COVID-19 calling for continuous adjustments in the employed measures, our attempt is to assess the key interventions and policy reorientations that the Government of Odisha, known widely for its track record of disaster preparedness and management, adopted to control this challenging and dynamic situation.

Economics of Natural Disaster, Green Accounting and Development Economics

Dr. Amarendra Das, Reader-F

Economic Implications of Natural Disaster

The conventional measures of national income accounting do not account for the depreciation of physical capital caused by natural disasters. Some national and subnational economies face natural disasters more frequently than the others. Capital formation through continuous investment in physical capital is a prerequisite for fast economic growth and poverty reduction. Therefore, frequent occurrence of natural disasters may deplete the physical capital base (such as public infrastructure, private enterprises etc.) and hence may reduce the capability of individuals and states to improve their living standard. Therefore, NDP calculation should also take into account the depreciation of physical capital caused by natural disasters.

I am trying to account for the economic loss due to natural disasters, as the depreciation of capital and provide the adjusted estimate of NDP. Systematic data on economic loss due to natural disasters are limited for all Indian states. We are developing a methodological framework for accounting for the depreciation of the capital due to natural disasters for all Indian states and provides an approximate estimate of adjusted NDP for all Indian states. Due to availability of systematic data on the economic loss due to natural disasters, time series estimate of adjusted NDP are provided for Odisha state which experiences maximum climatic natural disasters. Calculation of adjusted NDP will be very much useful

for fiscal transfer from Union to States and other economic policy making.

GreenAccounting

Does the present income accounting system represent the real value of the wealth of the economy? If not, how are we evaluating the performance economy? How the present evaluation method accommodates different aspects of the economy, society, and the environment? If these aspects are not considered in the evaluation process, is it justified socially or environmentally? We are highlighting the limitations of conventional income accounting, recent developments on environmental accounting at the international level, the progress of environmental accounting in India, the challenges and the way forward. We are developing an Integrated Economic and Environmental Accounts for the mining sector of India.

COVID-19 and the Indian Economy

COVID-19 has severely impacted the Indian Economy and the regional economies. We did forecasts on the extent of contraction of India's GDP. As the secretary of the Orissa Economics Association I was the lead author in preparing a detailed report on how COVID-19 is going to impact the Odisha Economy, we analysed the implications for growth, employment, public finances. The report titled "COVID-19 and the Economy of Odisha: Challenges and the Way forward", is published by Orissa Economics Association. Currently working on a paper how COVID-19 impacted the income and employment of households. In another paper we are examining the fiscal management of Indian states during COVID-19.

Tourism, eSociety, Social network and Health care

Dr. Debashis Pattanaik, Assistant Professor

Social network- Our social network research focuses on understanding outcome individual interconnectedness for system outcomes. Currently our group is working on network effects on health care and homestay tourism. **eSports-** There is growing concern about digital entertainment and digital sports today. The process of creativity, engagement, professionalisation and social technical issues creates both challenges and opportunities for growth and participation. The research group focuses on

professional aspects of eSports in the context of electronic gaming systems. **Tourism-** Tourism is a multifaceted system. It is one of the largest growing service sectors in the world, spreading over simple homestays to star rated hotels. The research group focuses on understanding the dynamics of host-guest interaction in mountain regions of India. The group is also working on Revisit and referral issues in tourism system using online data.

We are in the process of making a paper on Revisit and referral issues and is likely to be communicated to a journal by October 2021. A paper on the literature review on eSports will be communicated as an article to a journal by November 2021.

Development of a Psychometric Instrument for Unconditional Self-acceptance and Exploring its Correlates

Dr. Rooplekha Khuntia, Assistant Professor

Recent research focus is developing a psychometric measure for the construct unconditional self-acceptance (USA). While the construct USA is considered as a psychological strength and has been found to have positive impact on the psychological wellbeing of an individual, empirical studies of the same has been scarce. In addition to developing a psychometric measure, this study also explores how USA is associated with quality of life at both personal and professional levels.

Publications

Dr. Pranaya Kumar Swain, Associate Professor

1. Nayak, Medha and Swain, Pranaya (2020). From Fear to Festivity: Multi-stakeholder Perspectives on Human-Elephant Conflict and Coexistence in India, *Journal of Public Affairs*, DOI:10.1002/pa.2496
2. Swain, P.K. (2020). "Desperate Measures at Desperate Times: A case study of Odisha Addressing the Ongoing Covid-19 Pandemic". In Sikarwar, A.P. & Yadav, B.C. (Eds). *Recent Trends in Global COVID-19 Pandemic*, Agra: Shriyanshi Prakashan, 85-104
3. Nayak, M & Swain, P. (2020). "Predicaments of Wildlife During Covid-19 Crisis: Time to Transform Hunters into Heroes Of Conservation". In S Patra and A Nanda (Eds) *Reimagining Odisha: Stepping into Future with Unpredictable Risks*. New Delhi: Kunal Books. 373-86

4. Nayak, Medha and Swain, Pranaya (2020). Pachyderms through Pencil: Children's Perception and Understanding of Human Elephant Conflict and Coexistence. SageSubmissions. Preprint. <https://doi.org/10.31124/advance.12361484.v1> ('Children sketch human-elephant conflict and coexistence in Odisha'Featured in **Mongabay Series: Beyond Protected Areas** to commemorate the International Elephant Day-2020. (<https://india.mongabay.com/2020/08/children-sketch-human-elephant-conflict-and-coexistence-in-odisha/>)
5. 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>
6. 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

Dr. Amarjeet Nayak, Reader-F

1. Sethi, Bijay Kumar and Amarjeet Nayak. "'Speaking and Speaking Differently: Language as Resistance, Liberation and Celebration in Dalit Women's Autobiographical Narratives". *Contemporary Voice of Dalit*, Vol. 12, Issue 2, 2020. pp. 138-148. (SAGE Publications) <https://doi.org/10.1177/2455328X20924882>
2. Nayak, Amarjeet, Yeldho, Joe V. and Prajnaa Ananyaa. "Exploring Literary Representations of Ageism and Coping Mechanisms, through Fakir Mohan Senapaty's short story "Dak Muni" as a Case Study". *Springer Handbook on Aging*. Accepted.
3. Nayak, Amarjeet. "Folklores in Words and Images: A Study of Folktales from North-East India and their Cinematic Adaptation". In *Critical Essays on Folktales from North-East India*. Ed. Bhaskar Roy Barman. Sahitya Akademi, New Delhi. Accepted.

Dr. JoeVargheseYeldho, Reader-F

1. Yeldho, Joe Varghese. "Sounding Harlem: Ann Petry's *The Street* and the Experience of "Dwelling." **American, British and Canadian Studies**. Spl Issue, City and Literature. 34 (2020): 69-83.

Dr. Amarendra Das, Reader-F

1. With Biplab Kumar Guru (2021) Cost of Human-Elephant Conflict and Perception of Compensation:

Evidence from Odisha, India, *Journal: Journal of Environmental Planning and Management (CJEP)*. <https://doi.org/10.1080/09640568.2020.1838264>

2. With Biplab Kumar Guru (2021) COVID-19 and uncertainty spillovers in Indian stock market. *MethodsX*. Volume 8, 2021, 101199. <https://doi.org/10.1016/j.mex.2020.101199>.
3. With Pradeep Kumar Sahoo and Himanshu Shekhar Rout (2020) Mining, Livelihood and Adivasis, in *Orissa Economic Journal* Vol 52.
4. Lead author (with Keshab Das and Mitali Chinara) "COVID-19 and the Economy of Odisha: Challenges and the Way forward", published by Orissa Economics Association
5. Das, Amarendra (2020): Odisha's Growth Forecast for 2020-21. SageSubmissions. Preprint. <https://doi.org/10.31124/advance.12328388.v1>
6. With Subhankar Mishra (2020). India's Growth Forecast for 2020-21. arXiv preprint arXiv:2005.06461.
7. Das Amarendra (2020) Turnaround in Maternal and Child Healthcare: Role of Institutional Innovation and Interactive Learning in Inclusive Innovation: Evidence and Options in Rural India Editors Rajeswari S. Raina and Keshab Das, Springer.

Dr. Debashis Pattanaik, Assistant Professor

1. A conceptual Reconstruction of the host-guest encounter in tourism, submitted to *Journal of Hospitality and Tourism Insights* (Under review)

Invited Talks

Dr. Pranaya Kumar Swain, Associate Professor

Professional Ethics and the Spirit of Academic Responsibilities, AICTE - Faculty Development Programme on Nurturing Morals, Work Ethics & Accountability for Technical Teachers, at the Dept. of Computer Science and Engineering, VRSEC, Vijaywada, 12 December 2020

Dr. Amarjeet Nayak, Reader-F

Delivered an invited talk on Speculative Fiction to students and faculty of Gangadhar Meher University, Sambalpur, Odisha (29th June, 2020 - Online mode)

Dr. JoeVargheseYeldho, Reader-F

"Urban Narratives: Cities, Texts, Aesthetics." Prof. Susan

Thomas Memorial Lecture. Department of English, UC College, Alwaye (September, 2020).

Dr. Amarendra Das, Reader-F

1. Budget during COVID-19 (karona kalare bajet), Organised by Prajatantra, on February 27, 2021 at Prajatantra Office, Cuttack
2. Webinar on "An analysis of Union Budget 2021-22" organised by Swami Vivekananda Yova Sansad, February 17, 2021
3. Odisha Post Corona: The Road to Recovery, May 22, 2020, Webinar organised by Odisha Alochana Chakra
4. Implications of Farm Reforms 2020 for the Farmers at Kalinga Mavidyalaya, G Udayagiri, Kandhamal, Odisha on December 21, 2020.
5. The Fallouts of Rule-Based Fiscal Policy during COVID-19 in India in Second Global International Conference 2020 organised by Global College International, Kathamandu, Nepal on December 12, 2020.
6. Impact of COVID-19 on the Indian Economy at OPS Mahavidyalaya, Dhenkanal, Odisha on December 04, 2020.
7. Odisha's Fiscal Management During COVID-19 at KSUB College, Bhanjanagar, Ganjam, Odisha on November 22, 2020.
8. Sources of Livelihood in Odisha in National Webinar on Access to Rural Livelihood in Eastern Region of India with a special reference to Odisha on September 15, 2020 at Berhampur City College, Berhampur, Odisha.

9. Impact of COVID-19 on Odisha's Economy, at Ekamra College, Bhubaneswar, on September 05, 2020.

10. Impact of COVID-19 on Odisha Economy at Sarankul College, Sarankul, Nayagarh, Odisha, on July 24, 2020.

Dr. Rooplekha Khuntia, Assistant Professor

Depression: Healing the Invisible - Invited talk in a Webinar by Amity University, Uttar Pradesh, 22nd October, 2020.

Creating a Culture of Ethics and Values - Invited speaker at AICTE sponsored short term training program for faculties at Silicon Institute of Technology, Bhubaneswar, 22nd March, 2021.

Conferences and Seminars

Dr. Amarjeet Nayak, Reader-F

Nayak, Amarjeet. "The past is a palimpsest: South Asian Science Fiction and Its Dialectic Engagement with the Past – A Close Reading of "Sultana's Dream" and "Reunion"" presented in IACLALS (Indian Association for Commonwealth Literature and Language Studies) 2021 Conference. 17-20 March, 2021. Delhi University (Online mode)

Dr. Amarendra Das, Reader-F

Natural Capital Accounting: Case of Mineral Resources in India: 1995-2015. Online (Twitter of MoSPI, Govt of India) in Poster presentation (with Dasarathi Pradhan) **NCAVES INDIA FORUM 2021**. January 15, 2021

RECOGNITION, HONOURS & AWARDS

Honours/Awards/Recognition received by Faculty members/Students

School of Biological Sciences

1. Dr. Aniruddha Datta Roy and his research team has discovered a new species of skink from the Nilgiri Hill region that was published in the reputed journal Zootaxa. This description was covered by an article in THE HINDU Science & Technology section:
<https://www.thehindu.com/sci-tech/energy-and-environment/new-species-of-skink-found-from-western-ghats/article34567454.ece>
2. Dr. Aniruddha Datta Roy has become an invited member of International Union for Conservation of Natural resources (IUCN) Species Survival commission (SSC) and a representative from India for the Skink-specialist group.
3. Dr. KV Badireenath has become the reviewer of SERB Project Proposals.
4. Dr. Chandan Goswami is serving as the "DAAD Research Ambassador for 2018-2022.
5. Dr. Debasmita P Alone has become an Expert Committee Member in SERB for NPDF and Early Career Grants.
6. Dr. Debasmita P Alone has become a reviewer for Journal on Investigative Ophthalmology & Visual Science, Experimental Eye Research, Journal of Genetics, PLOS One and Clinical Ophthalmology, European Journal of Ophthalmology.
7. Dr. Harapriya Mohapatra has become a reviewer for several national and international journals such as International Journal of Antimicrobial Agents, Open Microbiology, Current Microbiology, Environmental Monitoring and Assessment, Frontiers in Microbiology, ACS Nanomaterials.
8. Dr. Harapriya Mohapatra is serving as a Member Board of Studies (Life Sciences) HBNI, DAE.
9. Dr. Manjusha Dixit has become the Editorial Board Member for "Scientific reports" & "BMC cancer"
10. Dr. Renjith Mathew has become the Member of Local Research Advisory Committee (LRAC) for Multidisciplinary Research Unit (MRU), SCB Medical College, Cuttack.
11. Dr. Palok Aich has become the Editorial Board Member for Medicine in Microecology (Elsevier), 2020.
12. Dr. Palok Aich has become the Review Editor for Frontiers in Cellular and Infection Microbiology (section: Microbiome in Health and Disease) 2020.
13. Dr. Palok Aich has become the Member, Board of Advisors, Bencos Research Solution, Mumbai / Bengaluru, India, 2020.
14. Dr. M. Saleem has been awarded with the DBT-Wellcome Trust Intermediate Fellowship.
15. Dr. S. Chattopadhyay has served as an invited judge for the topic "Exploring and understanding the COVID19 pandemic" for class XI and XII students, organized by DAV Public School, Chandrasekharpur, Bhubaneswar, dated 28/11/2020.
16. Dr. S. Ghosh has been awarded with Scientist Award 2020 in Pharmaceutical Sciences by Dr. B. Vasantharaj David Foundation Excellence Awards -2020.
17. Dr. S. Ghosh has become the Editorial Board member for J. Appl. Zool. Res for 2020-2025 in 2020.
18. Dr. S. Ghosh has chaired a Technical Session on Effective Scientific and Technological Approach in combating COVID-19 Across the world, Hiralal Mazumdar Memorial College for Women, West Bengal, India, 27th June 2020.

Awards and Honors by the SBS Students

1. An invited review article in Curr Opin Physiol on COVID-19 is under review. Primary authors of this article are the MSc students from Dr. Asima Bhattacharyya's Lab.

2. Best Poster Award in the following Conferences by Ms. Sohini Mukhopadhyay a student under the guidance of Dr. PalokAich:
 - Conference Name- 5th Biennial Virtual Conference of PAI and International Symposium on “Probiotics and Immunity: Way Forward to Microbial Therapy” Date- 19th & 20th November,2020,Title of the Poster- Akkermansia muciniphila- A Potent Upcoming Probiotic to Reduce Colitis Related Disease Severity
 - Conference Name- BIOSPECTRUM 2020- International Conference on Biotechnology & Biological Sciences. Date- 19th to 21st November 2020, Title- Colitis Leads to Neurophysiological Changes and Impede Normal Behaviour Due to Impairment of Gut-Brain Axis
3. C-terminus of SopA- A key player in mediating segregation. Mishra D a student under Dr. R Srinivasan Selected for a Flash Talk in the Boston Bacterial Meet (BBM) 2020, 16th July-17th July, 2020.(Virtual).
4. Dissecting the role of SopA C-terminus in F plasmid maintenance. Mishra D a student under Dr. R. Srinivasan awarded as a Best Talk in the National seminar on “Advances and challenges in Biological sciences” [ACBS-2020],12th Feb-13th Feb,2020

School of Chemical Sciences

Dr. Bishnu Prasad Biswal, Assistant Professor

Received DST-INSPIRE Faculty Award (Research Grant:Rs.35 Lakh for 5 years)

Dr. Chidambaram Gunanathan, Associate Professor

- Thieme Chemistry Journals Award 2020.
- CRSI Bronze medal 2020.

- Appeared among top 1% in the list of top 2% scientists worldwide for the year 2019.

Dr. Dipak Samanta

DST-Inspire Faculty Award

Dr. Himansu Sekhar Biswal, Associate Professor

Affiliate member of the Royal Society of Chemistry, UK

Dr. Jogendra Nath Behera, Associate Professor

Contribution to the Powder Diffraction File in Release 2020 (ICDD).(Certificate awarded)

Inspire Award-Manak, has served as reviewer of innovative ideas/innovations received under the **INSPIRE Awards-MANAK** for the year **2020-21**.

Dr. Moley Sarkar, Associate Professor

Selected as an associate member (**AMRSC**) of Royal Society of Chemistry.

Dr. Prasenjit Mal, Associate Professor

CRS Bronze Medal 2021 (Chirantan Rasayan Sanstha, Vidyasagar University, West Bengal)

Dr. Krishnan Venkatasubbaiah, Associate Professor

Selected as CRSI-convenor for Bhubaneswar chapter.

School of Earth and Planetary Sciences

- Visiting Associate, Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, India, 2020 (Dr. Majumdar)
- Fellow of Royal Astronomical Society (FRAS), 2020 (Dr. Majumdar)

School of Mathematical Sciences

Dr. Sutanu Roy has been selected for the INSA Medal for Young Scientists - 2020.

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	EPS2001	Dr. Guneshwar Thangiam	SEPS	Max Plank Partner Group Germany	Max Plank Partner Group	EURO 100,000	01.09.2020	31.08.2025	5
2	EPS2002	Dr. Jaya Khanna	SEPS	NMCG	Rejuvenation of dying springs in Tokoli Gad Catchment of Tehri Garhwal District using Geo-Chemical & Geo-Physical techniques	₹ 650,000.00	15.05.2020	14.05.2023	2
3	EPS2003	Dr. Jaya Khanna Co-PI- Dr. Sumit Sen, IIT Roorkee Dr. Jagdish Krishnaswamy, ATREE	SEPS	MHRD-STAR	Comparing the disparate impacts of Oak and Chir pine tree species on their local hydrological and hydroclimatic regimes in the west-central Himalayas	₹ 9,708,000.00	15.05.2020	14.05.2023	3
4	PH2001	Dr. Satyaprasad P. Senanayak	SPS	SERB	Perovskite based flexible thermoelectric power generators for portable power systems	₹ 3,089,607.00	22.12.2020	21.12.2022	2
5	MT2002	Dr. Jaban Meher	SMS	SERB	Structure of Hermitian modular forms modulo p and mod p kernel of theta function	₹ 3,041,544.00	30.12.2020	9.12.2023	3
6	CH2001	Dr. Nagendra Kr. Sharma	SCS	SERB	Synthesis of Functional DNA Comprising Aminotriphyl 2'-deoxyuridine Analogues For Cross-linking with Peptides	₹ 4,745,400.00	30.12.2020	29.12.2023	3

7	MT2001	Dr. Sutanu Roy	SMS	SERB	Levy process on braided quantum groups and bosonization	₹ 660,000.00	29.12.2020	28.12.2023	3
8	MT2003	Dr. Anil Ku. Kam	SMS	SERB	Absolute matrix order unit spaces: an order theoretic generalization of C^* -algebras	₹ 660,000.00	11.01.2021	10.01.2024	3
9	PH2002	Dr. Avdhesh Kumar under mentorship of Dr. Amaresh Kumar Jaiswal	SPS	SERB	National Post-Doctoral Fellowship	₹ 2,131,200.00	15.01.2021	14.01.2023	2
10	PH2003	Dr. Ritwick Das & Dr. Pratap Kumar Sahoo	SPS	SERB	Topological phase measurement in one-dimensional periodic and quasi-periodic photonic crystals	₹ 5,907,000.00	12.01.2021	11.01.2024	3
11	PH2004	Dr. Pratap K. Sahoo	SPS	Canoslix GmbH, Germany	Cancer Scan Project	₹ 2,220,000.00	01.02.2021	30.01.2023	2 + 1 yr extn.
12	PH2005	Dr. Guruprasad Prakash Kadam	SPS	DST-INSPIRE	Transport coefficients near the critical point of strongly interacting matter	₹ 2,248,001.00	02.04.2018 (Transferred from Shivaji University, Kolhapur) DOS at NISER 01.01.2021	01.04.2023	5
13	CH2002	Dr. Bishnu Prasad Biswal	SCS	DST-INSPIRE	INSPIRE Faculty Fellowship	₹ 3,500,000.00	11.02.2021	10.02.2026	5
14.	CH2003	Dr. Dipak Samanta	SCS	DST-INSPIRE	INSPIRE Faculty Fellowship	₹ 3,500,000.00	11.02.2021	10.02.2026	5
15.	EPS2004	Dr. Pathikrit Bhattacharya	SEPS	SERB	Theoretical and computational investigations on the physical origins of rate-state friction- insights from a diverse set of normal stress step laboratory friction experiments	₹ 3,082,000.00	02.03.2021	01.03.2023	2

NINTH GRADUATION CEREMONY

Due to the pandemic situation the 9th Graduation Ceremony was not celebrated in NISER. However, the transcripts and Certificates for the 9th Graduating batch was distributed from 24.08.2020 to 28.08.2020.

In the 9th graduating batch, 78 Integrated M.Sc. students, 6 Int. Ph.D students and 26 Ph.D scholars were graduated.

The students who own various awards in the 9th Graduating Batch are mentioned below;

Gold Medal for Best All Round Performances-2020

Mr. Renu Raman Sahu (School of Physical Sciences)

Mr. Prottay Das (Int. M.Sc-Ph.D Physics)

Silver Medal for Best Academic Performance in each discipline of the graduating class-2020

Ms. Preeti Prava Sahu (School of Biological Sciences)

Mr. Indranil Ghosh (School of Chemical Sciences)

Mr. Telikicherla Sai Parthasarathy
(School of Mathematical Sciences)

Mr. Renu Raman Sahu (School of Physical Sciences)

Best M.Sc Thesis Award-2020

Ms. Preeti Prava Sahu (School of Biological Sciences)

Mr. Abhijit Rana (School of Chemical Sciences)

Mr. Telikicherla Sai Parthasarathy
(School of Mathematical Sciences)

Mr. Abhishek Panda (School of Physical Sciences)

Mr. Prottay Das (Int. M.Sc-Ph.D Physics)

Memorial Awards-2020

1. Winner of Sarat Chandra Annapurna Award-2020

Mr. Renu Raman Sahu
(School of Physical Sciences)

2. Winner of Smt. Jayalaxamma Award-2020

Mr. Indranil Ghosh
(School of Chemical Sciences)

3. Winner of Prof. Tribikram Pati Memorial Award-2020

Mr. Telikicherla Sai Parthasarathy
(School of Mathematical Sciences)

4. Winner of Dr. Sumitra Moharana Memorial Award-2020

Ms. Preeti Prava Sahu
(School Biological Sciences)

5. Mrs. Kanak Benjamin Memorial Award-2020

Ms. Subhashree Pani
(School of Chemical Sciences)

6. Iswar-Parbati Memorial Award-2020

Mr. Renu Raman Sahu
(School of Physical Sciences)

The 11th Foundation Day was celebrated on 6th September, 2020. On this occasion, Dr. A Srinivasan, Professor School of Chemical Sciences, NISER and Dr. Bedangadas Mohanty, Prof. School of Physical Sciences, NISER delivered the foundation Day lectures.

Admission Statistics in the 5yr Integrated M.Sc programme, 2020

- Approved intake for 5 year integrated M.Sc programme is 200
- Total admitted into the 5 year integrated M.Sc programme in the year 2020 was 192.

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

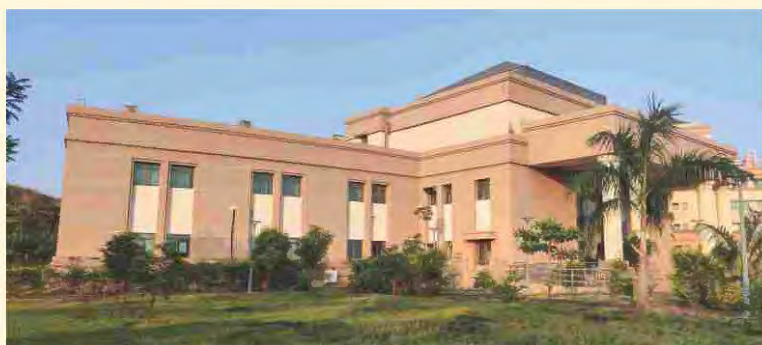
NISER, Jatni Project comprises a total of 127 buildings, having plinth area 175937.92 sqm. The building comprises of various types like Academic buildings, Amenities buildings, Service buildings, Residential, Hostels.





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, Local control substations, 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 Arugul 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.

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

Sl No	Description	Quantity (No.)	Saving in each light (W)	Total Saving (W)	Total Saving in Units (KWH)/ Day (conside light usage of 12 hrs per day)	No of days in a year	Saving in Units/ Month	Remarks
1	36W PL Lamp replaced with 12 W LED	304	24	7296	87.552	365	31956.48	Hostel
2	10W Incandescent Lamp Replace with 0.5W LED	98	9.5	931	11.172	365	4077.78	
3	2X28W CFL replaced with 2x18W LED	551	20	11020	132.24	365	48267.6	Academic Building
4	1X18W CFL replaced with 1x10W LED	373	8	2984	35.808	365	13069.92	
5	2X18W CFL replaced with 1x18W LED	123	18	2214	26.568	365	9697.32	
6	2X 28 Batten Light replaced with 1X 20W LED	31	36	1116	13.392	365	4888.08	
7	2X18W CFL replaced with 1 x 20W LED	28	16	448	5.376	365	1962.24	
8	11W CFL replaced with 5 W LED	28	6	168	2.016	365	735.84	
9	1X28 W T5 lamp replaced with 12W LED	160	16	2560	30.72	365	11212.8	
10	1X28 W T5 lamp replaced with 24W LED	24	4	96	1.152	365	420.48	
Total units saving per Year (KWH)126288.54								

Total Energy Consumption in KWH in year 2020-21:9,757,800 KWH

Maximum Power Demand in KVA:2,460 KVA

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.

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 has 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.

Due to COVID-19 pandemic situation, no Outreach activity was undertaken during 2020-21.

MISCELLANEOUS

International Day of Yoga

International Day of Yoga was celebrated by the institute on 21.06.2020. NISER conducted various yoga sessions, pranayama etc in which the faculty members, staff and students of the institute participated with all enthusiasm through online mode following all the COVID-19 guidelines.

Foundation Day

Since the inception of NISER, the Institute has been celebrating its foundation day every year. On this occasion two prominent faculty members of NISER i.e. Professor A Srinivasan and Professor Bedangadas Mohanty delivered the Foundation day lecture on 6th September 2020, NISER celebrated its 11th Foundation Day of the institute, commemorating initiation of the academic programs at NISER. The Foundation day lecture was delivered online due to COVID-19 pandemic.

Sadbhavana Diwas, Rastriya Ekta Diwas (National Unity Day) & Vigilance Awareness Week etc. were conducted in the virtual mode following all the COVID-19 guidelines.

Seminars/Conferences/Workshops etc. during the period 2020-21

- Student Conference on Photonics and Quantum Technology 2021 - 24/02/2021 to 26/02/2021
- Advanced Functional Analysis and its Applications 2020 - 16/12/2020 to 24/12/2020
- DAE-BRNS High Energy Physics (HEP) Symposium 2020 - 14/12/2020 to 18/12/2020
- Young Investigator Meet on Quantum Condensed Matter Theory (YIMQCMT) 2020 - 15/12/2020 to 18/12/2020
- International Conference on Main-group Molecules to Materials-II - 09/12/2020 to 11/12/2020
- A virtual conference on Infectious Disease,

Microbiome, and Public Health In the current scenario - 10/08/2020 to 11/08/2020

- Indian Institutions-Fermilab Neutrino School - 05/04/2020 to 11/04/2020

All the above activities were conducted following the COVID-19 guidelines.

Swachha Bharat Abhiyan

Swachhata Hi Seva Hai (SHS) Campaign

स्वच्छता ही सेवा है Cleanliness is Godliness

NISER is maintaining complete cleanliness in its entire campus viz. offices, labs, classrooms, lecture halls, library, medical dispensary, hostels, corridors, roads, parks, playgrounds etc. To accomplish this task other than the routine cleaning the Swachhata Committee and Students conduct special cleanliness drives, sensitization programmes time to time in the institute. Student volunteers are significantly contributing to this cause by conducting frequent cleanliness drives especially in the hostel areas. "Swachhata Pakhwada" as per directives received from DAE is also being conducted in the Institute. Some of such events conducted during the year 2020-21 are being reported here.

Swachhata Pakhwada – February 16th to 28th, 2021:

(a) February 16th, 2021 - 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 on February 16th, 2021.
- Roadsides, parks, playground, streets of residential colony, hostels, dispensary, bank and vehicle parking areas were cleaned.
- During the march past placards with swachhhatta related messages were shown to sensitize the people towards cleanliness.
- Some photographs of march past are shown below.



(a) **Sensitization Programme on February 17, 2021:** Dr. Amarendra Das of HSS Department and a team of student volunteers have conducted this sensitization programme for NISER employees, students, and residents of the campus towards proper segregation and disposal of solid and liquid waste.

- **Swachhata Movie Show on February 18th, 2021** was organized by the NISER Film Club and the relevant clips from the following 6 documentaries were screened to sensitize the campus community towards cleanliness: Carbon – Royal stag Barrel
- YOU – A step towards clean India
- Little Steps by KAT Productions
- Nanha Doot
- Murga
- Satkarmi RatiWadho

(b) **Swachchhata Survey and Audit February 19th to 21, 2021:** Dr. Amarendra Das of HSS Department and a team of student volunteers have conducted this Swachchhata Survey and Audit in the campus. They collected the relevant facts / data / information which can be used to improve the cleanliness and better disposal of solid and liquid waste in the campus and the surrounding areas. The report was presented before the Director, NISER in the closing function of the Pakhwada on March 3rd, 2021.

(c) **Cleaning of the Plantation area February 22nd to 26th, 2021:** To clean the bushes in the plantation area special drive was conducted as part of Pakhwada activity, so that the campus

community freely walk through the plantation area. It is pertinent to mention here that in order to increase the greenery in the campus around 5000 plants of Cashewnut, Mango, Guava and Coconut have been planted with the help of state forest department of Government of Odisha.

(d) **Swachhata Art and Craft Competition February 24th, 2021:**

- The competition was announced on February 24th, 2021 for the duration up to February 28th, 2021 and the theme of the competition was “Best out of Waste”.
- The creations were display / shown and evaluated in the Pakhwada Concluding Function held on March 3rd, 2021.
- First, Second and Third place winners were rewarded with Certificate and Cash Prize of Rs.1500/- 1000/- and 500/- respectively

The winners were:

- First Prize: Mr. Laxmidhar Bhuiyan
- Second Prize: A Student and Mr. Manoranjan Maharana
- Third Prize: Ms. Sunayana Kashyap

(e) **Essay / Poem Writing Competition on Swachchhata February 26th, 2021 :**

- An Essay / Poem writing competition on “Role of Cleanliness in Prevention of COVID Pandemic” was conducted in the Institute.
- First, Second and Third place winners were rewarded with Certificate and Cash Prize of Rs.1500/- 1000/- and 500/- respectively



The winners of this competition were:

- First Prize: Ms. Babita Pradhan & Smt. Smruti Kanungo
- Second Prize: Mr. Nikhil Kumar & Mr. Sudhanshu Kannaujiya
- Third Prize: Ms. Shikta Priyadarshini

(f) Swachhata Based Eco – Quiz Competition on February 26th, 2021:

- In this event the participation was in the form of teams of two Students / Employees.
- The competition was consisting of written screening round & five rounds of oral quizzing. First, Second and Third place winner teams were rewarded with the Certificate and Cash Prize of Rs.1500/- 1000/- and 500/- respectively.

The winners were:

- First Prize: Mr. Akhil Tripathi & Mr. Nikhil Kumar
- Second Prize: Mr. Shaswat Sourav Sahoo & Mr. Sunandan Panda
- Third Prize: Mr. Kaustubh Prakash & Mr. Monu Kumar

(g) Cleanest Hostel Competition during February 26th to 28th, 2021:

The Cleanest Hostel Competition was announced for 3 days i.e. from February 26th to 28th, 2021.

During the period every participating hostel students were asked to maintain best possible cleanliness in their respective hostel areas. The council of wardens coordinated by Dr. Deepak Dalai has inspected each participating hostel every day to decide the Cleanest Hostel. Wardens announced that the “Brahmaputra Hostel” is the winner of this year’s competition. A team of students from Brahmaputra Hostel has received the Certificate and cash prize of Rs.2000/- from the Director on the Pakhwada Closing function on March 3rd, 2021.

- (h) Pakhwada Closing Function on March 3rd, 2021:** Though the Pakhwada was observed during February 16th to 28th, the closing function was organized on March 3rd, 2021 because of some logistics and administrative reasons. Honourable Director, Prof. Sudhakar Panda was the Chief Guest of the function. In this function Swachhata Survey and Audit Report was presented by Dr. Amarendra Das of HSS Department. The Chief Guest of the function has distributed the prizes to the winners of all competitive events conducted during the Swachhata Pakhwada period.

Few snaps of the Art and Craft exhibition & prize distribution in the concluding function held on March 3rd, 2021 are depicted below:





Official Language in NISER

NISER is making all possible efforts for effective implementation of Official Language Policy of the Union in the institute. The Official Language Implementation Committee (OLIC) under Chairmanship of Director, NISER plays an active and important role to ensure proper implementation of the policy level orders, instructions received from DAE as well as Government of India. Some of the mandatory requirements like bilingual signage, stamps, letterheads, advertisements, tenders, and reports are already 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 and the staff members are being awarded the cash prizes under the scheme. The institute time to time also conducts Hindi Seminars / Webinars, Conferences, Workshops and Training Sessions. Competitive events in official language Hindi like essay writing, film quiz, shrutlekh, open speech

competitions etc. are the essential part of Hindi Pakhwada / Hindi Diwas celebrations in the Institute every year. Some of such major events and activities conducted during the year 2020-21 are being reported here:

1. Hindi Diwas Celebration:

- Hindi Diwas programme was celebrated in the Institute on September 14, 2020. Honorable Director, NISER was the Chief Guest of the function. On this occasion a meeting of the OLIC was also conducted. Considering the COVID-19 Guidelines all the participants of the function have joined the programme through online mode. Only the prize winners were present in function to receive the prizes from the Chief Guest. During the programme messages of Honorable Home Minister, Secretary, Ministry of Home Affairs and the Secretary, DAE on Hindi Diwas were read out. The Chief Guest of the function honorable Director, NISER has distributed the cash prizes to the winners of the ATOLIS. The details of the prize winners are given below:

Sl. No.	Name & Post of the Winner	Quarter	Category	
			Employee	Language
1.	Ms. Sandeepa Sahoo, UDC	October – December, 2019	Administrative	C
2.	Dr. Arun Kumar, SO-F	January to March, 2020	Scientific	A
3.	Ms. Sandeepa Sahoo, UDC	January to March, 2020	Administrative	C

Few snaps of the prize distribution on Hindi Diwas are depicted below:



2. Webinars / Online Sangoshthi / Interactive Talk Sessions organized in Hindi:
 - An online interactive talk session in Hindi on “**Desh Videsh me Hindi ki Sthiti**” by **Shri Achaleswar Singh, Joint Director, (OL), DAE** was organized through Google Meet on September 18th, 2020.
 - An online interactive talk session in Hindi on “**Shiksha Evm Byaktitwa**” by **Dr. Anand Kumar, Principal, Atomic Energy Junior College, Anushakti Nagar, Mumbai** was organized through Google Meet on September 22nd, 2020.
 - An online interactive talk session in Hindi on “**Triage in COVID-19**” by **Dr. Siva Shankar Paswan, Associate Professor, AIIMS, Patna** was organized through Google Meet on September 29th, 2020.
 - An online Hindi Sangoshthi on “**Hindi Sahitya Evm Vigyan**” was organized by IRE Chhatarpur on March 31, 2021 in which NISER has also participated. In this Sangoshthi a presentation talk was delivered by **Shri Dinesh Bahadur Singh, Officer In-charge (OL)** on the topic of “**Hindi me Takneek Evm Vaigyanik Lekhan: Chunoutiyan evm Sansadhan**”.

3. **Hindi Fortnight** was observed in the Institute during September 14th to 28th, 2020. On this occasion many events / activities were conducted, few of them are detailed below:

a. **Hindi Essay writing competition:** This event was conducted in two categories viz. Students and Employees. For students the event was conducted online / offline modes and for the employees it was only offline on September 22nd, 2020 on the topics of “**Kya Vigyan Gaavon Tak Pahuncha**”. Winners of this competition were:

Students Category:

- i. **First Prize (Cash award of Rs. 2000):**
Ms. Pranjali Singh
- ii. **Second Prize (Cash award of Rs.1500):**
Mr. Aniruddha Shekhawat
- iii. **Third Prize (Cash award of Rs.1000):**
Ms. Isha Dwivedi

Employees Categories:

- i. **First Prize (Cash award of Rs.2000):**
Ms.Sunayna Kashyap
 - ii. **Second Prize (Cash award of Rs.1500):**
Mr.Vijay Singh & Ms. Babita Pradhan (Jointly won the prize as both of them have secured equal marks)
 - iii. **Third Prize (Cash award of Rs.1000):**
Ms.Swarupa Pradhan
- b. **Hindi Film Quiz Competition:** This event was conducted on September 23rd, 2020 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 Rs.2000):**
Ms. Bishnupriya Dash & Ms. Sandeepa Sahoo



ii. **Second Prize (Cash award of Rs.1500):** Shri Vijay Singh & Shri Sukant Kumar Das

iii. **Third Prize (Cash award of Rs.1000):** Ms. Sunayna Kashyap & Ms. Swarupa Pradhan.

c. **Hindi Shrutlekh / Dictation writing competition:** This event was conducted for the students and employees through online mode only on September 24th, 2020. In this competition an audio clip was circulated and the participants were asked to listen it and write. Winners of this competition were:

i. **First Prize (Cash award of Rs.2000):** Mr. Anoop Pramanik

ii. **Second Prize (Cash award of Rs.1500):** Ms. Smrutimedha Parida & Mr. Vijay Singh (Jointly

won the prize as both of them have secured equal marks)

iii. **Third Prize (Cash award of Rs.1000):** Smt. Elina Dash & Ms. Richa Bhalchandra Joshi (Jointly won the prize as both of them have secured equal marks)

4. **Hindi Fortnight Closing Function:** The programme was organized on September 28th, 2020 through both the modes offline and online. Mostly the participants other than the prize winners have participated through online mode. Director, NISER was the Chief Guest of the function and distributed the cash prizes & certificates to the winners of different events. Few snaps of the prize distribution function are depicted below:



OUTSTANDING PERFORMERS AWARD



Dr. Biswajit Mishra, Scientific Officer-E (Medical)

Our Administrative and Technical staff play an invaluable role in ensuring the smooth functioning of all Institute activities. This year (2021) on Republic Day the Institute acknowledged the contributions made by them and felicitated several members of the NISER family for their devotion to duty.



Dr. Bandita Dash, Scientific Officer – E (Medical)



Shri Adhikari Suryakanta Dash, SA-B (Pharmacist)



Shri Dhaneswar Nayak, Administrative Officer –I



Shri Susanta Kumar Sethi, UDC



Shri Sujit Kumar Rout, SA-C (Mechanical)



Shri Sandeep Kumar Behera, Technician-C

STUDENTS ACTIVITIES

April 2020, Coding Club of NISER conducted a Talk on computational problems involving chordal graphs. Prahlad Narasimhan (Batch 17, SMS) gave an online talk discussing some important computational problems involving chordal graphs.

May 2020, The Astronomy Club of NISER conducted a Talk on CMB Temperature Power Spectrum. R. Vasanth Kashyap (SPS, Batch 19). Understanding of the methods that enable us to move from the high uncertainties of cosmology to that of precision cosmology, and associated techniques were discussed.

May 2020, Conducted talk on "Inflation, Quantum Fluctuations, and Primordial Black Holes". As a part of NISER Alumni Webinar, Swagat Saurav Mishra (Batch 08, SPS, NISER), SRF at IUCAA, Pune discussed and shared his experiences while working on the said topic.

May 2020, Launch of their first edition of club's biannual journal Kshitij. Kshitij is the first magazine by any club at NISER. Prepared by the members of NISER Astronomy Club, it encompasses several contents written by NISER students related to Astronomy, Astrophysics, Astrochemistry etc. Highlights and activities of the club were also portrayed in the magazine.

August 2020, Conducted talk on "Mapping the Universe using Sky Surveys". As a part of NISER Alumni Webinar, Biprateep Dey, (Batch '13, SPS, NISER), PhD student at University of Pittsburgh discussed about the several survey techniques plus some upcoming Sky survey plans.

August 2020, Conducted talk on "Evolution of our models of the Universe". As a part of NISER Alumni

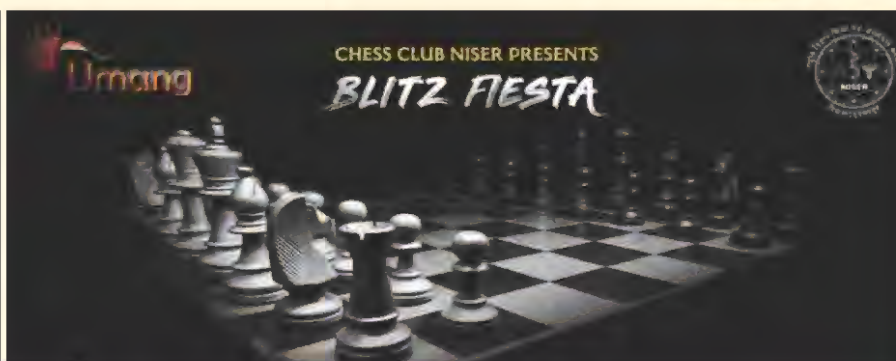
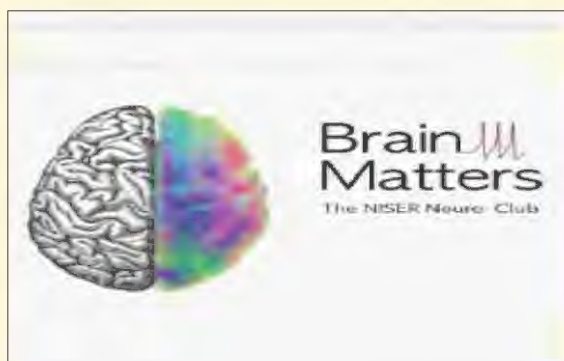


Webinar, Sagar Shrivastava, Ph.D. student at TIFR Mumbai, Batch 11 SMS, discussed the progressions made in modelling the universe.

Conducted a telescope session to Observe the Jupiter-Saturn conjunction. With following all COVID protocols and social distancing norms, NISER members were invited to observe this celestial event on 21st Dec 2020 through the telescopes of SPS, NISER.

January 2021, Also Launch their 2nd edition of club's biannual journal Kshitij. The second edition delved more into providing a richer content to its readers while also showcasing the skills of NAC members in Astrophotography at home (without the telescopes).

January 2021, Conducted an Introductory Astronomy Talk series. Adya Anwesa Mahapatra (SPS, Batch 18),



Pratyaksha (SCS, Batch 19) and Datti Raga Sahiti (SBS, Batch 18) discussed on the concepts and techniques in Astrochemistry and Astrobiology.

March 2021, Conducted a talk on "Ancient Astronomical Calculations". On the occasion of world environment day, we requested the members to come up with creative ideas to transform materials which were considered waste into wonderful and useful crafts. Later we mentioned some special entries in a talk on the environment day and we had also posted the entries in our social media handles.

March 2021, Conducted talk on "Perseverance; a big leap towards MARS". Aheesh Chandrakant Hegde and Chandan Kumar Sahoo (2nd year, Int. MSc., SPS, NISER) discussed the Perseverance Mars exploration mission.

March 2021, Conducted talk on "A brief Overview of Digital Imaging" Adesh Natthuji Thawale, SCS-B18, Int. MSc., discussed the characteristics of images and the involved sensors.

May 2020, Arts Club of NISER conducted an event Share-your-lockdown-art event. This was conducted to provide a platform for sharing the art that the students had done during the lockdown. There was an overwhelming response. This was an online event.

It also conducted Synesthesia. This was an online challenge. This gave students an opportunity to share their favorite music and come up with artistic interpretations of the songs. There was a good response. All the work was posted on the club's social media pages.

June 2020, Brain Matters, NISER conducted an alumni talk by Parameswaran Valiathan from Friedrich Miescher Institute (FMI), based on thinking outside of the (Cortical) box.

January 2021

Conducted Club talk and training Session on Cartoon drawing; by Prajwal Roopanath M M, Batch 19, SBS, NISER; Number of participants: 35

Conducted an art Competition on National Youth Day Weekly art contest with topic art based on quotes of Swami Vivekananda; Number of participants: 30

Conducted an art Competition on Martyrs Day Weekly art contest on Topic: - 1. SOLDIER (or) 2.

PORTRAIT OF SOLDIERS AWARDED WITH PARAM VIR CHAKRA (or) 3. PATRIOTISM

Conducted Club Talk and Training session on topic: Illustrations by Ananya Das, Batch 17, SBS, NISER; Number of participants: 40

January 2021, Conducted an alumni talk and interaction by Aindrita Saha from University of Wisconsin-Madison on Encoding ColorVision.

August 2020, Chess Club, NISER conducted an Intra-Club Friendly Chess Tournament. It was an online blitz intra club friendly tournament on LiChess platform. Accounted for some 10-15 participants. Such tournaments were organized twice, both in August 2020. This helped people have some much needed escape from the monotonous life of the 1st lockdown.

Drama and Music Club

January 2021 - DMC conducted Pratibha, Participants had to post the videos of songs, acts, etc. on their Instagram account in the format of IGTV video and tag DMC. Then, DMC would post those IGTVs on their Instagram and Facebook stories. Total number of students participating in this event was 19.



Students Gymkhana Conducted UMANG-2021 an Intra NISER cultural fest

In February 2021, the student's gymkhana organized an online fest over the span of 3 days in which all the clubs of NISER participated. There were various events in the form of competition.

The events of UMANG 2021 include Nrityotsav by dance club. It was an intra-NISER dance competition, with over 40 participants in solo and group categories. Blitz Fiesta was organized by the chess club, Blitz Fiesta is the annual intra NISER blitz chess championship,

which is held as a part of Umang-the in-house fest. The 2021 edition of Blitz Fiesta was organized online on LiChess due to the covid restrictions in place. However, we registered a record 50 participants, who battled it out over a riveting 90 minutes of fast paced chess.

DMC conducted Music Mayhem, it was a musical open-mic for everyone to come forth to have fun and showcase their musical and instrumental talents, either solo or as a group. Participants could transcend boundaries and can perform any genre of music, and play any instrument. Total number of participants was 28 including vocalists and instrumentalists. DMC and Litc came together to organize Twist It, It was a literature-drama competition, participants had to do it all in Twist It! - think, plan, act, and most importantly, have fun! A team of 5 was required to add their wits to the backdrop of a popular story, and then act it out. Number of groups participating was 3 and movies given to them were: Devdas, Hera Pheri, Harry Potter (Note: These were selected by groups before the event based on the chit system.)

Photography club came up with 2 interesting events, first was Spart It Up, It was an intra NISER photography competition with the theme to capture pictures using an external light source to illuminate the subject. Around 33 students participated. The second event of the photography club was Light painting. It was an intra NISER photography competition in collaboration with NISER Art club with the theme to capture pictures using long exposure technique to draw any artistic design. Around 21 students participated. Arts Club conducted another event with Litc which was named Trip Tales, it was an Anecdote writing + travel brochure painting event. Litc also organised Tag Team Tantrums, which was a team debate tournament. Film club organized an interesting event Video Mixtape. It was a film making event in which participants had to cut out scenes from different films and make a coherent story of their own.

Arts club also organized Untrammled, A Mega Art Inter NISER Contest to unleash creativity and skills. We had a record of 50+ participation.

NISER Astro club along with arts club organized an astro poster making competition for various topics on astronomy. Astro club also organized two more events, one astronomy quiz competition, Antariksh where 30

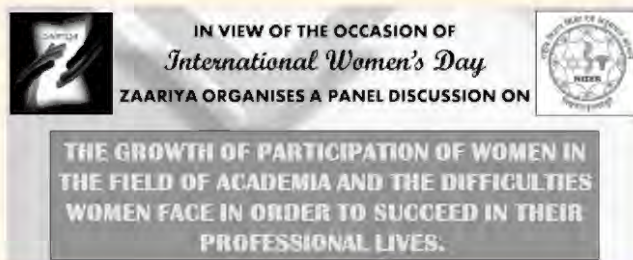
students participated in teams of two for a thrilling contest. And the second fun filled event was the meme making competition Memonomia. It received a total of 70 entries. The nature club of NISER participated in Campus Bird Count 2021 organized by BIRD COUNT INDIA. We counted 59 different species of birds within the campus in a span of 3 days. Yoga club of NISER organized Yoganushthan, A yoga event containing yoga asanas, exercises and short guided meditation which was conducted by Deepanshi Choudhary. The number of participants was 10.

December 2020,

Zaariya conducted a talk on Mental Health during pandemic on importance of mental health and how to be mentally healthy during pandemic by Dr. E. Aravind Raj, Associate Professor of Psychiatric Social Work, NIMHANS. Its main motto was to highlight the social issues that have arisen due to the pandemic and ways to successfully overcome them.

Your's कृतज्ञतापूर्वक. In this event, Zaariya requested the members of our NISER family to drop letters/ gifts showing their gratitude for their dear friends, who helped them survive 2020 and helped them to get through the adversities of 2020. COVID 19 guidelines were strictly followed throughout the event and special measures were taken to avoid public gathering. Students posted their letters and gifts under a beautiful decorated Christmas tree which were later given away to the respective intended recipients. The senders remained anonymous to surprise their friends.

March 2021, Conducted Women's day donation programme. On the occasion of Women's day, we distributed umbrellas to all the female helping staff and security guards, to show our gratitude towards them. We chose umbrellas as they would be useful during the summer which was extremely hot this year. Zaariya volunteers and NISER members contributed generously to the cause, and helped make the event a success.



Conducted Panel Discussion in light of International Women's Day. This panel discussion focused on exchanging views on the growth of participation of women in the field of academia and the difficulties women face in order to achieve something in their professional lives. We invited some of the faculties of NISER and a few senior PhDs to discuss the topic and share their experiences with the members of our institute.

Mathematics Club

October 2020, Mathematics Club, NISER conducted an alumni talk and interaction, by Sagar Shrivastava (Batch 11, SMS, NISER), [Ph.D. at TIFR, Mumbai] on "Origami - The Art/Math's of Paper folding".

November 2020, Conducted an alumni talk and interaction by Priyanga Ganesan (Batch 12, SMS, NISER), [Ph.D. in Mathematics at Texas A&M University (TAMU), College Station, USA] on "Introduction to quantum graphs"

January 2021, Conducted an alumni talk and interaction by Rajula Srivastava (Batch 12, SMS,

NISER), Ph.D. in Mathematics at University of Wisconsin- Madison on "The Polynomial Method"

Sports club

February 2021, Sports club, NISER conducted an Inter batch cricket tournament. This event happens generally once in a semester. Teams from each int. MSc batch, departmental PhDs and a staff team participate and compete with each other.

Conducted an Intra NISER volleyball tournament. The tournament was Auction based. A call for players and managers were taken. After the successful completion of the auction 4 teams were formed and 49 players participated in the auction.

Conducted an Inter batch badminton tournament. The team from Int. MSc, PhDs and Staff participated in the tournament to compete with each other.

Intra NISER kabaddi tournament. The tournament was conducted on Auction Basis. A call for players and managers were taken. After the successful completion of the auction 4 teams were formed. 47 players participated in auction.

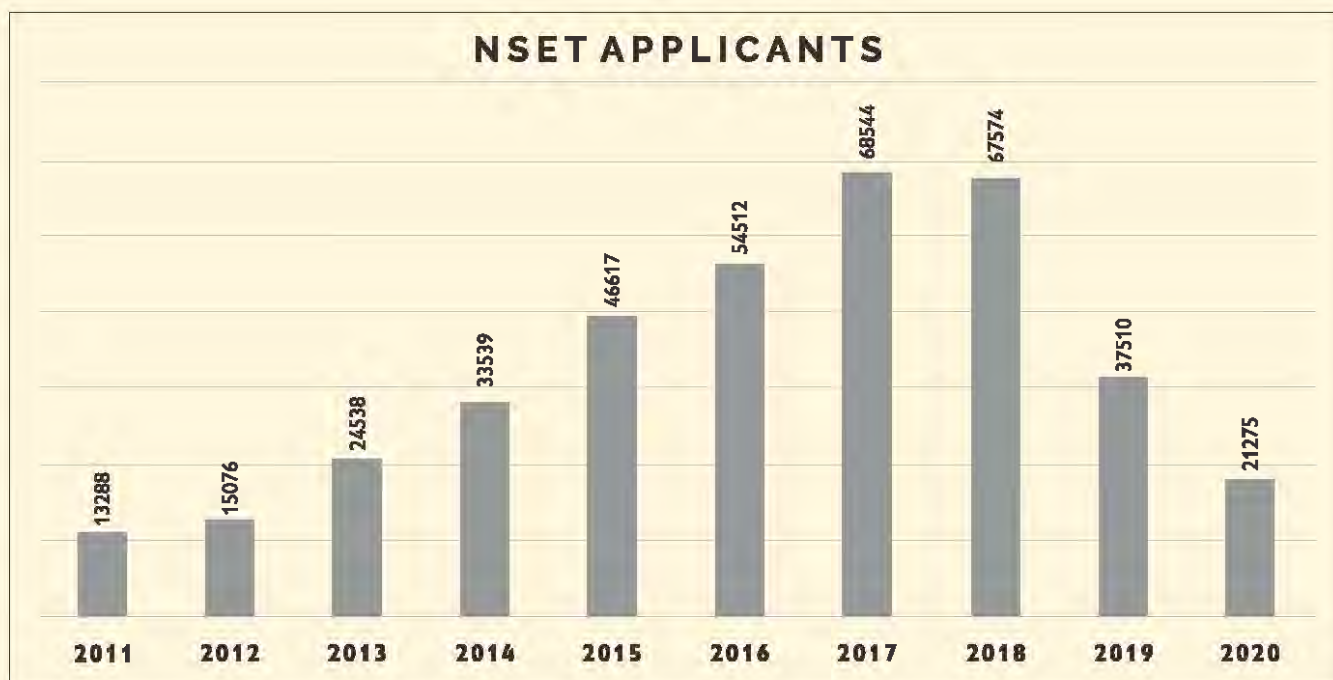
NATIONAL ENTRANCE SCREENING TEST (NEST)

Intake to the Flagship program – NEST

National Entrance Screening Test (NEST), the nationwide 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 2020, was conducted on September 29, 2020 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 21,275 applications were received for NEST 2020 examination. Out of which, nearly 10,000 applications were from Odisha and Kerala put together alone. NEST 2020 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 2020 was published on the website on October 10, 2020 Proposed student intake at NISER, Bhubaneswar for was: 200+2 (Supernumerary) for the session 2020-25. Total 200 candidates were admitted into various streams of integrated M. Sc program of NISER for the Academic Session 2020-25.

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	5492	4166	1185	355	18	84	11,216
Female	5173	3602	914	356	14	26	10,059
Total							21,275

State of Domicile	Number	Percentage	State of Domicile	Number	Percentage
Odisha	7266	34.15	Chhattisgarh	347	01.63
Kerala	2736	12.86	Karnataka	299	01.41
Uttar Pradesh	1580	07.43	Uttarakhand	282	01.33
West Bengal	1240	05.83	Chandigarh	278	01.31
Maharashtra	963	04.53	Himachal Pradesh	263	01.24
Delhi	935	04.39	Assam	133	0.63
Andhra Pradesh	800	03.76	Gujarat	120	0.56
Rajasthan	752	03.53	Tripura	87	0.41
Tamil Nadu	713	03.35	Jammu & Kashmir	86	0.40
Bihar	693	03.26	Punjab	83	0.39
Telangana	691	03.25	Manipur	22	0.10
Jharkhand	519	02.44	Meghalaya	9	0.04
Madhya Pradesh	378	01.78	TOTAL	21,275	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 as per the time schedule and the school wise break up of Ph. D and Integrated Ph. D is as follows:

2020-2021 Application Received Data

SESSION	YEAR	SBS	SCS	SPS	SMS	SHSS	SCoS	SEPS	Total	Int.Ph.D application received	Ph.D students from other states
2020-21 Ph.D	2020- JANUARY SESSION-02.01.2020										14
	APPL.RECD.	217	51	111	0	34	26	0	439	0	
	SHORTLISTED	189	51	68	0	27	11	0	346	0	
	JOINED	7	4	4	0	2	2	0	19	0	
	2020- JULY SESSION										-NA- Due to COVID-19
	APPL.RECD.	742	274	587	192	95	75	76	2041	251	
	SHORTLISTED	621	272	324	137	80	8	71	1513	122	
	JOINED	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	SESSION 2021- JANUARY										
	APPL.RECD.	155	76	587 (from July 20 session)	40	95 (from July 20 session)	15	44	1342	251	
	SHORTLISTED	38	76	324 (from July 20 session)	19	80 (from July 20 session)	1	36	744	122	
	JOINED	8	10	14	6	1	0	6	45	0	

Total no. of PhD students as on 31.03.2021 – 297 & Int. PhD students 22. – Total – 319.

LIST OF 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

LIST OF SCIENTIFIC AND TECHNICAL STAFF

Sl.	Name of Employees	Designation
1	Dr. Arun Kumar	Scientific Officer-F
2	Shri Saikat Hira	Scientific Officer-F (Computer)
3	Dr. Shyamasree Basu	Scientific Officer-F
4	Dr. Sudakshina Prusty	Scientific Officer-F
5	Dr. Bandita Dash	Scientific Officer-E (Medical)
6	Dr. Biswajit Mishra	Scientific Officer-E (Medical)
7	Shri Dilip Jha	Scientific Officer-E (Elect.)
8	Dr. Ranbir Singh	Scientific Officer-E
9	Dr. Santosh Babu Gunda	Scientific Officer-E
10	Dr. Saurabh Chawla	Scientific Officer-E (Vet.)
11	Shri Souvagya Mahapatra	Scientific Officer-E (Civil)
12	Shri Ananda Raman A.	Scientific Officer-E (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 KS Kashyap	Scientific Officer-D
18	Dr. Ajay Kumar Dash	Scientific Officer-C
19	Shri Ashank Vishwakarma	Scientific Officer-C (Mechanical)
20	Shri Kapil Kumar Gupta	Scientific Officer-C (Library)
21	Shri Dipak Kumar Rout	Scientific Assistant-E
22	Shri Jitendra Narayan Dash	Scientific Assistant-E
23	Shri Ranjan Kumar Rana	Scientific Assistant-E (Elect.)
24	Shri Sambid Ranjan Pradhan	Scientific Assistant-E (Civil)
25	Shri Amit Kumar Panigrahi	Scientific Assistant-D (Elect.)

26	Shri Bhagaban Dhal	Scientific Assistant-D (Elect.)
27	Shri Binod Bhagat	Scientific Assistant-D (Civil)
28	Shri Deepankar Dash	Scientific Assistant-D (Computer)
29	Shri Pramod Kumar Nath	Scientific Assistant-D (Civil)
30	Shri Ajit Kumar Mohanty	Scientific Assistant-C (Mech.)
31	Shri Alok Sahoo	Scientific Assistant-C (Computer)
32	Shri Bidyut Siba Sankar Mohanty	Scientific Assistant-C (Library)
33	Shri M Suryanarayan	Scientific Assistant-C (PET)
34	Shri Sujit Kumar Raut	Scientific Assistant-C (Mech.)
35	Kum. N Bharati Reddy	Scientific Assistant-C (Nurse-A)
36	Kum. Sibani Bhuyan	Scientific Assistant-C (Nurse-A)
37	Smt. Smrutirekha Behera	Scientific Assistant-C (Nurse-A)
38	Kum. Susama Pachalasingh	Scientific Assistant-C (Nurse-A)
39	Kum. Binodini Behera	Scientific Assistant-C (Nurse-A)
40	Shri Adhikari Suryakanta Dash	Scientific Assistant-B
41	Shri Bhola Nath Karmali	Scientific Assistant-B (MLT)
42	Shri Jyotiranjana Sahoo	Scientific Assistant-B (Physiotherapist)
43	Shri Ram Jeet	Scientific Assistant-B (Radiography)
44	Kum. Suchismita Dash	Technician-F (Library)
45	Shri Rabindra Kumar Maharana	Technician-F (Library)
46	Shri Bikash Chandra Behera	Technician-D
47	Shri Ram Prasad Panigrahi	Technician-D
48	Smt. Anuradha Das	Technician-D
49	Shri Sanjaya Kumar Mishra	Technician-D
50	Shri Alok Kumar Jena	Technician-D
51	Shri Rudranarayan Mohanty	Technician-D
52	Shri Pravakar Mallick	Technician-D
53	Shri V.A. Sakthivel	Technician-D
54	Shri Amit Sankar Sahu	Technician-D
55	Shri Prafulla Kumar Sethi	Technician-D
56	Shri Mriganka Sadhukhan	Technician-D
57	Shri SK. Safatulla	Technician-D (Library)
58	Shri Tapan Kumar Panigrahi	Technician-D (Computer)
59	Kum. V Shiny Jerusha Joseph	Technician-C
60	Shri Debasis Das	Technician-C
61	Shri Deepak Kumar Behera	Technician-C

62	Shri Kuna Mahara	Technician-C
63	Shri Mukesh Kumar Meena	Technician-C
64	Shri Prakash Chandra Behera	Technician-C
65	Shri Rakesh Kumar Behera	Technician-C (Mech.)
66	Shri Sandeep Kumar Behera	Technician-C (Elect.)
67	Shri Srikrushna Sahu	Technician-C
68	Shri Subhransu Sekhar Panda	Technician-C
69	Shri Susanta Kumar Parida	Technician-C
70	Smt.Ashwini Babrubahan Sethi	Technician-C

Employee Data on SC, ST, OBC and PWD

As on 31.03.2021

ACADEMIC

SC	ST	OBC	PWD
01	Nil	12	Nil

NON-ACADEMIC

SC	ST	OBC	PWD
14	07	18	Nil



Audited Statement of Accounts & Statutory Auditor's Report for the Financial Year 2020 - 2021



**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-751 013
Tel. : 0674-2542418, 9437012300
E-mail: jmpbbsr@yahoo.com

INDEPENDENT AUDITOR'S REPORT

TO,

THE MEMBERS
National Institute of Science Education and Research,
P.O: Jatni, Dist: Khurda, Odisha
PIN-752050

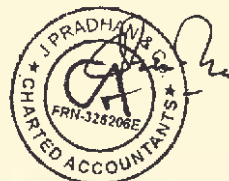
We have audited the accompanying financial statements of **National Institute of Science Education and Research (NISER)**, which comprise the Balance Sheet as at 31st March 2021, the Income and Expenditure account and the Receipt & Payment account for the year ended 31st March 2021, and a summary of 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.

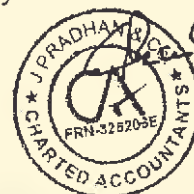
We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion on the standalone financial statements.

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.

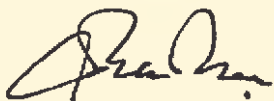
4. In our opinion and to the best of our information and according to explanations given to us the said accounts give a true and fair view:

(i) In the case of the Balance Sheet, of the state of affairs of the Institute as at 31st March, 2021.

AND

(ii) In the case of Income and Expenditure Account of the excess of Expenditure over income for the year ended on that date.

For J Pradhan & Co.
Chartered Accountants
FRN- 326206E



Amiya Kumar Pradhan, (FCA)
(Partner)

M. No. 054626

UDIN-21054626AAAAHP3081

Place: Bhubaneswar

Date: 01-09-2021



NATIONAL INSTITUTE OF SCIENCE EDUCATION AND RESEARCH (NISER)
ANNUAL ACCOUNTS
BALANCE SHEET AS AT 31ST MARCH, 2021

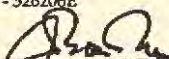
2020-21

Amount in (₹)

Particulars	Schedule	As at 31st March, 2021	As at 31st March, 2020
A. CAPITAL FUND & LIABILITIES :			
1. Capital Fund	1	7,688,599,319	7,841,927,484
2. Reserves & Surplus	2	-	-
3. Earmarked/Endowment Fund	3	-	-
4. Secured Loans & Borrowings	4	-	-
5. Unsecured Loans & Borrowings	5	-	-
6. Deferred Credit Liabilities	6	-	-
7. Current Liabilities & Provision	7	129,593,195	126,282,434
TOTAL		7,818,192,514	7,968,209,918
B. ASSETS :			
1. Fixed Assets	8	7,118,599,085	7,039,600,288
2. Investments of Earmarked/Endowment Funds	9	-	-
3. Investments (Others)	10	209,719,200	349,212,030
4. Current Assets, Loans & Advances etc.	11	489,874,229	579,397,600
5. Miscellaneous Expenditure (to the extent not written off or adjusted)		-	-
TOTAL		7,818,192,514	7,968,209,918
Significant Accounting Policies	24		
Contingent liabilities & Notes on Accounts	25		

*As per our report of even date attached

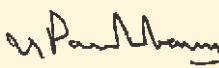
For J Pradhan & Co.
Chartered Accountants
FRN - 326206E


Amiya Kumar Pradhan, FCA
(Partner)

M. No. 054626
UDIN ~21054626AAAAHP3081
Place: Bhubaneswar
Date: -01-09-2021




Administrative Officer - I
(Finance)


Officer on Special Duty
(Finance)


Director

NATIONAL INSTITUTE OF SCIENCE EDUCATION AND RESEARCH (NISER)
ANNUAL ACCOUNTS

2020-21

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2021

Amount in (₹)

Particulars	Schedule	For the Year Ended 31st March, 2021	For the Year Ended 31st March, 2020
A. INCOME :			
1. Income from Sales/ Services	12	-	-
2. Grant/ Subsidies	13	1,130,000,000	1,102,000,000
3. Fees/ Subscriptions	14	28,128,099	21,602,073
4. Income from Investment	15	-	-
5. Income from Royalty, Publication etc.	16	-	-
6. Interest Earned	17	20,171,458	38,816,917
7. Other Income	18	-	-
8. Increase/(Decrease) in stock of Finished Goods & Work-in-Progress	19	-	-
TOTAL (A)		1,178,299,557	1,162,418,990
B. EXPENDITURE :			
1. Establishment Expenses	20	595,468,389	624,763,677
2. Other Administrative Expenses etc.	21	227,458,691	252,367,848
3. Expenditure on Grants, Subsidies etc.	22	-	-
4. Prior Period Income (Adjustment)		38,816,917	-
5. Interest	23	-	-
6. Depreciation (Net total at the year-end-corresponding to Schedule-8)		780,583,725	693,798,776
TOTAL (B)		1,642,327,722	1,570,930,302
Balance being Excess of Income over Expenditure (A-B)		(464,028,165)	(408,511,312)
Add/Less: Prior Period Expenditure		-	176,197,309
BALANCE BEING SURPLUS/(DEFICIT) CARRIED TO CORPUS/ CAPITAL FUND		(464,028,165)	(584,708,621)
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 - 326286E

Amiya Kumar Pradhan, FCA
(Partner)

M. No. 054626

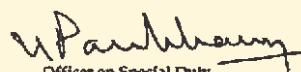
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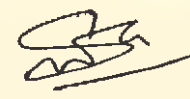
Place: Bhubaneswar

Date: 01-09-2021




Administrative Officer - I
(Finance)


Officer on Special Duty
(Finance)


Director



ANNUAL REPORT & Audited Statement of Accounts 2020-2021



NATIONAL INSTITUTE OF SCIENCE EDUCATION AND RESEARCH (NISER)

ANNUAL ACCOUNTS

RECEIPTS AND PAYMENTS ACCOUNT FOR THE PERIOD FROM 1ST APRIL, 2020 TO 31ST MARCH, 2021

2020-21

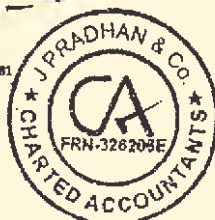
Amount in (₹)

RECEIPTS	For the Year Ended 31st March, 2021	For the Year Ended 31st March, 2020	PAYMENTS	For the Year Ended 31st March, 2021	For the Year Ended 31st March, 2020
I. Opening Balances			I. Expenses		
a) Cash in Hand	-	-	a) Establishment Expenses (corresponding to Schedule 20)		
b) Bank Balances:			i) Pay & Allowances	451,278,964	440,006,504
i) In Current Accounts	209,818,718	552,295,009	b) Administrative Expenses (corresponding to Schedule 21)		
ii) In Savings Accounts	165,545,096	265,171,326	i) Duties & Taxes	-	-
II. Grants Received			ii) Other Administrative Expenditure	287,561,443	310,472,711
a) From Government of India	1,393,200,000	1,252,000,000	iii) Prior Period Expenses	-	-
b) From State Government	-	-	iv) NISER XII Plan	24,097,993	35,626,925
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)	20,171,458	67,809,197	IV. Expenditure on Fixed Assets & Capital Work-in-Progress		
V. Other Income			a) Purchase of Fixed Assets	636,929,212	726,356,348
a) Registration Fee (MSc & PhD)	131,914	1,072,296	b) Expenditure on Capital WIP	201,448,437	-
b) Job Application Fee	18,500	51,500	V. Refund of Surplus Money/Loans	-	-
c) Summer Course Fee	-	122,000	VI. Finance Charges (Interest)	38,816,917	28,992,280
d) RTI Application Fees	310	120	VII. Other Payments		
e) Sale of Tender Paper	153,000	174,316	a) NISER R&D	8,308,509	6,800,812
f) Guest House Rent	127,710	1,706,058	b) Deposit (Asset : LC)	239,103,294	534,952,913
g) License Fees (Rent of Quarter/Bank Branch)	1,229,974	1,734,808	c) Deans Allowance Receivable	-	12,000
h) Fine	15,000	40,100	d) Security Deposit (Refundable)	2,749,227	1,829,229
i) Transcript Fees	2,600	13,700	e) Duties & Taxes	69,532,461	64,646,800
j) Identity Card/Health Card (Duplicate Fee)	4,950	8,425	f) EMD	4,759,361	572,218
k) Lease Rent	994,898	288,708	g) License Fees	3,920	-
l) Water Charges	1,121,442	243,689	h) Liquidated Damage	271,824	-
m) Sale of News Paper	-	20,380	i) Quarantine Expenses	875,618	-
n) Sale of Assets	36,000	2,682,557	j) Scholarship Payable	-	2,064,580
o) Liquidated Damage	3,172,848	128,828	k) Statutory Recoveries	29,127,219	26,028,521
p) EMD/SD (Forfeited)	-	30,800	l) Student Dues	3,993,121	1,188,448
q) Sample Testing Charges	-	-	m) Registration Fee (MSc & Ph.D)	29,389	2,395,064
r) NISER R&D Payable	1,399,147	-	n) Loans & Advance (Asset)	5,131,255	20,456,020
s) Quarantine Expenses	790,000	-	o) Liabilities for Expenses	85,380,180	111,800,009
t) Contingency INSPIRE Payable	230,000	-	p) Guest House Rent	6,300	9,600
u) Leave Travel Concession -Recovery	5,318,077	-	VIII. Closing Balances		
VI. Amount Borrowed	-	-	a) Cash-in-Hand	-	-
VII. Any other receipts (Loans, Advances & Expenses Recovered)			b) Bank Balances:		
a) Security Deposit (Refundable)	8,925,880	5,929,770	i) In Current Accounts	74,530,431	209,818,718
b) E.M.D	6,058,314	893,135	ii) In Savings Accounts	169,226,364	165,545,096
c) Fixed Assets	221,843	4,449,596			
d) Duties & Taxes	67,958,514	65,879,021			
e) Statutory Recoveries	31,775,259	28,434,448			
f) Student Dues	19,577,486	19,432,100			
g) Deposit (Asset : LC)	381,003,571	387,865,791			
h) Loans & Advance (Asset)	1,903,802	21,240,248			
i) Scholarship Receivable	-	6,552,778			
j) NISER R&D Receivable	10,931,031	2,862,330			
k) Liabilities for Expenses	41,010	273,761			
l) DCSEM-Medical Expenses-Receivable	1,217,090	-			
m) Deans Allowance Receivable	-	168,000			
	2,333,095,442	2,689,574,795		2,333,095,442	2,689,574,795

*As per our report of even date attached

For J Pradhan & Co.
Chartered Accountants
FRN - 326208E

Amiya Kumar Pradhan, FCA
(Partner)
M. No. 054626
UDIN : 21054626AAAAHP3081
Place: Bhubaneswar
Date: 01-09-2021



Administrative Officer - I
(Finance)

Officer on Special Duty
(Finance)

Director

NATIONAL INSTITUTE OF SCIENCE EDUCATION AND RESEARCH (NISER)
ANNUAL ACCOUNTS

2020-21

Schedule -1 : Capital Fund

(Schedule forming part of the accounts for the period ended on 31.03.2021)

		Amount in (₹)	
Particulars	Current Year	Previous Year	
Balance as at the beginning of the year	8,260,700,000	8,210,700,000	
Add: Contribution towards Capital Fund	220,300,000	50,000,000	
Add: XII Plan New Project			
a) Advance Materials for Different applications Grant	143,000,000	143,000,000	
b) Basic Research in Cellular & Moducular Grant	171,100,000	157,600,000	
c) Centre for Fundamental Studies Grant	37,296,000	37,296,000	
d) Centre for Inter Disciplinary Sciences Grant	352,400,000	326,300,000	
e) Experimental Condensed Matter Ultra Cold Atom Grant	309,400,000	300,500,000	
f) Experimental High Energy Physics Programme Grant	44,200,000	43,000,000	
g) Microbes Immunity & Rearch Biology Grant	165,500,000	151,900,000	
h) Novel Organic Compounds for Boimedical Grant	145,200,000	145,200,000	
i) Outreach Programmes in Maths & Systems Biology Grant	3,450,000	3,450,000	
j) Research in Basic Sciences Grant	80,300,000	61,200,000	
k) Theoretical High Energy & Condensed Matter Grant	66,900,000	58,900,000	
l) Vigyan Pratibha Grant	5,000,000	5,000,000	
	1,523,746,000	1,433,346,000	
Less: Grant Transferred to Revenue	-	-	
	10,004,746,000	9,694,046,000	
Add/(Deduct): Balance of net Income/ (Expenditure) transferred from the Income & Expenditure Account	(2,316,146,681)	(1,852,118,516)	
TOTAL	7,688,599,319	7,841,927,484	

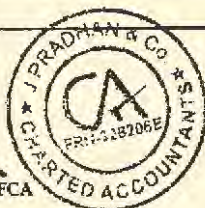
Schedule -2 : Reserves & Surplus

(Schedule forming part of the accounts for the period ended on 31.03.2021)

		Amount in (₹)	
Particulars	Current Year	Previous Year	
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
(Finance)

Officer on Special Duty
(Finance)

Director

Page-4

NATIONAL INSTITUTE OF SCIENCE EDUCATION AND RESEARCH (NISER) ANNUAL ACCOUNTS

2020-21

Schedule -3 : Earmarked / Endowment Fund

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Particulars	Fund-wise Break up				Totals	
	Fund WW	Fund XX	Fund YY	Fund ZZ	Current Year	Previous Year
1) Opening balance of the funds :						
2) Additions to the funds :						
a. Donations / Grants	-	-	-	-	-	-
b. Income from Investments made on account of funds	-	-	-	-	-	-
c. Other additions	-	-	-	-	-	-
TOTAL (A + B)	-	-	-	-	-	-
3) Utilisation / Expenditure towards objectives of funds :						
a. Capital Expenditure :						
(i) Fixed Assets	-	-	-	-	-	-
(ii) Others	-	-	-	-	-	-
Total (i)	-	-	-	-	-	-
b. Revenue Expenditure :						
(i) Salaries, Wages and allowances	-	-	-	-	-	-
(ii) Rent	-	-	-	-	-	-
(iii) Other Administrative expenses	-	-	-	-	-	-
Total (ii)	-	-	-	-	-	-
TOTAL (C)	-	-	-	-	-	-
Net Balance at the year end (A+B-C)	-	-	-	-	-	-

Amount in (₹)

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

2020-21

Schedule - 4 : Secured Loans and Borrowings

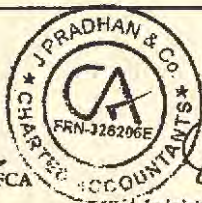
(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (₹)

Particulars	Current Year		Previous Year	
1. Central Government		-		-
2. State Government (Specify)		-		-
3. Financial Institutions				
a) Term Loans	-	-	-	-
b) Interest accrued and due	-	-	-	-
4. Banks:				
a) Term Loans	-	-	-	-
b) Interest Accrued & Due	-	-	-	-
c) Other Loans (Specify)	-	-	-	-
d) Interest Accrued & Due	-	-	-	-
5. Other Institutions & Agencies		-		-
6. Debenture & 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

2020-21

Schedule -5 : Unsecured Loans & Borrowings

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (₹)

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

Schedule -6 : Deferred Credit Liabilities

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (₹)

Particulars	Current Year	Previous Year
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)

Director

Director



NATIONAL INSTITUTE OF SCIENCE EDUCATION AND RESEARCH (NISER)
ANNUAL ACCOUNTS

2020-21**Schedule - 7 : Current Liabilities & Provisions**

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (₹)

Sl. No.	Particulars	Current Year		Previous Year	
A.	CURRENT LIABILITIES				
1.	Acceptances		-		-
2.	Sundry Creditors:				
a) For Goods			-		-
b) Others - EMD	9,336,700	9,336,700	8,031,747	8,031,747	
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)	287,718		1,108,347		
ii) TDS (CGST)	144,132		200,464		
iii) TDS (SGST)	144,132		200,464		
iv) TDS (IGST)	322,634		1,010,760		
v) TDS (Salary)	35,908	934,525	(11,742)	2,508,292	
6.	Other Current Liabilities				
a) Student Dues :					
(i) Internal Amenities S.D.	180,000		189,000		
(ii) Excess Prog. Regd. Fees	32,368		31,368		
(iii) Caution Money (Laboratory)	13,000		13,000		
(iv) Caution Money (Library)	2,336,000		2,062,000		
(v) Caution Money (Institute)	4,105,250		3,607,250		
(vi) Caution Money (Hostel)	93,700		135,600		
(vii) CSIR Contingency	125,401		170,690		
(viii) Alumni Association Subscription	112,020		65,800		
(ix) Student Welfare Fund	361,460		315,240		
(x) Kotak Mahindra Scholarship Payable	98,950		98,950		
(xi) DBT Scholarship (Ph.D)	26,210		26,210		
(xii) HDFC Scholarship	28,759		-		
(xiii) Inspire Scholarship (Ph.D)	117,949	7,631,067	1,902,617	8,617,725	
(b) Smart City Fund		2,974		2,974	
(c) Odisha State Fund		43,805		43,805	
(e) Interest on Deposit		-		-	
(h) 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	50,495		185,384		
- 4S Interiors	2,723,813		2,650,577		
- Avantor	40,000		-		
- Bigyan Kumar Pradhan	225,137		260,700		
- Bijay Kumar Behera	391,301		244,522		
- Bhagarathi Sahoo	22,638		22,638		
- B. K. Giri	18,133		18,133		
- Bi Biotech	10,000		-		
- Indo Electricals	16,666		16,666		
- Firestep Sales and Services	44,327		31,968		
- Uma Fire Services Pvt. Ltd.	157,000				
- Biswajeet Kandi	32,229		59,665		
- Deepak Kumar Mishra	39,028		39,028		

For J PRADHAN & CO
Chartered Accountants
Firm Regd. No. 326205E

Amiya Ku. Pradhan, FCA
Partner M No.054626



ANNUAL ACCOUNTS

2020-21

Schedule -7: Current Liabilities & Provisions

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (\$)

Sl No.	Particulars	Current Year	Previous Year
	- Geeken Seating Collection Pvt. Ltd.	5,536,542	5,536,542
	- Genamy Scientific Pvt. Ltd.	12,000	-
	- Giridhari Lal	293,647	-
	- Biplob Kumar Parida	-	81,913
	- HAK Electrical & Engineering Works	271,698	225,484
	- H Electrical Engg. Works	16,439	16,439
	- Hemtix Biotech	20,000	-
	- Indian Plant Feeds	282,261	-
	- Jagannath Refrigeration Services	3,200	3,200
	- Shri Rabindra Kumar Mallick	182,692	88,009
	- Ramakanta Sahani	6,349	-
	- Subhashree Engineering	4,890	4,890
	- Pest Control India Pvt. Ltd.	360	360
	- Biswajit Mishra	97,889	126,694
	- Canara Lighting Industries Pvt. Ltd.	1,404,939	-
	- Nobel Enterprises	2,000	-
	- Nirmal Chandra Sar	311,467	268,664
	- Numeric Power Systems Ltd.	14,343	14,343
	- Deepak Kumar Das	19,234	48,741
	- Laser Science Services (I) Pvt. Ltd.	450,900	450,900
	- Laxman Senapati	5,000	5,000
	- Lab India	30,000	-
	- Maa Dakshinachandi Catering Services	100,000	100,000
	- Bichitrananda Samantaray	27,013	107,198
	- Bikramajit Singh	5,000	5,000
	- Chandan Electrical	10,000	10,000
	- Debasis Pattanaik	-	94,772
	- Ensure Support Services India Ltd	5,000	5,000
	- EVAC Engineering Projects Pvt. Ltd.	449,238	-
	- Everest Computers	5,000	5,000
	- IN2IT Technology Pvt. Ltd.	5,000	5,000
	- J N Sharma	100,000	100,000
	- Johnson	718,585	634,285
	- Krishik Infrastructure Developers Pvt. Ltd.	172,967	-
	- Jyotirnanjan Tripathy	295,873	-
	- Kalina Combines Pvt. Ltd.	425,661	-
	- Kumar Electricals	5,000	5,000
	- Manor Computers	5,000	5,000
	- Maxim Systems	5,000	5,000
	- Nablok Das	5,000	118,533
	- Ray Electricals	230,084	230,084
	- Sahai Exclusive Contracts Pvt. Ltd.	758,312	-
	- Santosh Kumar Paikaray	5,000	5,000
	- SP Power System	13,975	13,975
	- Suvidha Engineers Pvt. Ltd.	71,593	188,590
	- Tarsun	10,000	-
	- Vedica Resources	-	33,387
	- Wizertech Informatics Pvt. Ltd.	5,000	5,000
	- Sai Aircon	28,009	28,009
	- Sanjeeb Kumar Das	5,000	5,000
	- Sridhar Routray	5,000	5,000
	- Sritam Computers	655,180	601,453
	- Sujit Kumar Nahak	44,579	44,579
	- Supdex Services Pvt. Ltd.	13,981	-
	- Indu Enterprises	19,783	19,783
	- Invitrogen	22,000	-
	- Mangaraj Hati	173,014	402,516
	- Martha Engineerings & Suppliers	31,281	25,716
	- Namah Shivaya Enterprise	105,891	21,230
	- Rabindra Electricals	82,701	52,321
	- Saraj Kumar Das	17,879	17,879
	- Shree Maa Constructions	-	555,456
	- Shreema Construction	-	60,039
	- Sonatech Infosolutions Pvt. Ltd.	89,614	89,614

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PO : Bhubaneswar, 751009, Jatani, Khurda - 752050, Odisha, India. Phone: 0674-2494008, Fax.: 0674-2494009, Email: director@niser.ac.in, Web : www.niser.ac.in

ANNUAL ACCOUNTS

2020-21

Schedule -7: Current Liabilities & Provisions

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (₹)

Sl. No.	Particulars	Current Year		Previous Year	
	- VL Access India Pvt. Ltd.	5000		5000	
	- Aurobindo Prasad Behera	-		25,200	
	- Bansidhar Hati	26,865		17,876	
	- Bhawani Air System	-		26,742	
	- Bibekananda Patra	133,837		115,100	
	- Electro Crafts	22,645		22,645	
	- Empire Hospitality	-		34,601	
	- Enhance Ecotech Solutions Pvt. Ltd.	115,500		-	
	- O. P. Gupta & Co.	66,527		-	
	- Gupta Sports	23,098		23,098	
	- Chem Eco Engineers	58,930		16,670	
	- Utkal Engineering	25,498		9,010	
	- Vadilal Chemical Ltd.	170,000		-	
	- Vijaypower Generators Ltd.	1,081,187		966,885	
	- Janaki Engineering	-		41,474	
	- Lacminarayan Enterprises	3,210		3,210	
	- Laxminarayan Enterprises	56,582		8,486	
	- Living Creation Pvt. Ltd.	248,020		-	
	- Manoranjan Pradhan	35,000		35,000	
	- Mega Fitness Planet	233,156		233,156	
	- Mira Engineering Services	444		-	
	- Mohapatra Scientific Supply	10,000		-	
	- Nandighosh Trading Agency	19,193		19,193	
	- Nihar Ranjan Parida	259,456		157,078	
	- Oberai Equipment	466,049		321,963	
	- Odisha General Electronics	100,559		69,026	
	- Oriental Security Services	918,518		129,881	
	- Palit Equipment Sales Pvt. Ltd.	4,601		-	
	- Ratan J. Batliboi Consultancy Pvt. Ltd.	194,122		69,000	
	- Fabtech Technologies International Ltd.	94,335		-	
	- Schneider Electric Infrastructure Ltd.	84,547		-	
	- Shubh Construction	57,266		-	
	- Sainath Fabric Care Pvt. Ltd.	36,626		36,626	
	- Sai Rasoi Sanstha	100,000		100,000	
	- Sanjay Kumar Khuntia	13,215		-	
	- Security Deposit	11,860		3,670	
	- Shri Arya Prakash Champatiray	695,664		-	
	- Shree Mahalaxmi Traders	-		207,434	
	- Shri Samareesh Chottaray	32,811		27,305	
	- Tathagata Engineering	548,583	23,472,456	509,873	17,295,803
	i) CHSS	-		3,885,999	
	ii) NPS Recovery	161,234		101,196	
	iii) Professional Tax	2,010	163,244	2,010	3,989,205
	Sub-Total (A)		41,584,771		40,489,551

For J PRADHAN & CO
Chartered Accountants
Firm Regd. No. 326206E

Amiya Ku. Pradhan, FCA
Partner M No.054626



ANNUAL ACCOUNTS

2020-21

Schedule -7 : Current Liabilities & Provisions

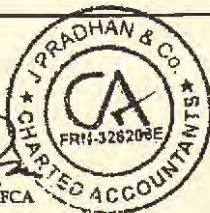
(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (₹)

Sl. No.	Particulars	Current Year		Previous Year	
B.	PROVISIONS				
1.	For Expenses Payable :				
	- Audit Fees Payable	57,820		57,820	
	- Fellowship Payable	8,446,330		7,914,391	
	- Hire Charges Vehicle Payable	456,553		646,434	
	- Stipend to Trainee Payable	-		81,000	
	- House Keeping Expenses Payable	1,721,960		26,800	
	- Honorarium and Remuneration Payable	376,716		296,000	
	- Outsourced Manpower Payable	-		5,124,587	
	- Medical Expenses Payable	721,751		45,154	
	- Electricity Charges Payable	7,481,426		4,880,815	
	- Children Educational Allowance Payable	1,917,000		1,923,571	
	- Meeting Expenses Payable	2,110		4,711	
	- Postage & Telegram Payable	13,133		25,582	
	- Work-in-Progress Payable	-		2,488,325	
	- Repair & Maintenance Expenses Payable	1,504,221		822,790	
	- Salary And Wages Payable	25,777,509		27,359,729	
	- Telephone & Internet Payable	175,933		158,168	
	- PRIS Payable	-		20,987,161	
	- NPS Employer Subscription Payable	3,247,568		3,468,157	
	- Beijing Quartz V. Glass Co. Ltd.	-		127,945	
	- Icon Analytical Equipment Pvt. Ltd.	-		728,159	
	- CRA Charges Payable	8,495		8,727	
	- DSS Imagetech PBG Payable	-		2,499,840	
	- Exim Logistics Pvt. Ltd. Payable	-		111,335	
	- HDFC ECSS Scholarship Payable	-		25,000	
	- Legal Expenses Payable	50,000		152,495	
	- Professional Charges Payable	114,735		618,630	
	- Outsourced Security Payable	3,891,637		3,697,266	
	- Scholarship Payable	2,310,000		1,512,290	
	- Lab Consumable Payable	2,920,838		-	
	- Lab Equipment Payable	7,422,776		-	
	- Leave Encashment Payable	215,514		-	
	- Leave Travel Concession Payable	1,765,747		-	
	- Machinery Equipments Payable	11,800		-	
	- Office Equipments Payable	1,976,509		-	
	- Advertisement Charges Payable	21,762		-	
	- Computer Exp. Payable	1,033,400		-	
	- Contingency Expenditure Payable	396,908		-	
	- Freight & Forwarding Expenses Payable	169,766		-	
	- Fuel Charges Payable	85,703		-	
	- Furniture & Fixture Payable	985,581		-	
	- Interior, AC, Firefighting, etc. Auditorium Payable	11,739,181		-	
	- Publication Charges Payable	27,789		-	
	- Purchase of Consumable Payable	860,430		-	
	- Subscription Charges Payable	59,000		-	
	- Supplies & Material Payable	32,423		-	
	- Water Charges Payable	8,400		-	
	Sub-Total (B)		88,008,424		85,792,883
	Total (A+B)		129,593,195		126,282,434

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 & Audited Statement of Accounts 2020-2021



2020-21

NATIONAL INSTITUTE OF SCIENCE EDUCATION AND RESEARCH (NISER) ANNUAL ACCOUNTS

Schedule - 8 : Fixed Assets
(Schedule forming part of the accounts for the period ended on 31.03.2021)

(Schedule forming part of the accounts for the period ended on 31.03.2021)											
		GROSS BLOCK			DEDUCTIONS / (Sale / Adjustt.) during the year		DEPRECIATION		NET BLOCK		
Sl. No.	Particular of Assets	Rate	Addition during the year		WDV as on 01.04.2020	Deductions / (Sale / Adjustt.) during the year	Cost/valuation at the year-end	Depreciation for the year	Total upto the year-end	As at the current year-end on 31.03.2021	As at the Previous year-end on 31.03.2020
			> 180 days	< 180 days				Deductio			
1	Land	0%	-	-	27,617,405	-	27,617,405	-	-	27,617,405	27,617,405
2	Buildings (Academic)	10%	309,680	59,969,945	2,045,221,211	-	2,105,500,836	207,551,586	207,551,586	1,897,949,250	2,045,221,211
3	Building (Residential)	5%	338,200	1,099,924	2,607,497,668	-	2,608,935,792	130,419,292	130,419,292	2,478,516,500	2,607,497,668
4	Electrical	10%	125,980	24,466,024	181,885,138	-	206,477,112	19,424,410	19,424,410	187,052,702	181,885,138
5	Furniture & Fixtures	10%	6,101,566	9,210,847	263,649,847	-	278,962,260	27,435,683	27,435,683	251,526,577	263,649,847
6	Computers	40%	4,299,132	15,818,714	24,223,958	-	44,341,804	14,572,979	14,572,979	29,768,825	24,223,958
7	Software	40%	-	1,777,795	7,975,123	-	9,752,918	3,545,608	3,545,608	6,207,310	7,975,123
8	Lab Equipments	15%	164,662,763	189,419,708	765,884,215	254,611	1,119,712,095	153,750,335	153,750,335	965,961,760	765,884,215
9	Tools Equipments	15%	-	-	77,797	-	77,797	11,670	11,670	66,127	77,797
10	Books	40%	1,687,486	4,610,479	4,754,947	-	11,052,912	3,499,069	3,499,069	7,553,843	4,754,947
11	Journals	40%	30,105,517	42,872,517	78,834,170	-	151,812,204	52,150,378	52,150,378	99,661,826	78,834,170
12	Air Conditioners	15%	443,532	2,093,073	5,182,208	-	7,718,813	1,000,841	1,000,841	6,717,972	5,182,208
13	Vehicles	15%	-	991,901	250,033	-	1,241,934	111,898	111,898	1,130,036	250,033
14	Bicycle	15%	-	-	1,890	-	1,890	284	284	1,606	1,890
15	Machinery & Equipments	15%	83,513,644	80,645,922	989,922,415	2,457,694	1,151,624,287	166,695,198	166,695,198	984,929,089	989,922,415
16	EPABX	15%	-	-	5,915	-	5,915	887	887	5,028	5,915
17	Kitchen	15%	-	-	2,751,945	-	2,751,945	412,792	412,792	2,339,153	2,751,945
18	Telephones	10%	-	-	8,153	-	8,153	815	815	7,338	8,153
19	Capital Assets(WIP)	0%	35,327,046	177,860,572	33,856,250	75,457,130	171,586,738	-	-	171,586,738	33,856,250
20	NISER XII Plan Asset	0%	-	-	-	-	-	-	-	-	-
20	Total	-	326,914,536	610,837,421	7,039,600,288	78,169,435	7,899,182,810	760,583,725	760,583,725	7,118,599,085	7,039,600,288

For J Pradhan & Co.

Chartered Accountants
FRN - 360093

Amit Kumar Pradhan
(Partner)
M. No. 054626

Administrative Officer - I
(Finance)

Officer on Special Duty
(Finance)

Director

ANNUAL ACCOUNTS

2020-21

Schedule -9 : Investments - Earmarked/ Endowment Funds

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (₹)

Particulars	Current Year	Previous Year
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 the accounts for the period ended on 31.03.2021)

Amount in (₹)

Particulars	Current Year	Previous Year
1. In Government Securities	-	-
2. Other Approved Securities	-	-
3. Shares	-	-
4. Debentures & Bonds	-	-
5. Subsidiaries & Joint Ventures	-	-
6. FD against LC's	209,719,200	349,212,030
TOTAL	209,719,200	349,212,030

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

Schedule -11 : Current Assets, Loans, Advances etc.

(Schedule forming part of the accounts for the period ended on 31.03.2021)

		Amount in (₹)	
Particulars	Current Year	Previous Year	
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	5,839,894	143,158,307	
b) SBI A/C - 37871572767	18,816,628	9,654,574	
c) IOB A/C - 373701000000001	168,435,028	164,923,661	
d) IOB A/C -147601000015510	791,337	621,434	
e) SBI A/C - 38629236942	49,873,909	57,005,837	375,363,814
Total (A)	243,756,796		375,363,814
B. LOANS, ADVANCES AND OTHER ASSETS:			
1. Loans & Advances			
a) Security Deposit :	6,317,910		6,317,910
b) Staffs:			
i) Atish Kumar Nayak, EX FO	-	106,000	
ii) Dukhishyam Mallick (Student)	-	97,953	
iii) Debasish Mallick	-	114,993	
iv) Prolay Kumar Mal	-	180,000	
v) Vijay Singh	-	10,000	
vi) Debasmita P.A lone	-	50,000	
vii) Kishore C S Panigrahi	-	87,100	
viii) P.C. Ravikumar	-	311,309	
ix) Other Advances (Imprest)	-	216,058	
x) Festival Advance to Staff	-		
xi) Abhay Kumar Mohanty	10,000	-	
xii) Ajay Kumar Das (EPS)	30,000	-	
xiii) Ashis Kumar Nandy	30,000	-	
xiv) A V Anil Kumar (SPS)	40,000	-	
xv) Bidyut Siba Sankar Mohanty	6,000	-	
xvi) Binod Bhagat	15,000	-	
xvii) Brundaban Sahu	50,000	-	
xviii) Chandramohan Bathrachalam	23,580	-	
xix) Dipak Kumar Rout	50,000	-	
xx) Dr. Nabin Kumar Jena	50,000	-	
xxi) Guneswar Singh Thangjam	40,000	-	
xxii) Joydeep Bhattacharya	30,000	-	
xxiii) Madhusudan Padhy	12,000	-	
xxiv) Mriganka Sadhukhan	12,000	-	
xxv) Praful S Singru	31,015	-	
xxvi) Pranaya Kumar Swain	40,000	-	
xxvii) Prasanjit Samal	30,000	-	
xxviii) Prasentit Mal	40,000	-	
xxix) Rabindra Kumar Maharana	6,000	-	
xxx) Rakesh Kumar Behera	9,000	-	
xxxi) Ranjan Kumar Rana	18,000	-	
xxxii) Sanjay Parui	60,000	-	
xxxiii) Sanjib Kar	30,000	-	
xxxiv) Saurabh Chawla	30,000	-	
xxxv) Sentil Kumar Kunju	10,000	-	
xxxvi) Subhadip Ghosh	30,000	-	
xxxvii) Subhransu Sekhar Panda	15,000	-	
xxxviii) Tuhin Ghosh	20,000	-	1,173,413
	767,595		



Schedule -11 : Current Assets, Loans, Advances etc.

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Particulars	Current Year		Previous Year	
c) Other Entities engaged in activities similar to that of others		-		-
d) Others				
i) Deans Allowance Receivable	-		85,200	
ii) M/s A One Hospitality & catering	-		36,707	
iii) DCS & EM, Mumbai	190,003,993		190,003,993	
iv) International Centre for Theoretical Science (ICTS)	300,000		300,000	
v) IPG Photonics India Pvt. Ltd.-Banglore	450,000		450,000	
vi) M/s Board of Radiation & Isotope Technology	29,731		-	
vii) Electrolab (India) Pvt. Ltd.	2,360		-	
viii) Festival Advance	242,000	191,028,084	-	190,875,900
2. Advances and other amounts recoverable in cash or in kind or for value to be received:				
a) on Capital Account	-		-	
b) Prepayments	-		-	
c) Others	-		-	
d) DCSEM-Medical Expenses Receivable	-		1,217,090	
e) R&D Receivable	427,805		4,449,474	
f) Lease Rent Receivable			-	
i) SBI (NISER Campus) - March 2021	30,999		-	
ii) IOB (NISER Campus) - March 2021	30,640		-	
iii) Subhamayee Devi - Feb, 21 & Mar, 21	9,600		-	
iv) Rudra Narmyan Mishra - Mar, 21	4,800	503,844	-	5,666,564
3. Income Accrued:				
a) On Investments from Earmarked/Endowment Fund	-		-	
b) On Investment (Others)	-		-	
c) On Loans and Advances	-		-	
d) Others	-		-	
4. Claims Receivables	-		-	
5. Grant Receivables		47,500,000		
Total (B)		246,117,433		204,033,787
TOTAL (A+B)		489,874,229		579,397,600

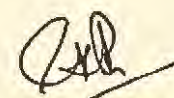
For J Pradhan & CO.

Chartered Accountants
FRN - 326206E

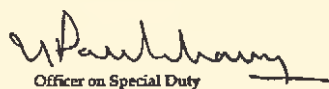
Amiya Kumar Pradhan, FCA

(Partner)

M. No. 054626

Administrative Officer - I
(Finance)



Officer on Special Duty
(Finance)



Director

Schedule -12 : Income from Sales/Services

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (₹)

Particulars	Current Year	Previous Year
1) Income from sales		
a) Sale of Finished Goods	-	-
b) Sale of Raw Material	-	-
c) Sale of Scraps	-	-
2) Income from Services		
a) Labour and Processing Charges	-	-
b) Professional/Consultancy 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 31.03.2021)

Amount in (₹)

Particulars	Current Year	Previous Year
(Irrevocable Grants & Subsidies Received)		
1) Central Government		
a) Revenue (Salary & General)	1,130,000,000	1,102,000,000
TOTAL	1,130,000,000	1,102,000,000

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

Schedule -14 : Fees/Subscriptions

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Particulars	Amount in (₹)	
	Current Year	Previous Year
1. Registration Fees (MSc & PhD)	16,141,758	14,349,679
2. License Fees	1,223,114	1,734,808
3. Sale of Tender Paper	153,000	174,316
4. RTI Application Fees	310	120
5. Transcript Fees	2,600	13,700
6. Identity Card/Health Card Fee	4,950	8,425
7. Summer Course fees	-	122,000
8. Guest House Rent	121,367	1,696,458
9. Job Application Fees	18,500	51,500
10. EMD/SD (Forfeited Deposit)	-	143,228
11. Sample Testing Charges	-	30,800
11. Lease Rent	1,070,937	288,708
12. Misc. Receipt (Fine)	15,020	41,705
13. Liquidated Damages	2,901,024	2,682,557
14. Leave Travel Concession - Recovery	5,318,077	-
15. Water Charges (Income)	1,121,442	243,689
16. Sale of News Paper	-	20,380
17. Sale of Assets	36,000	-
TOTAL	28,128,099	21,602,073

Schedule -15 : Income from Investments

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Particulars	Investment from Earmark Fund		Investment Others	
	Current Year	Previous Year	Current Year	Previous Year
(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	-	-	-	-

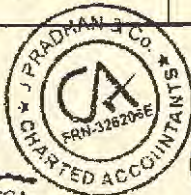
For J Pradhan & CO.

Chartered Accountants

FRN - 326206E

Amiya Kumar Pradhan, FCA
(Partner)

M. No. 054626



Administrative Officer - I
(Finance)

Officer on Special Duty
(Finance)

Director

Schedule -16 : Income from Royalty, Publication etc.

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (₹)

Particulars	Current Year	Previous Year
1) Income from Royalty	-	-
2) Income from Publications	-	-
3) Others (Specify)	-	-
TOTAL	-	-

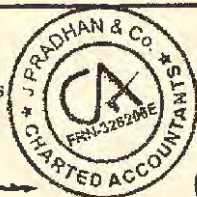
Schedule -17 : Interest Earned

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (₹)

Particulars	Current Year	Previous Year
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	20,171,458	38,816,917
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	20,171,458	38,816,917

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

Schedule -18 : Other Income

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (₹)		
Particulars	Current Year	Previous Year
1. Profit on Sale/disposal of Assets:		
a) Owned Assets	-	-
b) Assets acquired out of grants, or received free of cost	-	-
2. Export Incentives 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 31.03.2021)

Amount in (₹)		
Particulars	Current Year	Previous Year
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

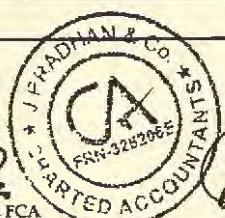
(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (₹)		
Particulars	Current Year	Previous Year
a) Pay and Allowances	295,656,546	281,836,008
b) Manpower (Outsourced)	106,431,364	105,716,307
c) Stipend to Trainee	-	-
d) Contribution to NPS	38,221,953	35,476,638
e) Leave Travel Concession	4,222,919	2,366,682
f) Fellowship	122,564,071	134,806,877
g) Honorarium & Scholarship	4,646,641	5,804,671
h) PRIS	548,719	42,121,926
i) Medical Expenses	11,185,301	12,973,419
j) Children Education Allowance	2,666,429	2,004,571
k) Leave Encashment	2,857,284	946,976
l) Leave Salary Contribution	-	92,794
m) Professional Update Allowance	5,467,161	-
n) Pension Contribution	-	-
o) Summer Course Fellowship - Student	-	305,249
p) Remittance of Employer Share	-	311,559
q) Gratuity	1,000,000	-
TOTAL	595,468,389	624,763,677

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)

Director

Page 10

Schedule -21 : Other Administrative Expenses

(Schedule forming part of the accounts for the period ended on 31.03.2021)

	Amount in (₹)	
Particulars	Current Year	Previous Year
A. Other Administrative Expenses :		
Graduation Ceremony Expenses	-	557,642
Academic Expenditure	251,592	
Freight & Forwarding Expenses	2,381,194	2,544,506
IISER/NISER Meet Expenses	-	-
Foundation Day Expenses	-	59,000
Purchases (Consumables)/ Supplies & Materials	60,958,343	63,217,519
Repair & Maintenance	51,502,181	38,226,648
Advertisement	1,812,933	2,663,802
Audit Fees	57,820	57,820
Bank Charges & Commission	152,185	215,310
CRA Service Charges	34,855	42,789
Electricity Charges	60,847,669	62,156,120
Fuel for DG Set	189,192	1,261,200
Hospitality Expenses	600	200,935
House Keeping Expenses	1,511,501	2,823,226
Legal Fees	981,387	619,230
Meeting Expenses	908,128	2,009,648
News Papers & Periodicals	37,291	112,577
Postage & Telegram	188,913	310,869
Printing & Stationery	215,647	750,880
Seminar/Workshop Expenses	228,886	1,304,014
Telephone & Internet Charges	9,915,126	12,396,119
Travelling & Conveyance - Domestic	647,319	7,956,139
T.A. on Transfer	780,281	413,518
Travelling & Conveyance - Foreign	276,896	5,443,899
Vehicle Maintenance Expenses	5,424,844	7,499,560
Professional Charges	1,315,235	2,414,527
Publication Charges	328,873	418,772
Horticulture & Plantation Expenses	-	20,600
Subscription Expenses	1,155,220	63,964
Thesis Evaluation Fee Expenses	30,000	200,000
Water Charges	119,700	-
Hindi Divas Expenses	30,200	-
B. NISER XII PLAN :		
a) Domestic Travel	-	462,678
b) Fellowships	278,775	1,068,485
c) Foreign Travels	534,500	4,865,081
d) Salary Expenses	1,969,177	2,080,624
e) Other Expense	88,000	997,332
f) Supplies & Materials	21,755,570	26,931,316
g) Honorarium	-	1,500
h) Membership Fees	548,658	-
TOTAL=====>	227,458,691	252,367,848

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

Page 20

Schedule -22 : Expenditure on Grants, Subsidies etc.

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (₹)		
Particulars	Current Year	Previous Year
a) Grant given to Institutions/Organisation	-	-
b) Subsidies given to Institutions/Organisation	-	-
TOTAL	-	-

Schedule -23 : Interest

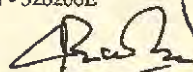
(Schedule forming part of the accounts for the period ended on 31.03.2021)

Amount in (₹)		
Particulars	Current Year	Previous Year
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

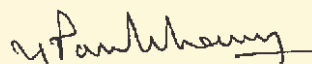
(Partner)

M. No. 054626




Administrative Officer - I

(Finance)



Officer on Special Duty

(Finance)



Director

Schedule 24 – Significant Accounting Policies

(Schedule forming part of the accounts for the period ended on 31.03.2021)

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 Baba National Institute, Deemed University of DAE, Mumbai conducts the following academic programs 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 707 students admitted in 5 year MSc program in the various streams of Basic Sciences. Moreover NISER has 350 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 :

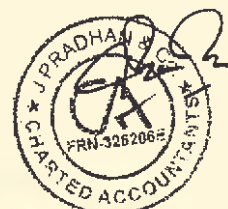
Fixed assets are stated at cost of acquisition inclusive of inward freight, duties & taxes and incidental & direct expenses related to acquisition.

3. Depreciation :

Depreciation has been provided on written down value method as per rate prescribed in the Income Tax Act, 1961.

4. Recognition of Income & Expenditure :

Income & Expenditure are generally recognised on accrual basis & provision made for all known liabilities.



5. Consumable Stores :

Lab consumables and stores consumables purchased during 2020-21 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 against lien of FD are being accounted for on receipt basis.

9. Government Grants/Subsidies :

- Government Grants of the nature of contribution towards capital cost of setting up projects are treated as Grant-in-Aid for creation of assets.
- Grants in respect of specific fixed assets acquired are shown as a deduction from the cost of the related assets as the project is under progress.

10. Lease :

Lease rentals are with reference to Lease terms.

11. Retirement Benefits :

Liability towards gratuity payable on death/retirement and provision for accumulated leave encashment benefit to employees is not applicable at present.

12. Taxation :

Since the Institute is a research oriented organization wholly funded by Government of India, Department of Atomic Energy (DAE) and there being no taxable income under Income Tax Act 1961, no provision for Income Tax has been made during the year.

For J Pradhan & Co.

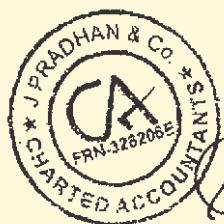
Chartered Accountants

FRN - 326206E

Amiya Kumar Pradhan (FCA)
(Partner)(Finance)(Finance)

M. No. 054626

Date:-01-09-2021



Administrative Officer-I

Officer on Special Duty

Director

Schedule -25: Contingent liabilities & Notes on Accounts

(Schedule forming part of the accounts for the period ended on 31.03.2021)

Contingent Liabilities Amt. In Rs. (In Crores)

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	20.97
5. Bills Discounted	NIL
6. Other items for which the entity is contingently liable	NIL

Notes on Accounts

1. Deposit with DCSE&M, Mumbai:

Against the deposit placed with DCSE&M, Mumbai, for construction of NISER Complex, detailed account statement for Rs.19,00,03,993/- is yet to be submitted by DCSE&M, Mumbai.

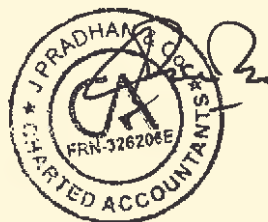
2. Lien against FD :

Lien against FD shown in Receipt & Payments account relates to items under import & the same is in order.

3. Fixed Assets Verification :

During the year under audit, Stock audit has been carried out by a Chartered Accountant.

Corresponding figures for the previous year have been regrouped/ arranged, where ever necessary.



4. Consumable Stores :

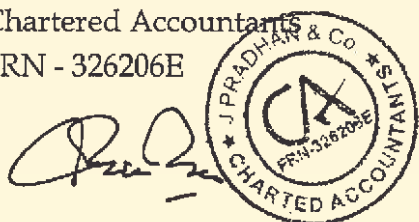
The Institution doesn't show any consumable store lying unused in each of the departments at the end of the financial year as all purchases are made against specific requirement and supposed to be consumed in totality.

****Schedules 1 to 25* are annexed to and form an integral part of the Balance Sheet as at 31st March, 2021 and the Income & Expenditure Account for the year ended on that date.

For J Pradhan & Co.

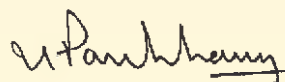
Chartered Accountants

FRN - 326206E

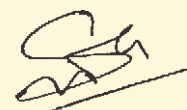


Amiya Kumar Pradhan (FCA)
(Partner)(Finance)(Finance)
M. No. 054626

Administrative Officer-I



Officer on Special Duty



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