IISER
THIRUVANANTHAPURAM

Indian Institute of Science Education and Research Thiruvananthapuram

भारतीय विज्ञान शिक्षा एवं अनुसंधान संस्थान तिरुवनंतपुरम

ANNUAL REPORT
2019 - 2020

वार्षिक प्रतिवेदन २०१५ - २०२०

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Indian Institute of Science Education and Research Thiruvananthapuram

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DIRECTOR'S FOREWORD

The financial 2019-20 marks my first full year as the Director of IISER TVM and I am pleased to submit this year's Annual Progress Report. It captures the shared commitment of all faculty, staff and students of IISER TVM in pushing for leadership in science education and research and seamless administrative excellence through good governance and financial probity.

Let me briefly provide a collation of research activities being pursued in each of the schools in IISER TVM and its overall accomplishments. The faculty and young scholars in the School of Biology are engaged in diverse domains of biology, with notable contributions in the areas of cell biology, cancer biology, plant biology, ecology, molecular biology, virology and infectious diseases, chronobiology and neurodegeneration, etc. In the School of Chemistry, the emphasis is on pushing the frontiers of materials chemistry, photochemistry, organic synthesis, asymmetric catalysis, photocatalysis, photoredox catalysis, supramolecular chemistry, carbohydrate chemistry, biomimetic inorganic chemistry, energy and sustainable development, bio-imaging, crystal engineering, molecular dynamics, electrocatalysis, etc. The School of Mathematics continues to focus on 4 broad research areas – algebra and number theory, analysis, applicable mathematics, data science, machine learning, artificial intelligence, geometry and topology. The priorities of the School of Physics constitute a mix of varied research areas that include superconductivity, magnetism, materials physics and device applications, photovoltaics, thermoelectrics, semiconductors, solar cells and LEDs, energy storage devices, non-linear optics, plasmonics, imaging technology, quantum devices, quantum field theory, fluid dynamics and non-linear dynamics, nonequilibrium physics, cosmology, particle physics, string theory and gravitational waves.

The research endeavours in IISER TVM have led to a number of publications in journals of national and international repute. Most notably, undergraduate student publications have risen with 7 papers each emanating from the Schools of Biology and Physics, 4 from the School of Chemistry and 3 from the School of Mathematics. It's with pride that I place on record the achievements of some of our faculty and students. While some faculty have been invited to be on editorial boards of leading scientific journal publications, the research work of some others has been showcased as cover pages in international journals. Some faculty have also been invited as members of executive committees/ boards of scientific bodies in the country. Two of our Ph. D. students have received the prestigious

Prime Minister's Research Fellowship, while some have gone on to receive best poster awards in international conferences.

Insofar as admissions are concerned, the institute had 51 new students admitted during this year for PhD and IPhD programs. A total of 191 students were admitted to the BS-MS program in 2019-20. The institute continues to pay special attention to the needs of our students. To allow for an enviable living ambience, a number of student activities were organized all through the academic sessions, providing students the space and time for artistic expression and sports activities; these include Anvesha, IICM, IISM, ITSAV, Ishya, etc. Students are also promoted to be part of clubs (music, math and movie) and societies (literature and fine arts, theatrics, dance and media) to allow them an exposure to the finer aspects of community living. To take care of the increasing need for social spaces, the institute has been developing more sports and recreational facilities for the students.

The institute has been steadfast in its commitment to giving back to society. The outreach programs ensured benefit to all schools and educational institutions in and around IISER TVM. The teacher training programs and the residential camp organised for school children received wide appreciation and increased science visibility among the next generation of scientists.

IISER TVM is a young institution that is continuously striving to make a visible impact in all spheres of Science. I am confident that IISER TVM will achieve excellence in innovation, research, scholarship and education and carve a niche for itself in the coming years.

Jai Hind

J. N. Moorthy
Director, IISER TVM

Prof. J.N. Moorthy with Bharatratna Prof C. N. R. Rao

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Professor I/c (Admin) & Registrar (Addl.Charge), IISER TVM

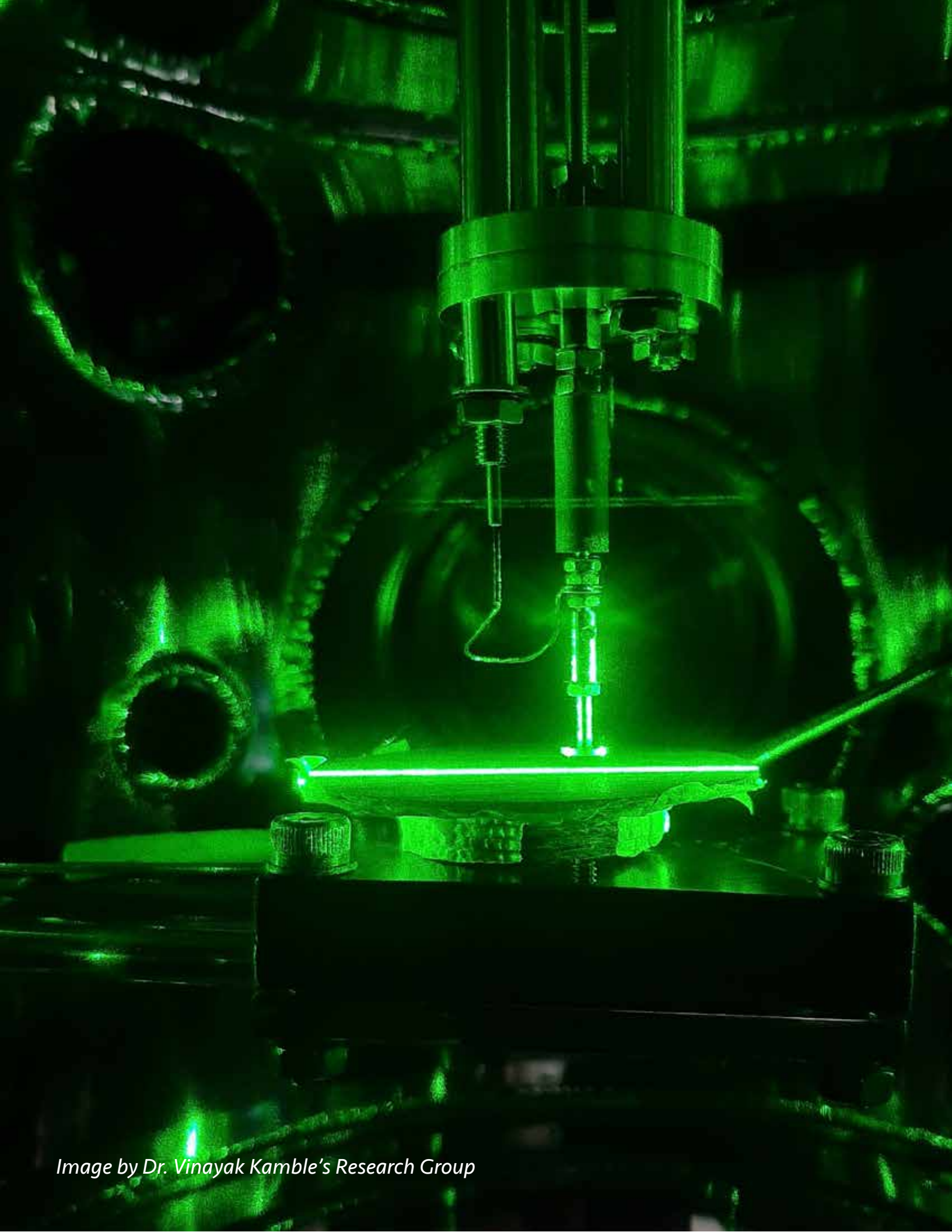
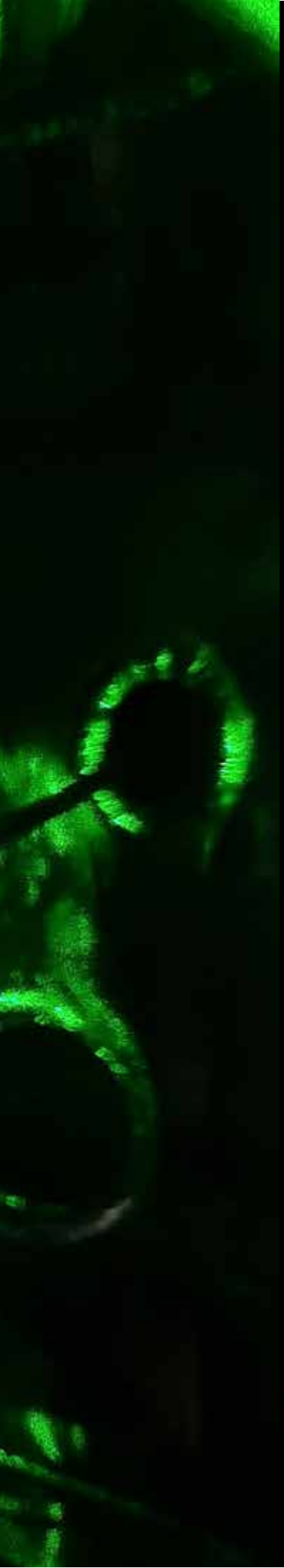


Image by Dr. Vinayak Kamble's Research Group



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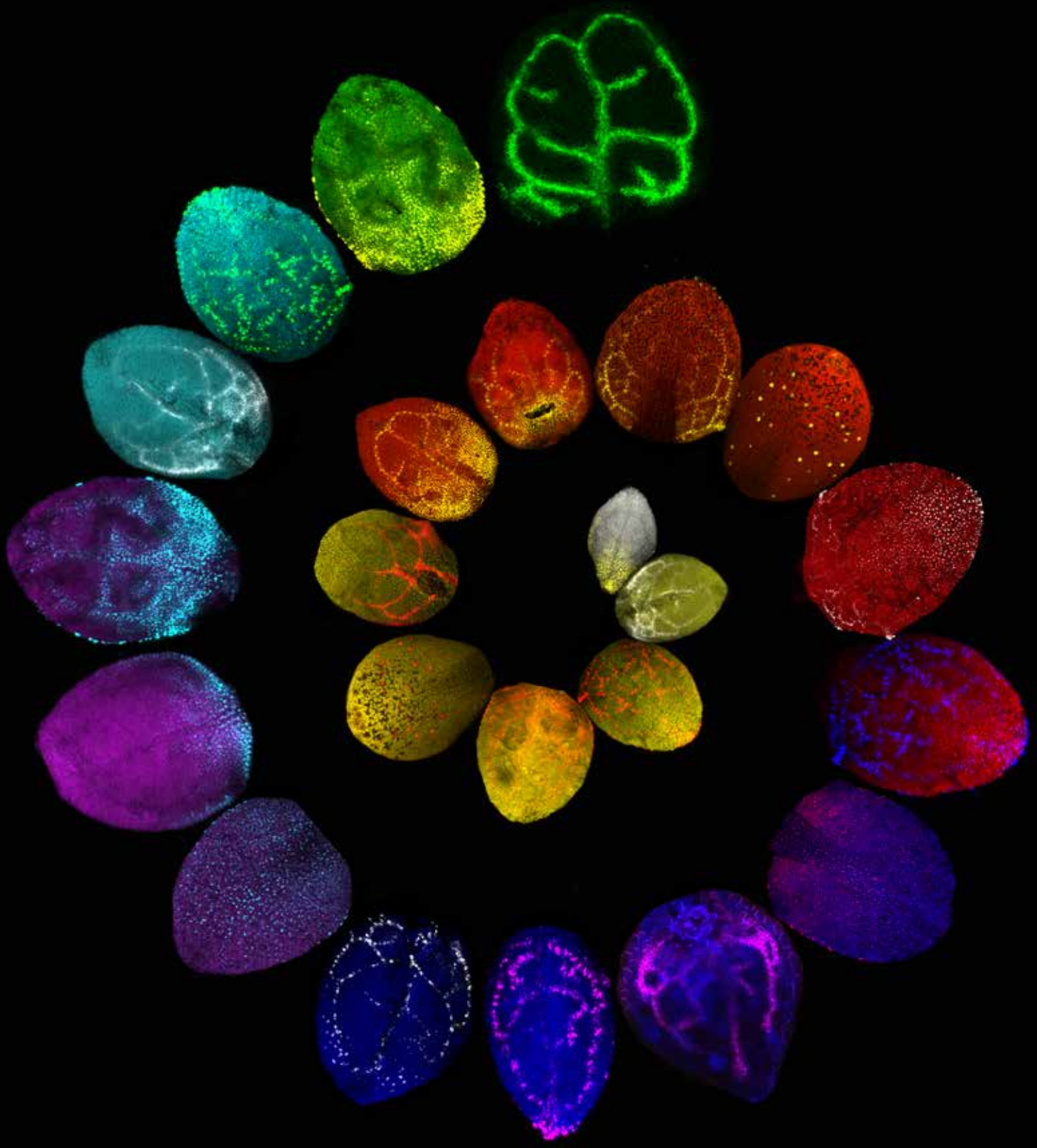


SCHOOL OF BIOLOGY

Image by Dr. Kalika Prasad's Research Group

BIOPHYSICS & STRUCTURAL BIOLOGY

Structural molecular

Dr. Ramanathan Natesh's lab focuses on structural studies of proteins, protein-protein, protein-DNA/RNA complexes involved in Mycobacterium tuberculosis and DNA damage repair in both prokaryotes and eukaryotes. The RNAP, the central player in transcription is an important target for novel antibiotics. The lab aims to understand the mechanisms by which transcription is regulated using two principle techniques viz., Cryo Electron microscopy (CryoEM) and Protein Crystallography (PX) along with bioinformatics and other biophysical methods Recently, the group showed that Ms5263 has moonlighting chaperone function in addition to its well-known transcription regulation (Joseph et. al., 2019, BBA Proteins and Proteomics). Further, the lab is interested in another transcription regulator Mfd, a highly conserved ATP-dependent DNA translocase that mediates Transcription-Coupled DNA Repair (TCR) in bacteria. They revealed the mechanism and conformational remodelling that occurs in Mfd upon ATP binding, hydrolysis, and DNA translocation through crystal and electron microscopy structures from Mycobacterium sp. (Putta et al., 2019, https://doi.org/10.1101/728246).

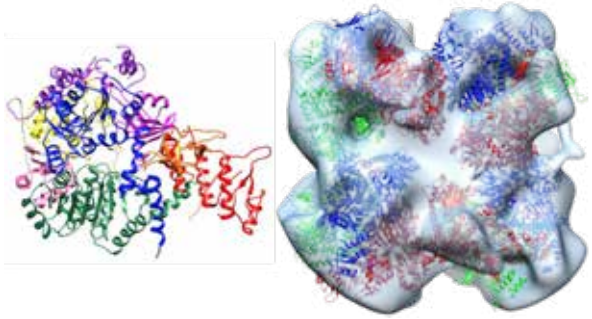


Figure: The crystal structure monomer (left) and single particle cryEM dodecamer (right) of MtbMfd

CELL BIOLOGY

Centromere-Centrosome biology

During the past year, Dr. Tapas Manna's group has uncovered the mechanism how cells regulate centrosome/centriole biogenesis in human cells (Current Biology, 2020). Centrioles, the core structure of centrosomes are essential for chromosome segregation and cilia formation. They are made of microtubule triplets, but how the microtubule triplets are assembled in the centriole has remained unclear. Their work revealed that interaction between a core centriole protein, SAS-6 with a multi-protein machinery, the gamma-tubulin ring complex is crucial for microtubule assembly and generation of the new centriole. Their work also unraveled a fundamental mechanism by which centrosome amplification is controlled in cells. They have identified the crucial role of a tumor suppressor ubiquitin ligase, FBXW7 in controlling centriole amplification, which is induced in many cancers. Further, his group showed that FBXW7 targets SAS-6 for ubiquitin-mediated degradation and thereby controls centriole assembly.

This work demonstrates first time a direct association of a ubiquitin-ligase with centriole (J. Biol. Chem. 2020).

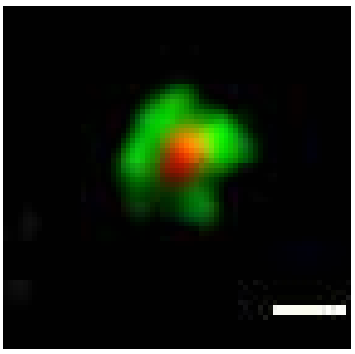


Figure: The recrutement to gamma-tubulin ring complex (green) to the mother centriole-localized protein SAS-6 (red) as a crucial step make the new centriole

DEVELOPMENTAL BIOLOGY

Cellular reprograming

Regeneration potential in living organisms is often unevenly distributed along the organ-axis. The study by Durgaprasad et al from Dr. Kalika Prasad's lab demonstrated that dosage of a gradient expressed transcription Factor, PLETHORA2 (PLT2) instructs the boundary for organ restoration potential, and uncovered the correlation of root-tip restoration ability with high PLT2 levels. The study also revealed that endogenous PLT2 transcription is dependent on a threshold-sensitive PLT2 autoregulatory-loop which distinguishes the regeneration potential of an organ from its growth during normal development. Aerial organs of plants are highly susceptible to injuries but the mechanism mediating the regeneration responses in aerial organs remained poorly understood. The group revealed that PLT and CUC2 transcription factors act in a coherent feed forward loop to upregulate local auxin biosynthesis thereby guiding the polarized growth of regenerating vascular stand to its destination (Dhanya et al., 2020).

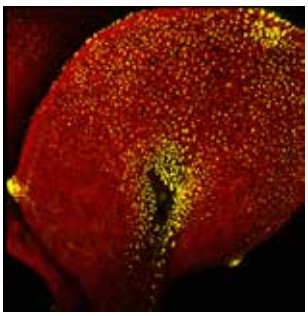


Figure: Leaf confocal micrograph displaying fluorescent tagged auxin reporter in reponces to injury.

Nutrient homeostasis

Dr. Jishy Varghese's lab works on understanding the maintenance of nutrient and energy homeostasis. They focus on identifying novel factors involved in the physiological maintenance of nutrient and energy balance using Drosophila. Recently, they have uncovered a novel role for insulin as a hunger hormone during initial stages of starvation in Drosophila (Sudhakar et al 2020; Developmental Biology). Further, they have identified Edem1, an ER resident protein, as a regulator of fat body specific cytokines that manage insulin signalling in Drosophila (Pathak and Varghese; BioRxiv 2020). Further, the lab linked a tracheal factor, lumens interrupted (Lint) to insulin signalling, and growth (manuscript under revision). Besides, to characterize post-transcriptional regulation of lifespan by microRNA function in neurons, they have identified miR-190, characterized sexually dimorphic regulation of its putative targets.

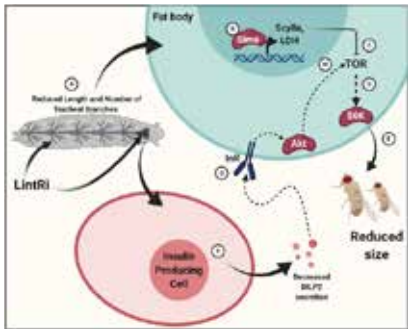


Figure: Lint plays a role in growth control: Blocking the function of lumen interruped (Lint) gene, leads to defects in the airway tubes in Drosophila larvae, which leads to hypoxia. Activation of hypoxia signaling in these larvae affects the function of insulin-producing neurons, which lowers systemic insulin signaling and affects body size. Figure generated using Biorender

Hematopoietic stem cells

Dr. Satish Khurana's group is focused on understanding the role of outside-in integrin signaling in hematopoiesis. The group addressed, if developmental stage influenced the effects of proliferative stress induced by loss of integrin signaling. The study, now published with the journal Stem Cell Reports (Biswas A et al. 2020), implicated higher levels of DNA damage response pathways in tolerance of proliferation stress in fetal stages. These results corroborated their findings reported earlier (Manesia J et al. 2015). Vav-iCre mediated loss of Itgav (integrin-αv) as well as systemic loss of its ligand Postn (Periostin) resulted in expansion of HSC pool in the fetal liver, which they confirmed using extensive transplantation assays. Interestingly, POSTN expression was found specifically in the vascular niche that hosts HSCs (Figure below). Significant progress was also made to understand the lympho-hematopoietic processes in mouse spleen. Currently, the group is applying pharmacologic modulation of integrin signaling in pre-clinical resolution of hemato-pathology linked extramedullary hematopoietic events.

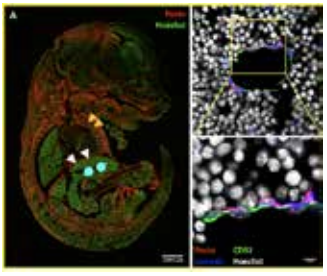


Figure: Longitudinal section of mouse fetal liver at E14.5 immunostained and tile scanned to locatePOSTN expression (A). Myofibroblasts, in general repressed high levels of POSTN as known before. Further, within the fetal liver tissue, expressed high levels of POSTN was explicitly detected in the vascular areas (B, upper panel). Vascular endothelium identified by CD31 labeling showed POSTN staining, suggesting a role of POSTN in creation of vascular niche for HSCs in fetal liver.

ECOLOGY & EVOLUTION

Plant-animal interactions

Research in Prof. Hema Somanathan's group focuses on understanding the sensory and behavioral ecology of mutualisms between pollinators and plants. BeeLab is interested in the evolution of multimodal floral signals, sensory cues that pollinators use to make foraging decisions and the consequences of those decisions for plant and pollinator fitness. Besides, the group works on the behavior of honeybee colonies and social spider societies. Recently, they showed that nocturnal bees despite adaptations for a visually challenging night environment experience resource limitations when foraging in the night with implications for fitness (Front. Ecol. Evol., 2020). Ongoing projects includes community plant-pollinator networks, navigation and foraging ecology of honeybees, stingless bees and carpenter bees.

Figure: Perching male carpenter bee

Ecology of diversification

The diversity of life around us is immensely fascinating, and we have only started understanding some of the complex and intricate evolutionary processes that have shaped this breath-taking diversity. Dr. Ullasa Kodandaramaiah 'Vanasiri' Evolutionary Ecology lab has been interested in addressing the patterns and processes of diversification. Some of the major research highlights over the last one year include work that has 1) shed light on colour patterns such as motion dazzle markings and flash markings protect moving prey from predation, and the evolutionary correlates of their origins 2) shown the adaptive significance of pupal colour plasticity in satyrine butterflies 3) demonstrated multi-modal sensory integration and context specificity in colour preferences of butterflies 4) how warning signals can promote morphological diversification in snakes.

GENETICS & GENOMICS

Genome stability

Dr. Nishant's group is interested in understanding mechanisms that maintain genome stability during mitotic and meiotic divisions using the budding yeast Saccharomyces cerevisiae as a model system. Two major research areas in the lab are: 1) Mechanisms of meiotic recombination and chromosome segregation 2) Mechanisms contributing to mutations, loss of heterozygosity (LOH) and aneuploidy during mitotic divisions. During 2019-2020, our group has showed that LOH is a significant source of genetic change in mitotically dividing yeast cells and contributes significantly more to genomic variation than base mutations. The group also generated a genome-wide LOH map for the S. cerevisiae S288c strain to identify hotspots (Ajith et al., G3, 2020). In collaboration with other groups, they also show that the number of secondary LOH in yeast strains are higher in the presence of pre-existing LOH (Sampaio et al., PNAS USA, 2020). This result is suggestive of systemic genomic instability which is also observed in tumor samples and highlights LOH as a major source of genome instability.

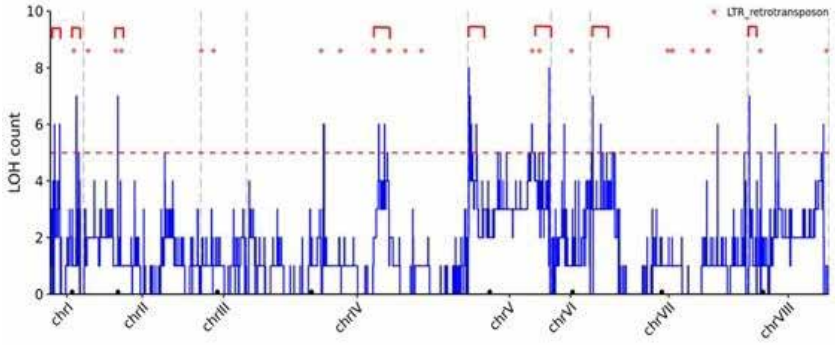


Figure: Genome wide LOH hotspot map for S. cerevisiae S288c strain. LOH hotspots are shown in red rectangle brackets. Chromosome boundaries are shown in grey vertical dash lines. Dash red lines show LOH events shared in 20% of the strains analysed.

Uniparental genetics

Dr. Ravi Maruthachalam's group is interested in understanding and exploiting the phenomena of uniparental genome elimination (UGE) in plant breeding and genetics. Latest research from our lab has exploited this process to reduce the ploidy of a natural tetraploid (2n=4x=20) Arabidopsis thaliana accession Warschau-1 to a diploid (2n=2x=10).

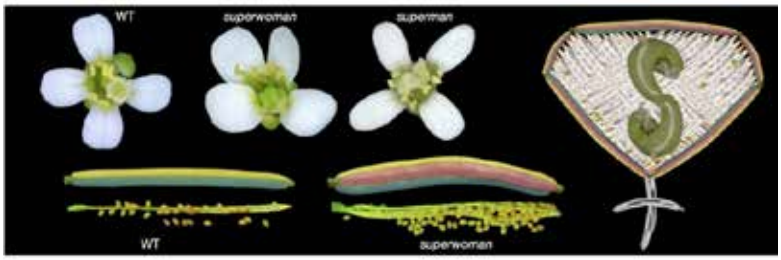


Figure: Flower and silque phenotypes of WT SUPERMAN, natural (lol-superwoman) and induced(clik-superman) SUPERMAN epialleles as indicated. A college of a superwoman insignia (leftmost image) inspired from the comic SUPERMAN insignia collated using superwoman pistil and silques.

Using this derived diploid, the group carried out a series of genetic and epigenomic studies, which culminated in the discovery of a suite of natural epimutations in the floral boundary gene, SUPERMAN(SUP) in Arabidopsis. These natural SUP epialleles display superwoman phenotypes (hence named lois lane (lol) epialleles) in contrast to the superman and supersex phenotypes manifested by artificially induced clark kent (clk) epialleles. The prevalence of such natural SUP epialleles in a dozen of geographically distinct diploid and tetraploid A. thaliana wild populations cannot be ignored as stochastic events, but gains significance when viewed as transition intermediates in the evolutionary path from bisexuality to unisexuality in plants (Bondada et al., (2020), Commun. Biol.).

INFECTION & IMMUNOLOGY

Immune cell biology

Prof. Murty Srinivasula's lab works on organelle homeostasis, ubiquitin signaling and host-pathogen interaction. Lysosomal exocytosis and resealing of damaged plasma membranes are essential for cellular homeostasis and tumor invasion. We demonstrated that RNF167-a, a lysosomal-associated ubiquitin ligase, negatively regulates lysosomal exocytosis by inducing perinuclear clustering of lysosomes. Our results revealed a novel role of RNF167-a, as well as its natural variants RNF167-a-K97N and RNF167-b, as an upstream regulator of lysosomal exocytosis and plasma membrane resealing (J Cell Sci. 2020 Jun 11;133(11):jcs239335.). Besides, we unravel a novel role of endosomes in modulating upstream pathways of Parkin-dependent mitophagy initiation. Parkin is a ubiquitin ligase whose mutations are associated with Parkinson's disease and defective mitophagy. We demonstrate that an endosomal ubiquitin ligase CARP2 associates with damaged mitochondria and this association precedes that of Parkin. Parkin stable recruitment to damaged mitochondria was substantially reduced in CARP2 KO cells (bioRxiv 2020.02.19.955880).

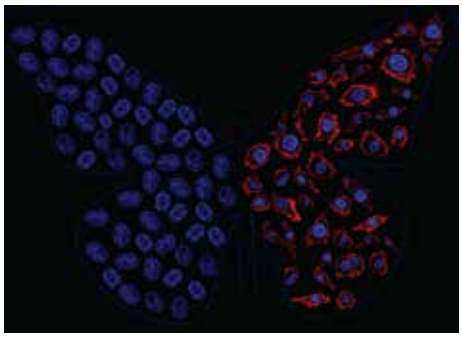


Figure: Cells expressing the wild-type protein (left-wing), those expressing RNF167-a-K97N (right wing) show enhanced lysosomal exocytosis and plasma membrane resealing. Nucleic were stained with DAPI (blue). *Cover page of Journal of Cell Science.

Emerging infectious diseases

Dr. V. Stalin Raj group's research focus is to discover novel, emerging or re-emerging viral pathogens from their zoonotic origin and try to understand the mechanisms of host switch and viral entry. They are currently working on Coronaviruses (CoVs), which infect a wide range of animals and birds. Their tropism is primarily determined by the ability of the spike protein to bind to a host cell surface receptor. First, we generated VSV-based pseudotyped viruses (PVs) of SARS-CoV-1, MERS-CoV, and SARS-CoV-2 to study the entry mechanism, screen entry inhibitors, and development of diagnostics. In the first series of experiments, we demonstrated that pseudotyped viruses specifically bind to their receptors for cellular entry. SARS-CoV-1 and MERS-CoV anti-serum neutralize SARS-CoV-1PV and SARS-CoV-2PV, and MERS-CoVPV, respectively. Incubation of soluble ACE2 inhibited entry of SARS-CoV-1 and SARS-CoV-2 PVs but not MERS-CoVPV. Also, the expression of ACE2 and DPP4 in non-permissive BHK21 cells enabled infection by SARS-CoV-1PV, SARS-CoV-2 PV, and MERS-CoVPV, respectively. We demonstrated the applications of pseudotyped coronaviruses in diagnostics (J. Biol. Chem. 2020), screening of entry inhibitors, and studying coronaviruses' entry mechanism.

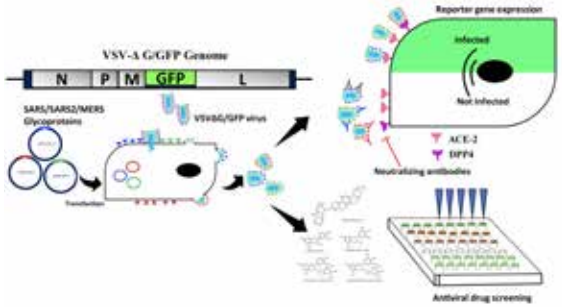


Figure: Schematic representation of pseudotyped coronaviruses and its potential applications

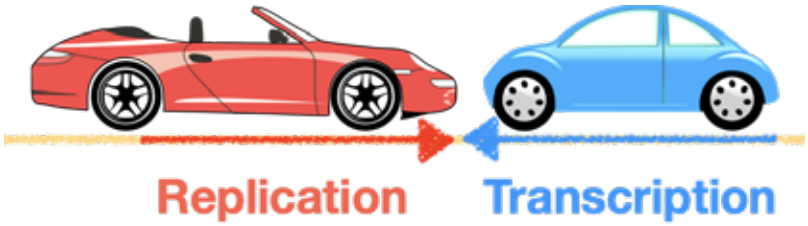
MOLECULAR BIOLOGY

Gene expression networks

Cardiovascular disease is one of the major leading causes of mortality and morbidity. High cholesterol level has been the major modifiable risk factor for better cardiovascular health outcome. Genetically, monogenic mutations in LDLR, ApoB have been associated with high-LDL cholesterol level. In addition, PCSK9 and multiple other genetic variants (polygenic) have been shown to be involved in LDL-cholesterol level regulation. In one of our recent studies, monogenic mutations with high polygenic scores significantly increase cardiovascular risk (Journal of the American College of Cardiology 2019, 74 (4), 512-522). The molecular functioning and regulation of genes involved in cholesterol homeostasis are not well understood. Dr. N. Sadananda Singh's group employs genome-wide as well as targeted genome editing, molecular biology, biochemical and imaging methods to understand regulation of cholesterol homeostatic gene as well as drug response genes.

Replication-transcription collisions

Dr. Sabari Sankar Thirupathy's group aims to understand how collisions between replication and transcription generate mutations. Replication and transcription are the two fundamental processes that use the same DNA template often simultaneously especially in rapidly dividing bacterial cells resulting in collisions between the two machinery (Figure). Two major mutation signatures were identified as resulting from collisions: Indels (insertions/deletions) and promoter base substitutions. They are investigating the mechanisms of the mutations generated by replication-transcription collisions. Further, they study how genome organization is influenced by the conflicts between DNA replication and transcription.



NEUROBIOLOGY

Chronobiology

Dr. Nisha N Kannan's group is interested to understand the circadian clock at the genetic, neuronal network level and how the circadian clock rhythmically regulates the behavior, physiology and metabolism of an organism. Recent studies conducted by the group on cricket, Gryllus bimaculatus showed that the temperature cycle could entrain both behavioral rhythm and transcriptional rhythm of core clock gene such as period, timeless, cryptochrome 2 and cycle in circadian pacemaker tissue optic lobe (Kannan et al., 2019. Figure). In addition, recent work from this group showed that circadian photoreceptor cryptochrome expressed in the fat body regulates triglyceride metabolism and elucidated the role of microRNA-14 in post-transcriptional regulation of circadian rhythm in Drosophila.

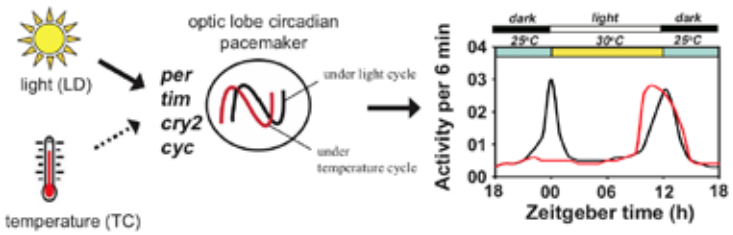
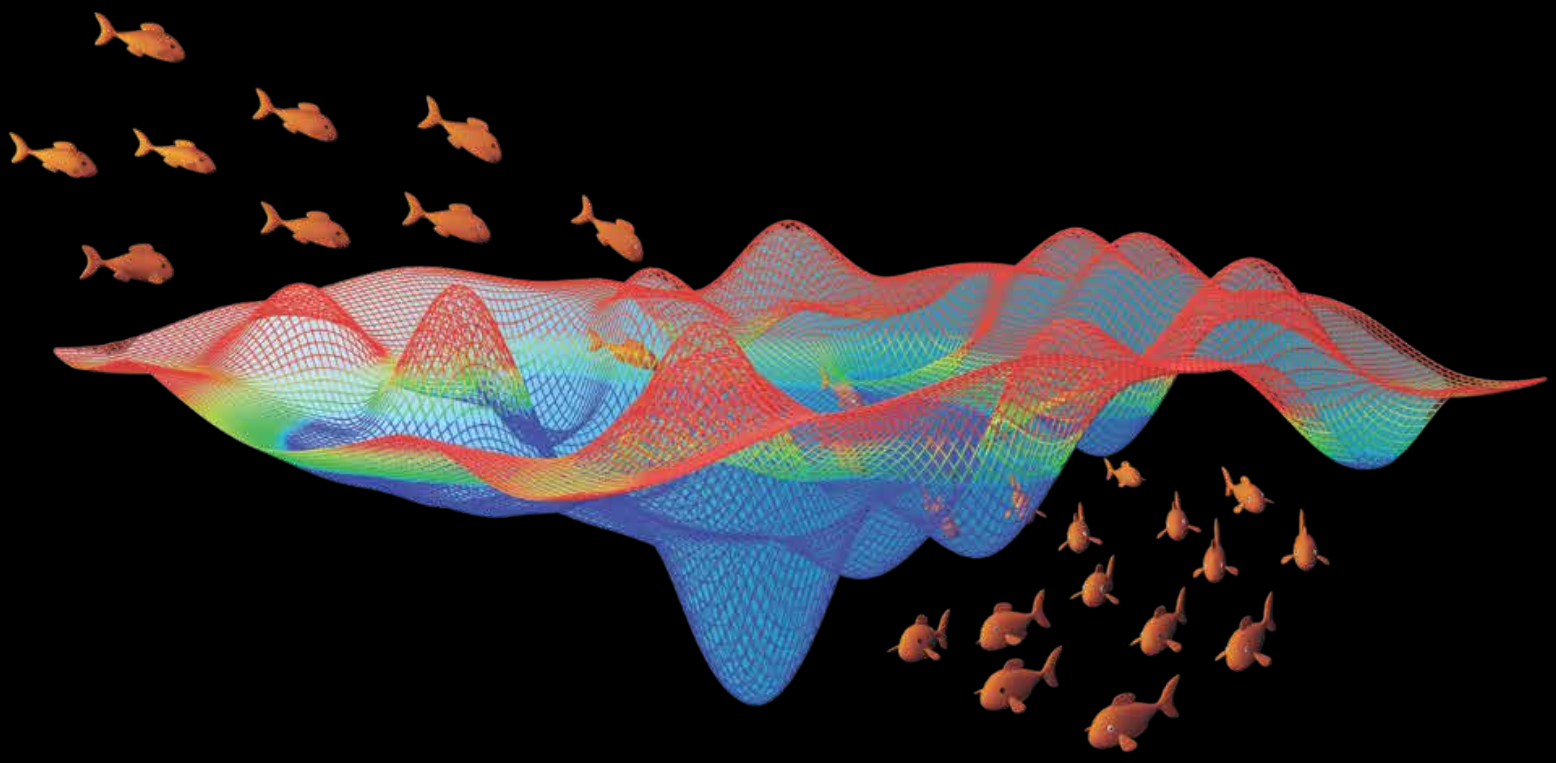


Figure: Temperature cycle entrains the activity rhythm and clock gene expression in the optic lobe of the cricket, gryllus bimaculatus. Temperature cycle advanceds the phase of both behavioral and clock gene transcription rhythm compared to those obtained under light dark cycles.

Neurodegeneration

Parkinson's disease (PD) is one of the most common progressive neurodegenerative disorder. While symptoms and progression of the disease vary with each patient, histopathologically, PD is associated with the aggregation of α-synuclein protein and progressive loss of dopaminergic neurons (DA-neurons). Further, although PD patients exhibit severe loss of DA-neurons, all DA-neurons are not equally susceptible to degeneration. For eg. those present in substantia nigra are more vulnerable to degeneration than those in ventral tegmental area. One of the major challenges is lack of suitable animal models that can accurately and reliably mimic the disease features. Dr. Poonam Thakur's lab works on developing better models of PD that can model the complex pathophysiology of PD. Utilizing these mouse models and electrophysiological approaches, her lab wants to study the mechanisms behind selective loss of dopamine neurons in PD. This understanding will also be utilized to develop potential therapeutic targets.



SCHOOL OF CHEMISTRY

Image by Dr. R.S. Swati's Research Group

ORGANIC CHEMISTRY

Prof. J. N. Moorthy

We have been concerned with development of porous materials – MOFs (Metal-Organic Frameworks) by metal-assisted self-assembly and POPs (Porous Organic Polymers) by covalent polymerization – and their applications for a variety of applications that include gas adsorption, sensing, heterogeneous catalysis, etc. Another area of our interest is the photochemistry of novel organic compounds.

Metal-Organic Frameworks (MOFs):

In our recent works on MOFs, by leveraging the preponderant occurrence of 4-connecting $[In(OCOR)4]^-$ SBU of In(III) ion in the MOFs constructed from tetracarboxylate linkers in particular, we have investigated tuning of porosity by a subtle variation of the structures of organic linkers that lie within two extremes of tetrahedral and square planar connectivity dispositions. It is shown that solvothermal reactions of eight rationally-designed 4-connecting tetracarboxylate linkers featuring concave shapes with In(III) salt lead to anionic In-MOFs of four different topologies, i.e., dia, neb, lon and pts. All the In-MOFs exhibit considerable sorption of gases with varying capacities, determined by the porosities that are tuned by structure, functionality and magnitude of interpenetration. The applicability of In-MOFs with tunable porosity is demonstrated for highly selective dye exchange in that only methylene blue is captured selectively from amongst nine cationic, neutral and anionic dyes, see: Appl Mater. Today, 2020, 19, 100613.

A zinc metal–organic framework, i.e., Zn-MOF (Zn-DBC), with ca. 27% solvent-accessible void volume was synthesized from a rationally designed tetraacid based on sterically insulated dibenzo[g,p]chrysene core. It is shown that the Zn-MOF can be employed as an efficient sensory material for detection of hazardous “quat” dicationic herbicides in water by diffusion-limited “turn-off” fluorescence. The unique structural attributes of the Zn-MOF for highly efficient fluorescence sensing of toxic herbicides in water are exemplified for the first time, cf. Inorg. Chem., 2020, 59, 6202.

In a similar manner, a cadmium metal–organic framework, i.e., Cd-BBI, was accessed starting from a rationally-designed tetraacid linker based on bisimidazole featuring concave shapes as the core scaffold. The MOF is shown to serve as an efficient sensory material for detection of hazardous biogenic polyamines by ‘turn-off’ fluorescence quenching with rates (kqs) beyond the diffusional limit. For a biogenic amine such as spermine, the detection limit is as low as 56 ppb. Indeed, the results constitute first of their kind for selective sensing of aliphatic amines in general and biogenic amines in particular by MOFs, see: J. Mater. Chem. C 2020, 08, 11449.

Porous Orgnic Polymers (POPs):

Covalent polymerization of contrived molecular building blocks leads to porous organic polymers (POPs) with intrinsic microporosity.

In spite of the fact that a variety of reactions have been exploited for creation of innumerable porous organic polymers (POPs), aldol condensation reactions between aldehydes and ketones leading to enones remain unutilized quite inexplicably. By subjecting rationally designed tri-/tetraacetyl-functionalized aryl amines to aldol condensations with terephthalaldehyde, three different POPs that feature enone functionalities have been synthesized and shown to exhibit palpable gas sorption properties. Indeed, they are found to stabilize in situ-generated Pd(0) nanoparticles to enable application of the resultant materials as a recyclable heterogeneous catalyst for a number of organic transformations such as Suzuki and Heck, reductions such as nitro-to-amine and hydrogenation of olefins, see: J. Catal. 2020, 384, 61.

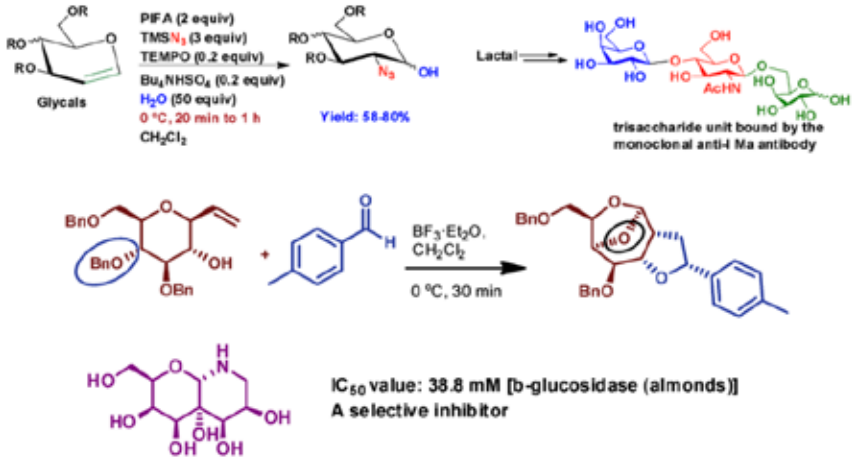
Leveraging the results of our extensive investigations with molecular systems based on twisted biaryl scaffold as applied to metal–organic frameworks (MOFs) and organic light-emitting diodes (OLEDs), we envisioned that the Fridel-Crafts polyalkylation of the 2,2′,6,6′-tetramethylbiphenyl core with α,α′-dichloro-p-xylene should lead to a hypercrosslinked polymer with assured porosity. Furthermore, sulfonation of the latter in a postsynthetic fashion was surmised to yield a POP grafted with sulfonic acid groups for catalysis. Indeed, the polyalkylation of tetramethylbiphenyl led to a highly porous POP (MeBP) with a BET surface area of 1277 m2 g−1 . Also, its sulfonated derivative (MeBP@H) exhibited a surface area of 766 m2 g−1 , as determined by N2 sorption analysis. Polymer MeBP@H with palpable porosity and endowed with Bronsted acid sites installed through sulfonation was explored for the heterogeneous catalysis of cyclocondensation and cycloaddition reactions in a recyclable fashion, see: ACS Appl. Polymer Mater. 2020, 02, 3084.

Synthesis and Photochemistry of Novel Organic Compounds:

In continuation of our studies on photochemistry of novel coumarins, we have developed One-pot synthesis of 4- carboethoxybenzo[h]coumarins starting from α-/β-naphthols. It is shown that a diverse 4-carboethoxybenzocoumarins can be synthesized in moderate-to-excellent (31–75%) isolated yields. The synthesis involves initial oxidation of naphthols to the intermediary 1,2-naphthoquinones with 2-iodoxybenzoic acid followed by a cascade of reactions, namely, Wittig olefination, Michael addition, β-elimination, and cyclization. Furthermore, we have comprehensively investigated the excited-state properties of differently substituted 4- carboalkoxybenzo[h]coumarins, see: ACS Omega, 2020, 05, 207.

Prof. Yashwant D. Vankar

Our work mainly revolved around synthesis of glycosidase inhibitors and development of various methodologies for important transformations in carbohydrate chemistry. This involved utilization of glycals and C-2 functionalized glycals as the main starting materials. A few important transformations and synthesis of a few glycosidase inhibitors carried out recently are shown below:

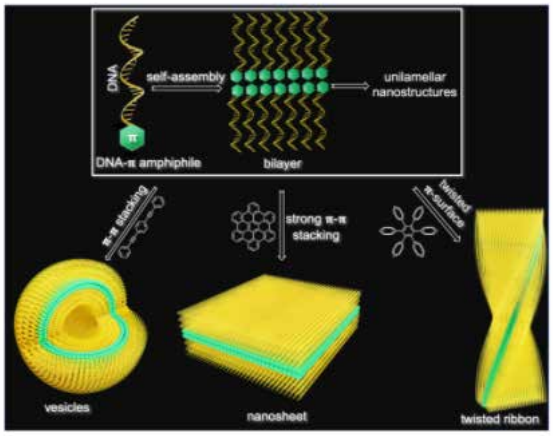


Prof. Kana M. Sureshan

An important area of research in Sureshan group is the design of topochemical reactions. Topochemical reactions, the reaction between pre-organized reacting motifs in the crystal lattice, are attractive as they do not require solvents, catalysts and other special reaction conditions for the reaction and provide products in pure form. We have developed thermal Topochemical Azide–Alkyne Cycloaddition (TAAC) reaction to synthesize various biopolymer mimics. We have exploited hydrogen bonding for the self-assembly of monomers in solid or gel to pre-organize the reacting motifs. Lattice controlled polymerization/oligomerization reaction of such pre-organized monomers gave various biopolymer mimics. By applying this methodology, we have topochemically synthesized glycopolymers, oligosaccharide mimics, DNA analogs and polypeptides. Many other topochemical reactions are being designed and pursued in our lab, to make functional materials. Design of novel gelators and their application in novel areas is another research topic in our group. We are also interested to develop novel organic transformation strategies, chemo/regioselective reactions, development of catalysts for novel transformations etc. We have devised a novel general strategy for inversion of up to three contiguous stereocenters. We demonstrated the efficiency and generality of this strategy by the practical synthesis of unnatural/rare carbohydrates and cyclitols from the cheaply available isomers. An important class of natural polyols is the carbasugars having c7 cyclitol skeleton. They have the common cyclohexenyl skeleton with a one-carbon side chain. We have developed a general methodology to install the internal double bond and the one-carbon side chain in cyclitols through a vinylogous opening of the orthoester or ketal. We have used this methodology to synthesize several natural carbasugars.

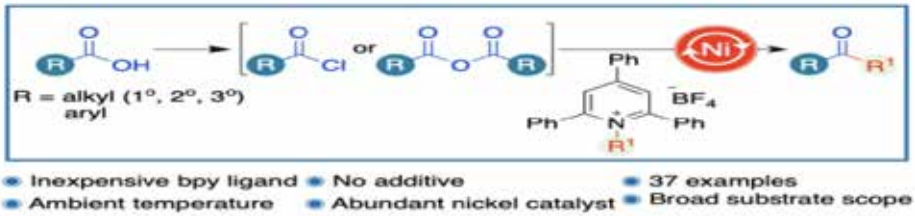
Dr. Reji Varghese

Dr. Reji Varghese's group is interested in the design and synthesis of DNA decorated nanostructures for various biological applications. Over the past few years, this group has developed a class of amphiphiles known as DNA-based amphiphiles. The unique structural feature of the nanostructures obtained from the self-assembly of DNA amphiphile is the extremely dense decoration of the surface with ssDNS of defined sequence (Acc. Chem. Res. 2020, 53, 11, 2668). Accordingly, this kind of nanostructures act as a nanoscaffold for the defined organization of other functional molecules of interest. The organization of plasmonic nanomaterials into various 1D, 2D and 3D nanostructures with interesting optical properties have shown. Moreover, the protrusion of ssDNA of defined sequence was used for the integration of cell targeting moieties for targeted drug delivery. Current interest of the group is to study the self-assembly of DNA amphiphile in a specific cell compartment by exploring the peculiar behaviors of cancer cell compared to normal cells for the development of drug-free cancer therapy.



Dr. Ramesh Rasappan

Dr. Ramesh Rasappan's group focus on the nickel mediated cross-coupling reactions including asymmetric variant. Recently, the group presented a nickel-mediated acylation of pyridinium salt for the first time. A broad range of acid chlorides, including sterically hindered, and pyridinium salts with varied functional groups underwent cross-coupling reactions to offer the acylated products in good yields. This protocol accommodates inexpensive bipyridine ligand, requires no additives, and proceeds at ambient temperature. It was also showed that the carboxylic acids can be used directly in place of acid chloride to incorporate acid-sensitive functional groups. The presence of the radical intermediate is confirmed by the identification of the TEMPO adduct through NMR and MS analysis.



The detailed mechanistic study revealed Ni(I) intermediate rather than Ni(0) complex, also the radical-chain mechanism is involved. The group also focus on the enantiospecific silylation via C-O bond cleavage, recently the group developed an unprecedented cross-coupling reaction that utilizes inexpensive, bench-stable nickel catalyst. This methodology has a wide scope. The synthetic application of this methodology was shown in the orthogonal reactivity of the carbamate in combination with directed ortho metalation (DoM).

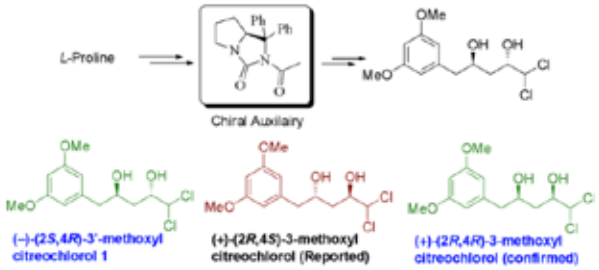
Dr. Alagiri Kaliyamoorthy

Dr. Alagiri's group research interests are directed towards organic synthesis with the focus on developing new synthetic strategies, asymmetric catalysis, and total synthesis of complex natural products having biological significance. Currently, his group primarily works on activation of less reactive pronucleophiles to active nucleophiles in the presence of a binary catalytic system, which consists of a soft Lewis acid, Lewis base, and Brønsted base followed by nucleophilic addition to electrophiles. In this direction, his group accomplished a 1,6-conjugate addition of alkylazaarenes to various para-quinone methides. Additionally, his group works on transition metal-catalyzed C–H functionalization of various aromatic and heteroaromatic precursors. In particular, C2-biarylation and -monoarylation of indoles has been recently accomplished. The other area of his group research interest is developing various C–C and C–X bond forming strategies using the cross-coupling method.

Dr. Rajendar Goreti

Chiral auxiliaries are most useful chemical entities in organic chemistry for asymmetric transformations. Auxiliary assisted asymmetric acetate aldol reaction one of the challenging reaction suffering with several draw backs. Especially the aldol reactions of highly enolizable aldehydes provides poor yields and selectivities. Dr. Rajendar group developed a new class of proline based chiral auxiliary.

The auxiliary consists of fused bicyclic imidazolidinone moiety and works well with highly enolizable phenylacetaldehyde derivatives. Also



provides very good to excellent selectivities with different aldehydes including acetaldehyde. The method successfully implemented in total synthesis of citreochlorols.

Citreochlorols are class of aromatic polyketides having geminal dichloromethyl functionality. The group has developed two distinct synthetic approaches, one involves auxiliary assisted aldol reactions and the second approach follows a concise, protecting group free chiral pool method for synthesis of all possible stereoisomers. Structures of citreochlorols were reassigned by synthesizing all the possible isomers.

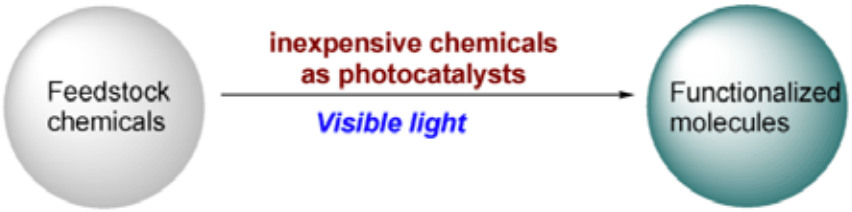
Dr. Basudev Sahoo

Sustainability is an aspect that has emerged to be widely considered in modern organic synthesis. Despite the chemical inertness, the utilization of renewable and easily available feedstocks have captured the broader attentions of synthetic organic chemistry community, while developing synthetic strategy for the constructing value-added products. Our research investigations encompass the following topics:

1. Transition Metal catalysis: In this research area, we intend to explore the novel reactivity of transition metal-based catalysts through its rational design, mechanistic probing and practical applications. The utilization of earth abundant metals holds the immense interests in organic synthesis while developing novel synthetic methods for molecular architecture construction from feedstocks. Mechanistic rationale will be addressed through spectroscopic techniques for the betterment of catalysts and methods.
2. Photocatalysis: Visible Light Photocatalysis has emerged to be a mild catalytic technique to activate the inert substrate for forging molecular linkages. We will develop the synthetic strategy for selective functionalization of inert bonds as well as less reactive functionality for late-stage modifications of natural products, pharmaceuticals and so on.
3. Metal Free Coupling Reactions: As an alternative to the transition metal catalysis paradigm, metal-free approach has well been accepted in synthetic organic chemistry, where we would like to contribute in the coupling chemistry arena, promoted by Phosphorus, Sulfur or Boron-based catalyst/reagent, dealing with the molecular entities that find difficulty

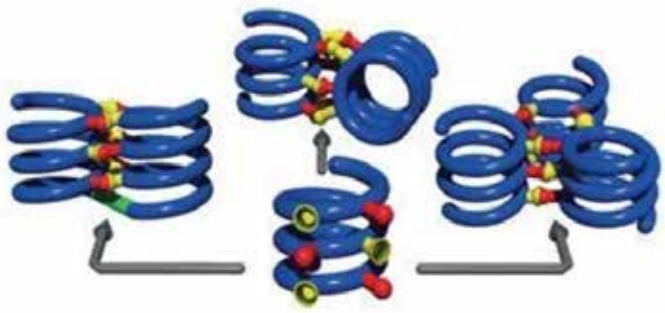
Dr. Veera Reddy Yatham

Dr. Veera Reddy's group focuses on development of new synthetic methodologies in the fields of photoredox catalysis and their applications in the late-stage functionalization of drugs and drug-like molecules. Their main focus on utilization of feed stock chemicals as reactants and employing inexpensive chemicals as photocatalysts. In this direction they found that the utilization inexpensive chemicals such as CeCl3 and PPh3/NaI as a photoredox catalysts to access benzo-3,4-coumarine and 6-alkyl substituted phenantharidines derivatives. These structural motifs are highly sought for their application in pharmaceutical chemistry and precursors for natural products. Replacement of expensive metal based photocatalysts (Ir, Ru) by inexpensive chemicals as a photocatalysts will open up new research avenues to be implemented in future with both academic and industrial partners.



Dr. Soumen De

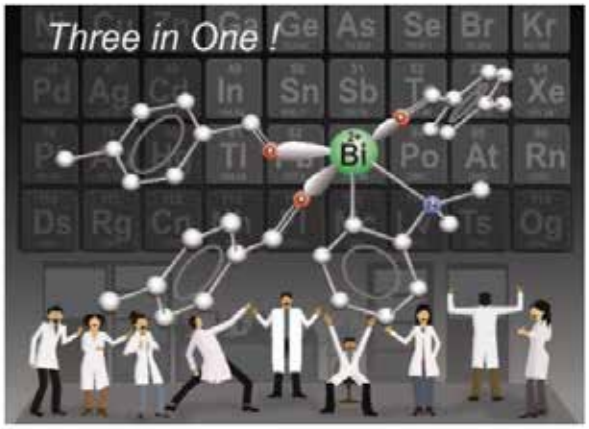
Our research is focused on the inter-disciplinary field of dynamic complex supra-molecular architectures to regulate the structure and motion across all scales to create new materials, discover their emergent properties and perform useful tasks through modulating different supra-molecular interactions. In doing so, we would like to expose important features of dynamic systems in biology and develop know-how in the design that will be critical in realizing the potential of supramolecular systems. We are also interested to explore new switchable architectures for controlling dynamic functions. In our research, we apply methods from synthetic organic chemistry to create our building blocks and use different non-covalent interaction and dynamic covalent chemistry to decorate the suitable functional groups in the desired position. Thus, it will help in expanding the tool-box available for practitioners in the field of supramolecular chemistry to control the structures and motions at various scales. Our research includes: Out of equilibrium self-assembly; Molecular switches and machines; Abiotic foldamers and their host-guest properties; Stimuli-responsive dynamic materials.
Funding: Start-up research grant by SERB



INORGANIC CHEMISTRY

Dr. Ajay Venugopal

Bismuth compounds are gaining importance as potential alternatives to transition-metal complexes and electron-deficient lighter p-block compounds in homogeneous catalysis. Propelled by the initial success in Bismuth Lewis acids and their application in catalytic hydrosilylation, Dr. Ajay Venugopal's research group ventured further in the field. A highly reactive dicationic organobismuth possessing multiple directional Lewis acidic sites have been prepared. This Lewis acid can activate three carbonyls at an instance. X-ray crystallographic studies and NMR spectroscopy have provided rare structural evidence of three aldehydes bound to the electrophilic bismuth center prior to hydrosilylation. The bismuth catalyst efficiently catalyzes aldehyde and ketone hydrosilylation and is the first example among bismuth Lewis acids. Trans-influence, an essential parameter for the activation of chemical bonds, has been explored using a series of bismuth compounds bearing tris(pyrazolyl)borate ligand, forming a basis for the development of heavier main group Lewis acids. A fundamental investigation on the higher Lewis acidity of BiCl3 over SbCl3 has been performed both in the solid-state and in the solution. The ideas developed from bismuth chemistry has been extended to other electropositive elements of the p-block. The first success in this direction is the generation of an organoaluminum cation that catalyzes aldehyde dimerization with turn-over frequencies reaching up to 6000 h-1, the best so far among main group catalysts.



Dr. Sukhendu Mandal

Dr. Sukhendu Mandal's group focused on synthesizing new materials with useful and interesting properties as well as applications. We are currently focused on synthesizing atom-precise metal nanoclusters as well as metal-organic frameworks (MOFs). The nanocluster (NC) sub-group has been involved in both synthesis of application-based Au and Ag-based NC as well as study of the fundamental nature of nanocluster structure transformation. Recently, we reported a mechanistic study of the effect of the nature of ligand in the transformation of NC from one geometrical kernel to another (J. Phys. Chem. Lett, 2020, 11,

10052-10059, Fig. 1a). Currently, work has been going on to develop Ag-based cluster-assembled materials and studying their properties. Catalytic activity of Au-phosphine based cluster on being embedded in metal oxide defect had been reported by our group recently (ACS Nano, 2020, 14, 16681-16688, Fig. 1b). Studies are underway to study the catalytic behavior of Au-NC on being embedded in defect site of MoS2.

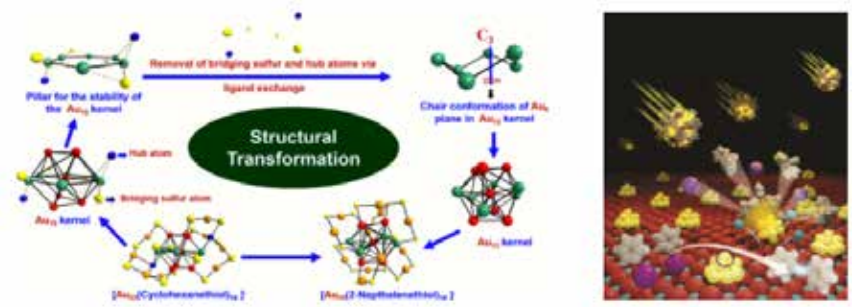


Figure 1. (a) Study of mechanism of nanocluster transformation; (b) schematic representation Au11 @CeO, for catalytic C-C bond coupling.

Dr. Subrata Kundu

The Bioinorganic Research Group guided by Dr. Subrata Kundu is actively engaged in providing molecular level insights into the signalling routes of hydrogen sulfide (H2S) and nitric oxide (NO) in mammalian physiology. While H2S and NO are historically known as potent toxins, both the gaseous molecules have recently gained prime research interests because of their pivotal roles as gasotransmitters in a diverse array of physiological processes including vasodilation, immune response, and neurotransmission. As a consequence, the generation and utilization of H2S and NO in the biological milieu are very tightly regulated through complex chemical pathways. Notably, therapeutic opportunities of H2S and NO donors are often uncertain due to the lack of unambiguous molecular level insights into these biochemical routes. In these connections, Dr. Subrata Kundu's research group has recently outlined a number of unique routes and their underlying molecular mechanisms. A recent work published by Kundu et al in J. Am. Chem. Soc. 2020 illustrates the involvement of proton-coupled-electron-transfer (PCET) mechanism in NO generation from a cross-talk between phenol and nitrite anion at copper(II) site. Thus, this work resembles

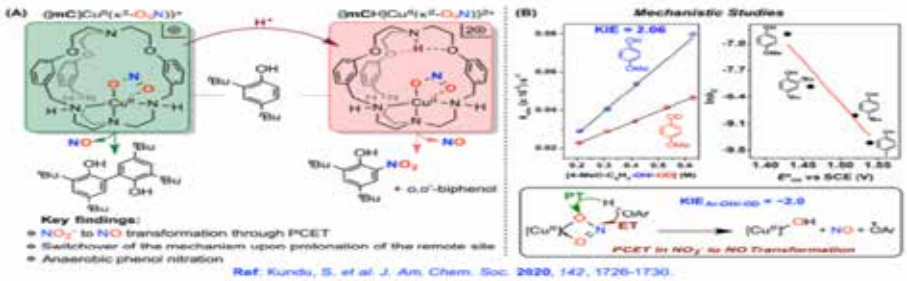


Figure 1. Representative models employed for providing the mechanistic insights into the NO generation from the phenol-nitrite cross-talk at copper(ll) site.

the interactions between polyphenols and nitrite originating from the dietary sources and resulting in the elevation of NO concentration in the stomach. Another recent work published in Chem. Commun. 2020 reveals NHC mediated deoxygenation of ArNO leading to the generation of aryl nitrene (ArN). This unique route not only bridges two 6e– species namely carbene and nitrene but also mimics the interactions of thiamine dependent enzymes with nitrosoarene as well as analogous transient HNO species in biology. Dr. Kundu's research group has also outlined the mechanism of H2S releasing pathway from CS2 / COS through the hydrolase activity of a dinuclear zinc(II)-aqua complex (Inorg. Chem. 2020).

Dr. A. Thirumurugan

Dr. A. Thirumurugan's research group aims to contribute to the global quest to find new and novel materials for energy and sustainable development. In particular, the focus is on the investigations of coordination polymers, nanocellulose composites of hierarchical porous materials, vanadium oxide clusters and their nanocomposites for molecular (gas) storage - separation, optical and electrochemical energy storage properties. We have employed a soft template based mesoassemblies of a gemini surfactant, C14-6-14, to introduce mesopores in one of the well-known metal organic framework (MOF), HKUST-1. A combination of certain synthetic parameters are adopted in this work, to induce variations in the nucleation and crystal growth conditions that are crucial to achieve a wide range of hierarchical porosity (HP). The observed HP structure, where the mesoporous channels separate the embedded MOF clusters from the surrounding MOF matrix, is unique due to the formation of vesicle like assembly of C14-6-14 and their utilization as soft templates. Exploring novel materials that provide simultaneously optimal energy density and power density for the next generation electrochemical energy storage (EcES) devices is an important research focus. We have explored a layered coordination polymer, a vanadium formate (VF) material and its composite with the partially reduced graphene oxide (prGO), VF-prGO, as anode materials for the Li-ion based EcES systems in the potential range of 0-3 V (vs Li+/Li). This study reveals that a reversible capacity of 329 mAhg-1 at a current density of 50 mAg-1 after 50 cycles can be realized for VF along with a high rate capability and a good capacity retention. The composite exhibits even a higher capacity of 504 mAhg-1 at 50 mAg-1. An ex-situ X-ray photoelectron spectroscopy (XPS) study indicates the involvement of V3+/V4+ redox couple in the charge storage mechanism. A significant contribution of (about 50% for VF and 60% for VF-prGO at a scan rate of 1 mVs-1) this reversible capacity is attributed to the pseudocapacitive behavior of the system. In VF-prGO, an enhanced electrochemical performance is observed with an enhanced energy density and a power density than that of VF. A lower charge transfer resistance is observed in the composite compared to the VF, which is due to the presence of the interfaces that occur between VF and prGO and their contribution could be the reason for the observed enhancement in the overall EcES performance.

Dr. S. Gokulnath Sabapathi

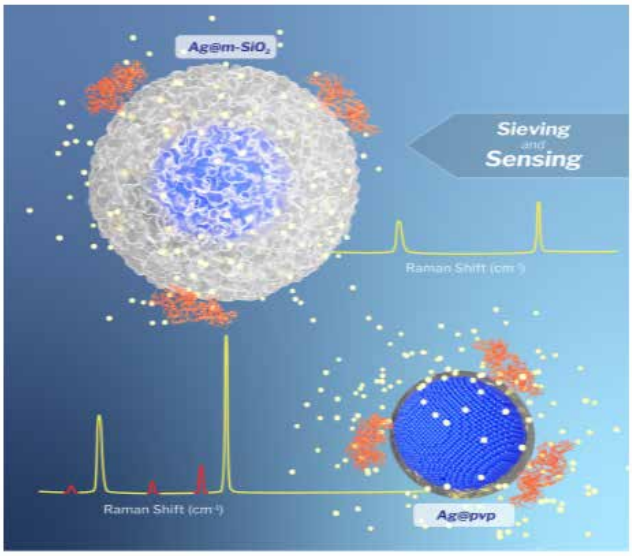
The modification of porphyrin core has been studied extensively, aiming to control and tune its electrochemical, photophysical, and coordinating properties. Various building blocks have been reported replacing either the pyrrole or pyrrolenine residues by monomeric five-/six-membered heterocycles, linear oligomeric heterocycles, and aromatic ring fused heterocycles. Dr. Gokulnath's group is developing methods to incorporate various functional subunits onto the macrocyclic framework to accomplish the modified macrocycles with altered optical and coordination abilities. Recently, his group successfully demonstrated a carbazole embedded porphyrinoids having N3O and N3S cores with strong intramolecular electronic interactions within the carbazole and the tripyrromethane core, thus invoking their aromatic features. The ion-recognition properties by fluorescence studies and X-ray crystallography proved that macrocycle with smaller oxygen core has a specific sensing affinity toward toxic Hg2+ ion over a range of other metal ions and is found to be reusable (Org. Lett. 2020).

His group has recently developed a simple acid catalyzed condensation of m-phenylene incorporated building blocks for the successful preparation of bithiophene-incorporated di-m-benziheptaphyrins which exhibits the optical absorption that covers the entire UV to visible region with a "black color" in solution by simple π-expansion without involvement of metal centers. This is in sharp contrast to our recent "black dye" via an expanded porphyrin hetero-bis-metal (AuIII–PdII) complex with absorption capabilities covering the visible to NIR region (J. Org. Chem. 2020). The high-yielding synthetic strategy is expected to open up an opportunity in making various meso–meso-linked porphyrin dimers and fused dimers for practical applications. Currently, his group is exploring various metal complexes of these newly synthesized macrocycles.

PHYSICAL CHEMISTRY

Prof. K. George Thomas

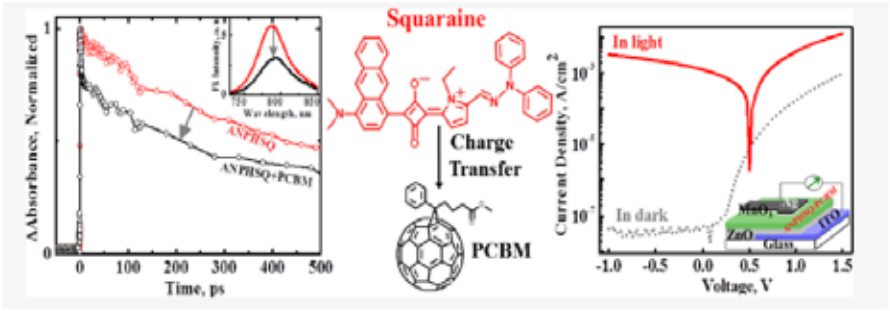
Research activities of George Thomas' research group at IISER Thiruvananthapuram focus on understanding the photochemistry and photophysics of molecular assemblies, plasmonic systems and semiconductor quantum dots, and chiral nanostructures. Recently our group has adopted differential extinction spectroscopy to bring out the otherwise hidden plexcitonic states in chromophore-bound plasmonic systems. Chromophore-bound plasmonic nanoparticles in water showed a single peak that is broadened when water is used as the reference; however, they displayed a conspicuous Rabi splitting with the chromophoric dye solution as the reference (J. Phys. Chem. C 2020 124, 26387–26395). The group has also designed core–shell plasmonic systems for SERS sensing, consisting of silver nanoparticles coated with mesoporous silica (Ag@m-SiO2) having an average pore size of 2.4 nm. The practical application of Ag@m-SiO2 having a shell thickness of □40 nm, compared to bare systems (Ag@PVP), for SERS sensing has been established using two commonly used organophosphorus pesticides (quinalphos and triazophos) directly from various vegetable matrices after the removal of plant pigments. The mesoporous silica shell sieves large molecules such as proteins and keeps them away from the electric field generated by the Ag nanoparticle, thus enabling the sensing of small molecules such as pesticides that penetrate into the shell (ACS Applied Nano Mater. 2020, 3, 6376–6384). We have demonstrated the role of hole accepting ligands in tuning the Fermi level of CdSe–Au heteronanostructures. The photoexcitation of CdSe–Au heterostructure capped with a hole accepting ligand, dodecylthiol, results in the elevation in Fermi level of CdSe–Au heteronanostructures as a result of the rapid hole scavenging by the hole acceptor ligand and electron transfer to the gold nanoparticle. This results in the elevation of the Fermi level of Au and equilibration with the conduction band of the QDs



(J. Chem. Phys., 2020, 152, 044710). Our group, jointly with Prof. Anna Painelli and Dr. Cristina Sissa of the University of Parma, has made a significant contribution to the understanding on the helicity of chiral supramolecular assemblies. It is concluded that the while assigning the handedness of a chiral assembly based on the sign of the CD couplet, care should be given to understand the nature of interaction energy (Chem. Commun., 2020, 56, 8281-8284).

Prof. Suresh Das

Our interest is in the design of novel dyes for applications in Near- and Short Wavelength Infrared (NIR/SWIR) detectors and bio-imaging. In this context an unsymmetrical squaraine (SQ) derivative containing anthracene and phenyl hydrazine (ANPHSQ) units linked to the central SQ was synthesized and used as electron donors in bulk heterojunction photovoltaic mode organic photodetectors (OPD), containing PCBM as the electron acceptor. Although the ANPHSQ exhibited a strong narrow band in the near infrared peaking at □760 nm in solution, the OPD constructed with this dye exhibited a broad spectral response extending to 950 nm. The enhanced sensitivity in the long wavelength region could be attributed to formation of ANPHSQ aggregates within the devices. This work was done in collaboration with Department of Physics, IISER-TVM and CSIR-NIIST.



Prof. Mahesh Hariharan

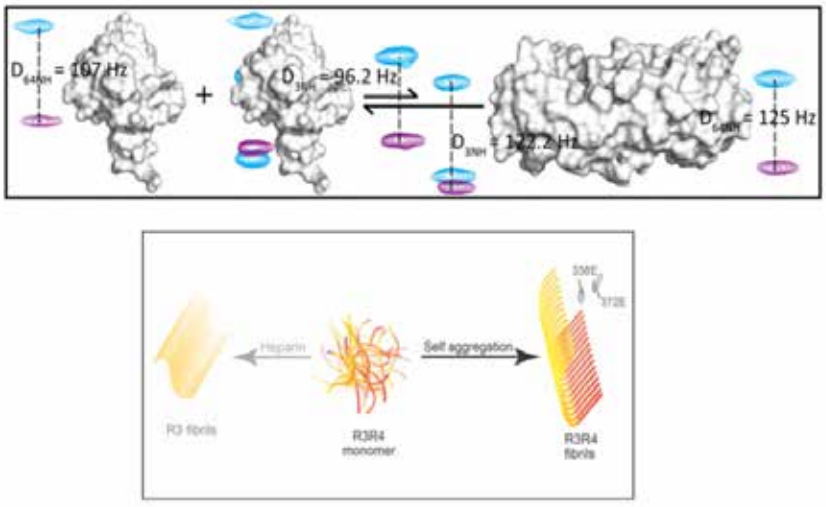
Chromophoric architectures with multifarious angular and slip-stacked arrangements elicit exciting functional properties and is considered as a fast evolving research area in the field of crystal engineering having implications in both fundamental and applied photochemistry. Prof. Hariharan's group has been involved in identifying and deciphering the origin of distinct crystalline supramolecular architectures of small organic molecules and their specific emergent characteristics. They were able to achieve crystalline evidence for null exciton splitting within orthogonally oriented chromophoric systems, as proposed by Kasha and co-workers six decades ago, in Greek-cross (+) stacked 1,7-dibromoperylene-3,4,9,10-tetracarboxylic tetrabutylester. Recently, the group conceived a design strategy to engineer perpendicularly stacked arrangement in pentacene systems via incorporating aryl substituents at the 6,13 positions and capitalizing on the C-H···C interactions that subsequently ensue. The crystalline pentacene derivatives possessing orthogonal stacking with significant interchromophoric separations

exhibited exceptionally exiguous excitonic communication by virtue of negligible long-range Coulombic and short-range charge-transfer-mediated couplings along with a distinct charge filtering phenomena epitomising Kasha's classic null exciton model. Additional theoretical investigations on the nature of excitonic states of pentacene dimers proved that any deviation from a 90° cross-stacked orientation results in the emergence of delocalized Frenkel/mixed-Frenkel–CT character. The analyses highlights the necessity to undertake the possibly challenging task of engineering chromophoric aggregates via modifying the rotational angle in order to fine-tune the optoelectronic properties for attaining tailor-made crystalline architectures with characteristic functionalities.

Figure 1. (a) Pictorial representation of Greek-Cross (+) orientation resulting in monomer-like optical properties. (b) Pentacene dimers depicting correlation of Coulombic (J) coupling with rotational angle and aryl groups substituted in the 6,13 positions of pentacene for attaining the orthogonally cross-stacked architecture.

Dr. Vinesh Vijayan

Our group works on the interface of solid, and solution state. Our lab focuses on developing and using NMR tools to study, and understand the structure, dynamics, and function of biomolecules. This year we studied the conformation of noncovalently formed Ubiquitin dimers in solution using residual dipolar couplings (RDCs). Comparing the RDC derived alignment tensor of the noncovalently formed dimer with the two most abundant (K11 and K48) covalent linked Ub dimers revealed that the conformation of K11 linked, and noncovalent Ub dimers were similar. Between the various NMR and crystal structures of K11 linked



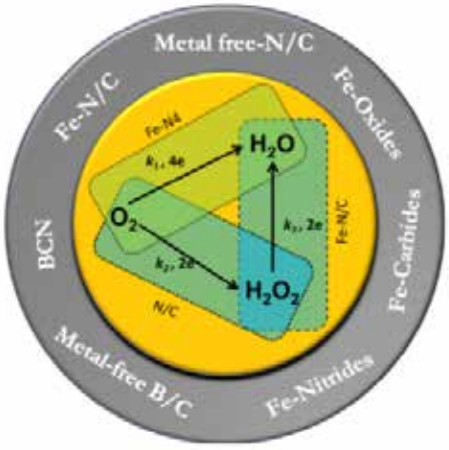
Ub dimers, RDC tensor analysis showed that the structure of K11 linked dimer crystalized at neutral pH is similar to noncovalent dimer. We therefore showed that it's possible to distinguish the shape of the homodimer proteins with RDCs, which is otherwise not that trivial using other methods.

Our main focus on recent years were on characterizing the structural transitions in amyloidogenic proteins. We have been making considerable progress in mapping the aggregation of different segments of CPEB3 (cytoplasmic polyadenylation element binding) protein, whose prion character is responsible for the long-term memory in mammals. We used solution, and solid-state NMR to show that a 40 residue stretch in the PRD1 domain of CPEB3 forms the core of the fibrils. This would the first structural characterization of the functional prion CPEB3. Our group also works on characterizing the aggregation of tau protein, whose aggregation is responsible for many neurodegenerative diseases. In the recent work, we were able to show that a section of the protein is sufficient to self-aggregate and form fibrils analogous to the in vivo fibril structure. This should help in invitro assay development for different tauopathies.

Dr. A. Muthukrishnan

Oxygen reduction reaction (ORR) is one of the most studied reactions in the electrocatalysis. The most abundant element oxygen is used as the oxidizing agent in the low-temperature hydrogen fuel cells. Typically, platinum-based catalysts have been used to improve the ORR kinetics, limiting large-scale commercialization of fuel cells for energy applications. Understanding the ORR mechanism and the active sites information on the NPGM or metal-free catalysts are the real bottlenecks for the development of highly active and durable Pt-free catalysts for the ORR. Despite the series of attempts to characterize the active sites and ORR mechanism, the conclusions are not clear and lead to debate.

Dr. Muthukrishnan's group is working on fundamental aspects of ORR, characterizing the active sites and mechanism of the Fe-N/C and N-doped carbon catalysts, via the kinetic analysis. A bottom-up approach to describe the role of various possible entities present in the



heat-treated heteroatom doped Fe-containing catalysts is individually studied. His group also work on the importance of defects on the carbon substrates for the improvement of ORR activity. Also, the mechanism of the synergistic effect on the two heteroatom-doped metal-free carbon catalysts. To specific, the BCN materials are studied, and its kinetic analysis reveals the mechanism of the synergistic effect.

Dr. Narendra Kurra

The objective of my research is to develop intercalation and Faradaic electrode materials for next generation electrochemical energy storage. Our goal is to tune the electrochemical properties of nanomaterials by controlling the surface chemistry and design of heterostructures through development of synthesis protocols and processing conditions. Top-down wet chemical and bottom-up physical methods would be employed for the synthesis of specific materials of interest. MXenes – a large family of two-dimensional transition metal carbides, nitrides or carbonitrides – are intriguing due to their rare combination of properties including metallic conductivity and hydrophilicity. High-rate redox charge storage properties make MXenes suitable for high rate and high energy storage applications. So, understanding of charge storage dynamics across MXene/electrolyte interface would benefit in the design of advanced energy storage devices including microsupercapacitors and hybrid devices. Exploration beyond Li-ion batteries opened avenues for development of multivalent metal-ion electrochemistry, dual-ion batteries and rechargeable metal-based batteries.

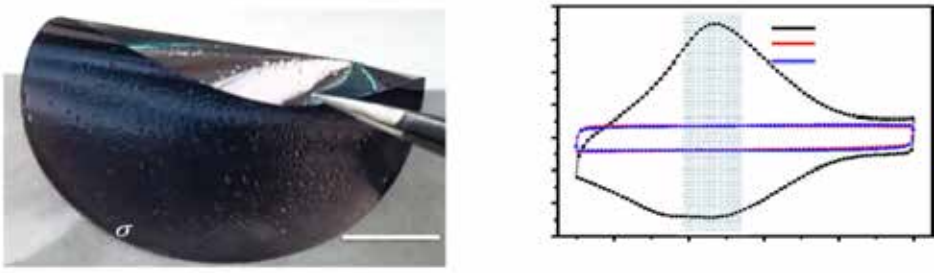


Figure 1. Conductive Titanium carbide MXene membrane and its electrochemical behavior in acidic and neutral electrolytes.

THEORETICAL CHEMISTRY

Dr. R. S. Swathi

Modeling of nanostructures necessitates a mix of modeling methodologies ranging from empirical and semi-empirical approaches to highly accurate quantum chemical approaches. Research at Dr. R. S. Swathi's multiscale modeling and computation group is directed at development and implementation of theoretical approaches for probing interesting phenomena involving carbon-based as well as metal-based nanostructures. Recently, Swathi's group has proposed an amalgamation of the swarm intelligence technique, particle swarm optimization with the continuum approximation for carbon nanostructures as an efficient strategy for probing confinement effects. The methodology can indeed be employed for the global optimization of a variety of cluster configurations on complex potential energy surfaces. In recent times, the group has also employed approximate analytical approaches based on coupled dipole approximation and electrodynamic polarizabilities to evaluate the optical properties of a range of plasmonic heterodimers of potential use in surface-enhanced spectroscopy.

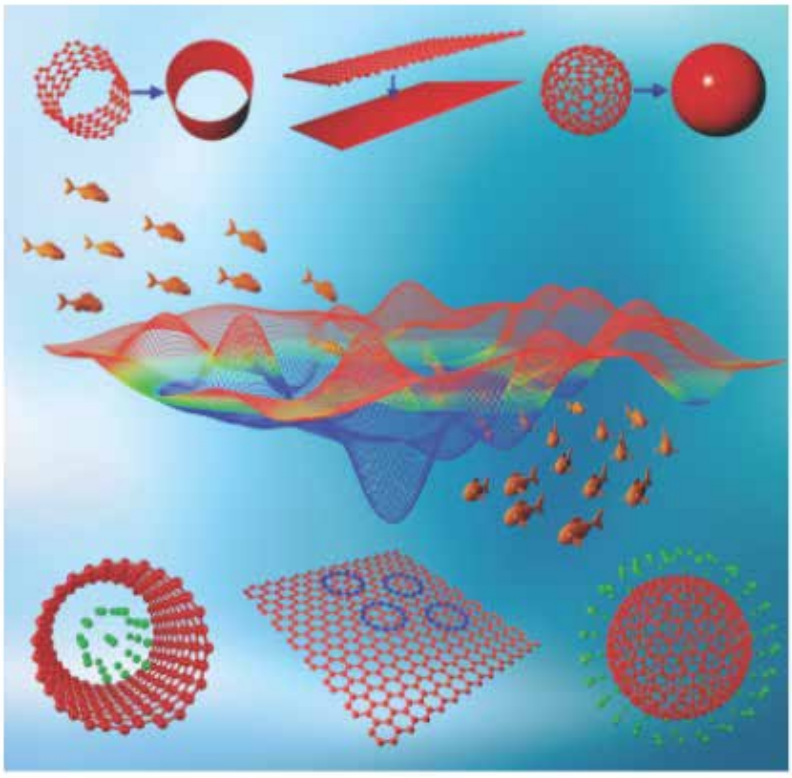
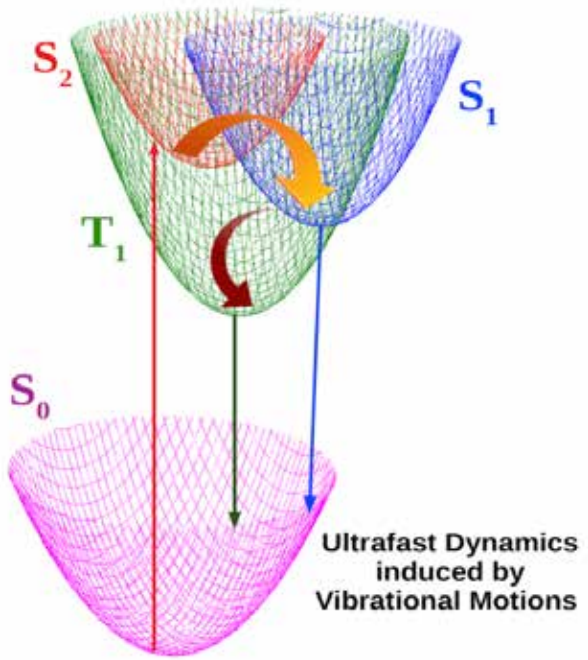
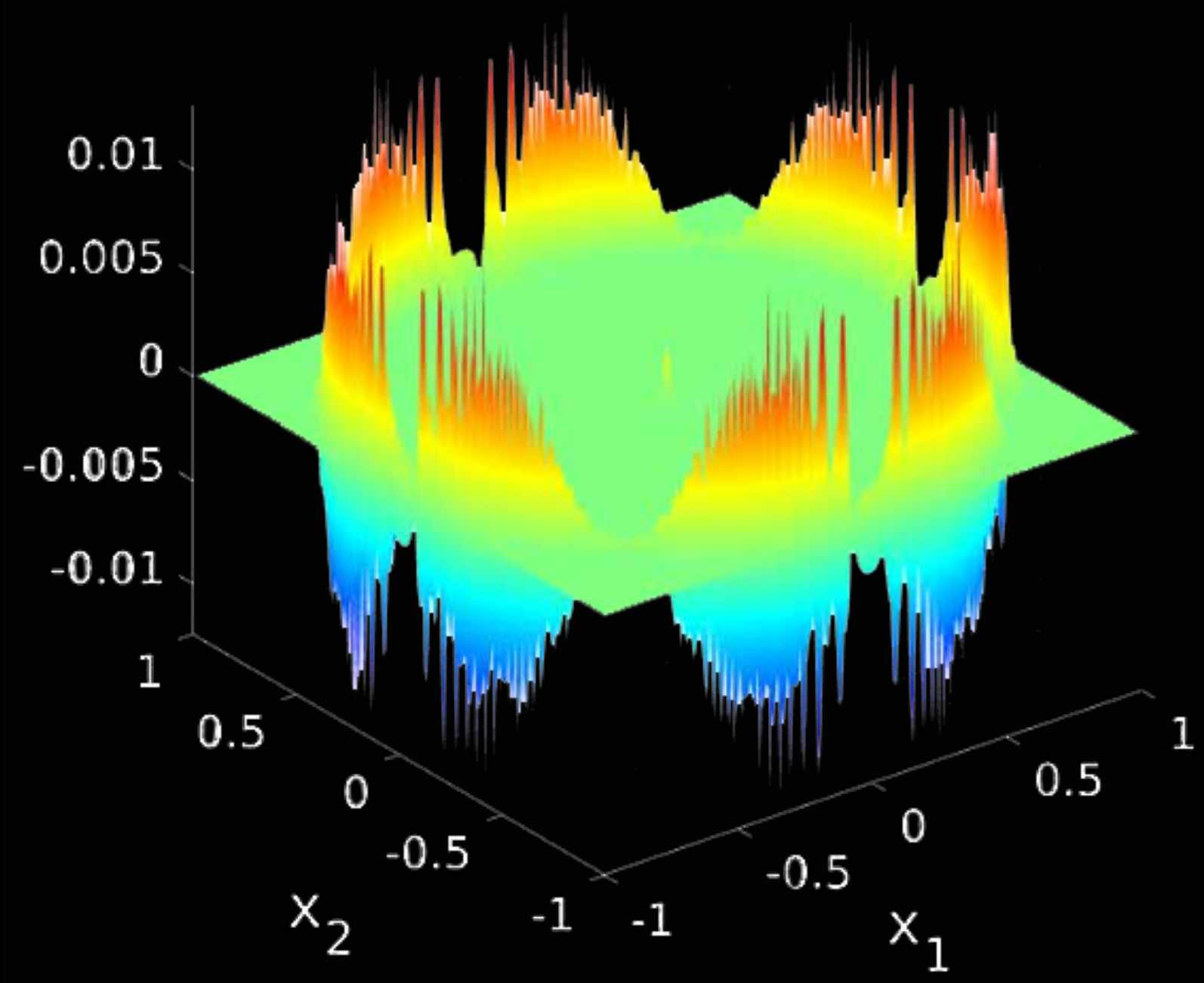


Figure 1. Confined cluster configurations obtained by undertaking an exposition on complex potential energy surfaces using particle swarm optimization, a swarm intelligence technique falling under the general ambit of artificial intelligence in conjunction with the continuum approximation for carbon nanostructures.

Dr. Vennapusa Sivaranjana Reddy

Dr. Sivaranjana Reddy's group explores early events taking place in photoexcited molecules using computational studies. Ultrafast dynamical events are analyzed based on the dynamics simulations carried out on the "pre-defined" and "on-the-fly" potential energy surfaces. The excited-state intramolecular proton transfer and the triplet state generation in molecules are two processes that are under investigation. They have identified multiple proton transfer pathways that would be initiated by different vibrational motions in molecules like 3-hydroxypyran-4-one and its derivatives, tropolone and alizarin. Singlet-triplet dynamics of naphthalene diimide and perylene diimide derivatives are studied to interpret their respective experimental triplet quantum yields. Insights obtained from such extensive studies are incredibly relevant to control and design efficient photon harvesting processes.





SCHOOL OF MATHEMATICS

Image by Dr. Arun K R's Research Group

ALGEBRA AND NUMBER THEORY

Dr Viji Z Thomas

Dr Viji Z Thomas works in Group theory, Homological algebra and Commutative algebra. For the past couple of years he has been working on Schur's exponent conjecture which states that for a finite group, the exponent of the Schur multiplier divides the exponent of the group. Along with his PhD students, he has shown that the conjecture is true in p groups of class at most p, p groups of class at most 5. Moreover using their approach they have been able to prove most of the results obtained towards this conjecture in the last 70 years. Presently they are trying to see if the problem holds true for metabelian p groups.

Dr. Srilakshmi K

In a joint work with Dr. Narasimha Kumar, Dr. Srilakshmi has proved a theorem which explicitly expresses the Eisenstein element and winding element for square-free level, which answers a question of Prof. Loic Merel. In another joint work with Mr. Sunil Kumar, Dr. Srilakshmi studied the p-divisibility of class numbers of an infinite family of certain imaginary quadratic fields. In another work with Dr. Kathiravan, Dr. Srilakshmi proved the existence of infinite families of congruences modulo p for B_{s,t}(n) for certain s, t and prime p, where the function B_{s,t}(n), which counts the number of (s,t)-regular bipartitions of n. In another joint work with Dr. Kathiravan and Mr. Abinash Sarma, Dr. Srilakshmi working on the vanishing of coefficients of η^26.

Dr. Sachindranath Jayaraman

Dr. SachindranathJayaraman's research interests are in Linear Algebra and Matrix Analysis. His recent research concerns the following non-overlapping themes: (1) Linear preservers of certain positivity classes of matrices (2) Linear Algebra and Dynamical Systems and (3) Combinatorial Matrix Theory.

Linear preserver problem has a rich history within linear algebra/matrix analysis. Current interest in this area involves preserver properties of positivity classes of matrices such as semipositive matrices, copositive and completely positive matrices as well as other related matrix classes. In a recent work with Dr. Vatsalkumar, a conjecture on linear preservers of semipositive matrices was resolved.

An interesting consequence of the Perron-Frobenius theorem discusses the existence of periodic points of a nonnegative matrix. In a recent work, jointly done with Dr. Shrihari Sridharan and our student Mr. Yogesh Prajapaty, a generalization of the above result for products of nonnegative matrices corresponding to words (possibly of infinite length) coming from a finite collection of nonnegative matrices was obtained. The existence of common periodic points for the collection as well as connections to random dynamics are worth mentioning. Possible extensions of these to the max algebra setting is being investigated.

The interplay between linear algebra/matrix analysis and graph theory is well known. Consider the collection of all real symmetric matrices

S(G) that shares a common (simple undirected) graph G. There is a nice relationship between the graph structure and the multiplicities of the eigenvalues of elements of S(G). An interesting question in this is to determine what is known as the minimum semidefinite rank of G. Estimating this number for some connected graphs is being studied jointly with my PhD student Mr. Joyentanuj Das

Dr. Geetha T

In a joint work with Prof. Amritanshu Prasad and Dr. Shraddha Srivatsava, IMSC Chennai, in Pacific Journal of Mathematics Dr. Geetha Thangavelu introduced alternating Schur algebras as the commutant of the action of the alternating group on the d-fold tensor power of an n-dimensional vector space. The classical Schur algebras classified the polynomial representations of the general linear group using the commuting action of the symmetric group on the Schur-Weyl duality setup. In this work they analysed what will happen when we restrict the action of symmetric group to the alternating group which leads to a simple understanding of the Koszul duality functor on the category of the polynomial representations of the general linear groups. They described a basis in terms of bipartite simple graphs and gave a graphic interpretation of the structure constants of alternating Schur algebra and used this to give a direct combinatorial proof of a well-known fact that the abstract Koszul duality is an equivalence.

In a joint work with student Amrutha P, Dr. Geetha Thangavelu they studied the determinants of the generalised symmetric groups G(n,r). They gave an explicit formula to compute the determinant of an irreducible representation of the generalised symmetric group and for given an integer n and an odd prime r and a non-trivial character of G(n,r), they gave a closed formula to compute the number of irreducible representations of G(n,r) whose determinant is the given character. This work generalises a work appeared in combinatorial theory series A by Prof. Amritanshu Prasad, Prof. Arvind Ayyer and Prof. Steven Spallone and another work appeared in Journal of Algebraic combinatorics by Prof. Steven Spallone and Dr.Debruan Gosh.

Dr. Sarbeswar Pal

Let X be a smooth projective curve over the complex numbers. A stable vector bundle is called wobbly if it admits a nonzero nilpotent Higgs field. Drinfeld asserts that the wobbly loci inside the moduli space of semistable vector bundles on X is of pure codimension one. In an article with C. Pauly we have proved the assertion for rank 2 case.

Let X be a very general sextice surface in P^3 over complex numbers. In an article, we have shown that the moduli space of stable vector bundles of rank 2 with first Chern Class O_X(1) and second Chern class ≥ 27 is irreducible.

Let X be a very general sextice surface in P^3 over complex numbers. The Mestrano-Simpson conjecture predicts that the moduli space of rank 2 vector bundles with first Chern class O_X(1) and second Chern class 11 has exactly two irreducible components. In an article (jointly with D. Bhattacharaya) we studied the conjecture.

ANALYSIS

Dr. Shrihari Sridharan

Last year, Dr. Shrihari Sridharan (with his PhD student, Atma Ram Tiwari) worked on exploring the dependence of Lyapunov exponents of polynomials on their coefficients. The same was published in the Journal of Computational Dynamics.

Dr. Devaraj

Dr. Devaraj's research during the last year deals with the analysis of certain convolution operators on locally compact abelian groups. He has given a characterization of the range when the convolver has a density which is a finite linear combination of indicator functions of cuboids in R^n.

In another work with his Ph.D student, he has analyzed the local average sampling problem over Shift invariant subspaces of L^2(G). They have established a sampling expansion for second countable locally compact abelian group G for which there is a countable discrete subgroup H such that G/H is compact.

Prof. Utpal Manna

Dr. Utpal Manna works in the areas of stochastic (geometric) partial differential equations with applications to problems arising from fluid dynamics, magnetisation, nematic liquid crystals and other physical models and study their existence, uniqueness, regularity and various statistical properties of solutions.

Dr. Sheetal Dharmatti

Dr. Sheetal Dharmatti's work is based on optimal control of the Cahn Hilliard system coupled with dynamics equations like Navier Stokes' equation(CHNS), Brinkman (CHB) equations etc. The main theme of these works is to prove the existence of optimal control for a suitable control problem subjected to given equations. Along with the student mahendranath a paper on regularity and optimal control of Cahn Hilliard Brinkman system was published. Three different works on the optimal control of Cahn Hilliard Navier Stokes system, one for quadratic cost functional with distributed control, one with initial data optimization and one on second order optimality condition of CHNS system was communicated in last 2 years and first got published while the third one has got accepted in the previous year. All these works are joint works with a student and a collaborator from IIT Roorkee. The stationary CHNS system was studied for existence, uniqueness and the exponential stability under certain conditions on the constants of the problem of the system and corresponding result was accepted for publication. Moreover, CHNS system was studied using Viscosity solution theory. Using dynamic programming principle, corresponding cost functional is shown to be the unique viscosity solution of the corresponding Hamilton Jacobi equation. This is a first work which uses viscosity solution theory to study optimal control associated with coupled nonlinear systems. This work has been communicated and further works on such coupled systems is initiated.

Dr. Dhanya Rajendran

Dr. Dhanya has been working on semilinear elliptic problems with indefinite sign. Along with Dr. Sweta Tiwari they have obtained a bifurcation result for a semipositone elliptic problem for Fractional Laplacian with sublinear growth. Along with that, existence of multiple solutions for a multiparameter problem is also obtained. Recently she is focussing on some existence results for a superlinear Fractional Laplace problem.

APPLICABLE MATHEMATICS

Dr. Arun K R

In a joint work of K. R. Arun and S. Samantaray, the design and analysis of a class of second order accurate IMEX finite volume schemes for the compressible Euler equations in the zero Mach number limit is completed. In order to account for the fast and slow waves, the nonlinear fluxes in the Euler equations are split into stiff and nonstiff components, respectively. The time discretisation is performed by an IMEX Runge–Kutta method, therein the stiff terms are treated implicitly and the non-stiff terms explicitly. In the space discretisation, a Rusanov-type central flux is used for the non-stiff part, and simple central differencing for the stiff part. Both the time semi- discrete and space-time fully-discrete schemes are shown to be asymptotic preserving. The numerical experiments confirm that the schemes achieve uniform second order convergence with respect to the Mach number. A notion of accuracy at low Mach numbers, termed as the asymptotic accuracy, is introduced in terms of the invariance of a well-prepared space of constant densities and divergence-free velocities. The asymptotic accuracy is concerned with the closeness of the compressible solution with that of its incompressible counterpart in a low Mach number regime. It is shown theoretically as well as numerically that the proposed schemes are asymptotically accurate.

In collaboration with A. J. Dasgupta and S. Samantaray, K. R. Arun has presented the analysis of an asymptotic preserving (AP) IMEX-RK finite volume scheme for the wave equation system in the zero Mach number limit. An IMEX-RK methodology is employed to obtain a time semi-discrete scheme, and a space-time fully-discrete scheme is derived by using standard finite volume techniques. The existence of a unique numerical solution, its uniform stability with respect to the Mach number, and the accuracy at low Mach numbers are established for both time semi-discrete and space-time fully-discrete schemes. The AP property of the scheme is proved for a general class of IMEX schemes which need not be globally stiffly accurate. Extensive numerical case studies confirm uniform second order convergence of the scheme with respect to the Mach number and all the above-mentioned properties.

Along with S. Samantaray, K. R. Arun has developed a class of high order accurate IMEX finite volume schemes for the compressible Euler-Poisson (EP) equations in the quasineutral limit. The EP system is a hydrodynamic model of plasma fluids and the quasineutral limit gives rise to a singular limit. In order to develop high order time discrete schemes, a semi-implicit framework is adopted. The space discretisation is realised in a finite volume setting. Both the time semi-discrete and space-time fully-discrete schemes are shown to be asymptotic preserving. The numerical experiments confirm that the schemes achieve uniform high order convergence with respect to the Debye length and asymptotic preserving property.

Dr. Sudarshan Kumar

Dr. Sudarshan Kumar has initiated works on problems related to hyperbolic conservation laws which involve both scalar and system of equations. A fifth-year BS-MS project student is also involved in the work along with Dr. Sudarshan's collaborators. In one of the problems the authors study the uncertainty quantification of polymer flooding problem arising in the oil reservoir simulations. The governing equations are conservation laws with discontinuous flux together with several random variables which determine the uncertainty of the system. In another work authors proposed a novel high-order discretisation of system of hyperbolic conservation laws, specifically Euler equations of compressible flows. Also, a work on fast solving algorithms for Tensors is initiated. The main idea here is to adopt a second-order convergent Nestrov's algorithm in the framework of singular value problem for Tensor

Prof. M. P. Rajan

My research group focuses on numerical Functional Analysis of PDEs, mathematical finance, mathematical biology, and machine learning and data science. My current Ph.D students are working on on solving inverse and ill-posed problems. The idea is to get stable approximate solution for problems that are ill-posed in nature. Also, our group deeply involved in data science research that is an interdisciplinary field that make use of mathematics, statistics and computer science applicable to various domain such as Banking, Financial Services and Insurance(BFSI), Health Care, Genetics and many scientific areas. Data plays a big role in the modern digital world. Machine Learning and Artificial Intelligence are modern techniques used to discover hidden truth behind the data. The research focus upon developing new algorithms in this direction.

Dr. Nagaiah Chamakuri

My current research group (Scientific Computing) focuses on numerical analysis and scientific computing, optimal control of partial differential equations, and computational cardiology. Recently, we proposed a novel memory-efficient coupled solver for the solution of the system of reaction-diffusion equations that arises in cardiac electrophysiology. The proposed method outperformed well qualitatively compared

with existing operator splitting approaches. Our group explores robust numerical methods for the analysis of drug effects on the electrical activity of human-induced pluripotent stem cell-derived cardiomyocytes (hiPSC-CMs) based on multi-electrode array (MEA) experiments. One of the main focuses of our group is to develop an optimal control framework for cardiac defibrillation. We are also developing an efficient simulation toolbox for the spatially detailed Ca2+ dynamics and the cardiomyocyte membrane potential interaction in cardiac electrophysiology.

Dr. Dond Asha Kisan

Dr. Dond Asha Kisan has been working on a posteriori error estimates for a distributed optimal control problem governed by the von Kármán equations. It contains a numerical approximation of the problem using the Morley nonconforming finite element method to discretize the state and adjoint variables. The control is discretized using piecewise constants. A reliable and efficient a posteriori error estimator is derived for the state, adjoint, and control variables. This is an ongoing collaborative work with Prof. Neela Nataraj, Dr. Devika Shylaja, and Dr. Sudipto Chowdhury.
In addition, she is also studying stabilized finite element methods for Keller-Segel Models with collaborators.

GEOMETRY AND TOPOLOGY

Dr. Saikat Chatterjee

My current research focuses are on (1) (Lie/topological) groupoid extensions and (differentiable/topological) stacks, and (2) gauge theory of categorical principal bundles over Lie groupoids. Under the first project, the paper “On two notions of a gerbe over a stack” (co-author P Koushik) has been published in Bulletin Des. Sci. Mathematiques 2020. The two other works, respectively titled “Chern-Weil theory for principal bundles over Lie groupoids” and “Atiyah sequences and connections on principal bundles over differentiable stacks”, in collaboration with P Koushik, I Biswas, F Neumann, have been completed. Work on another paper, titled “Topological groupoid extension and Serre, Hurewicz morphisms” in collaboration with P Koushik is also complete.
Under the second project, with Adittya Chowdhury, we are studying gauge theory of categorical principal bundles over Lie groupoids.

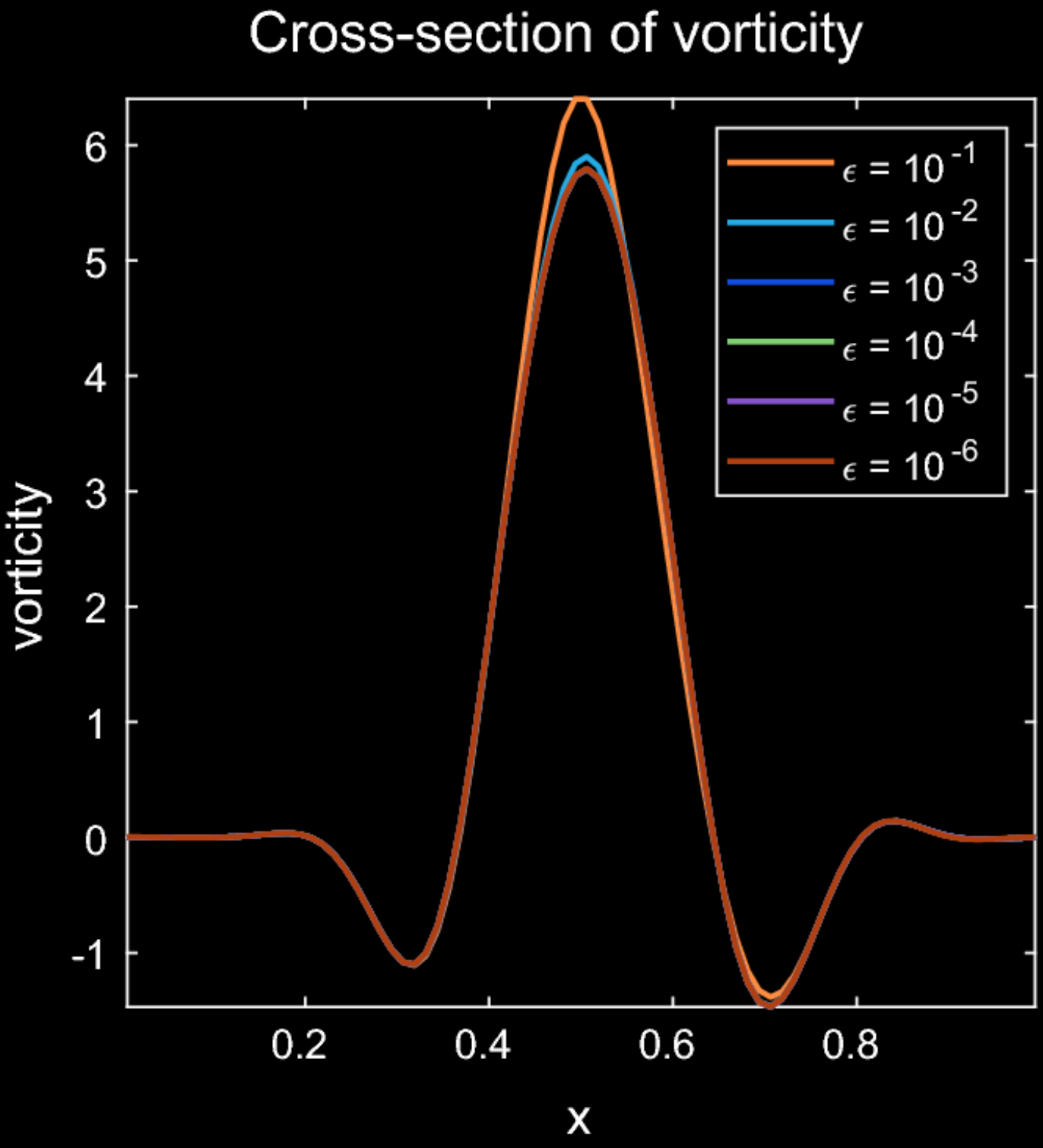
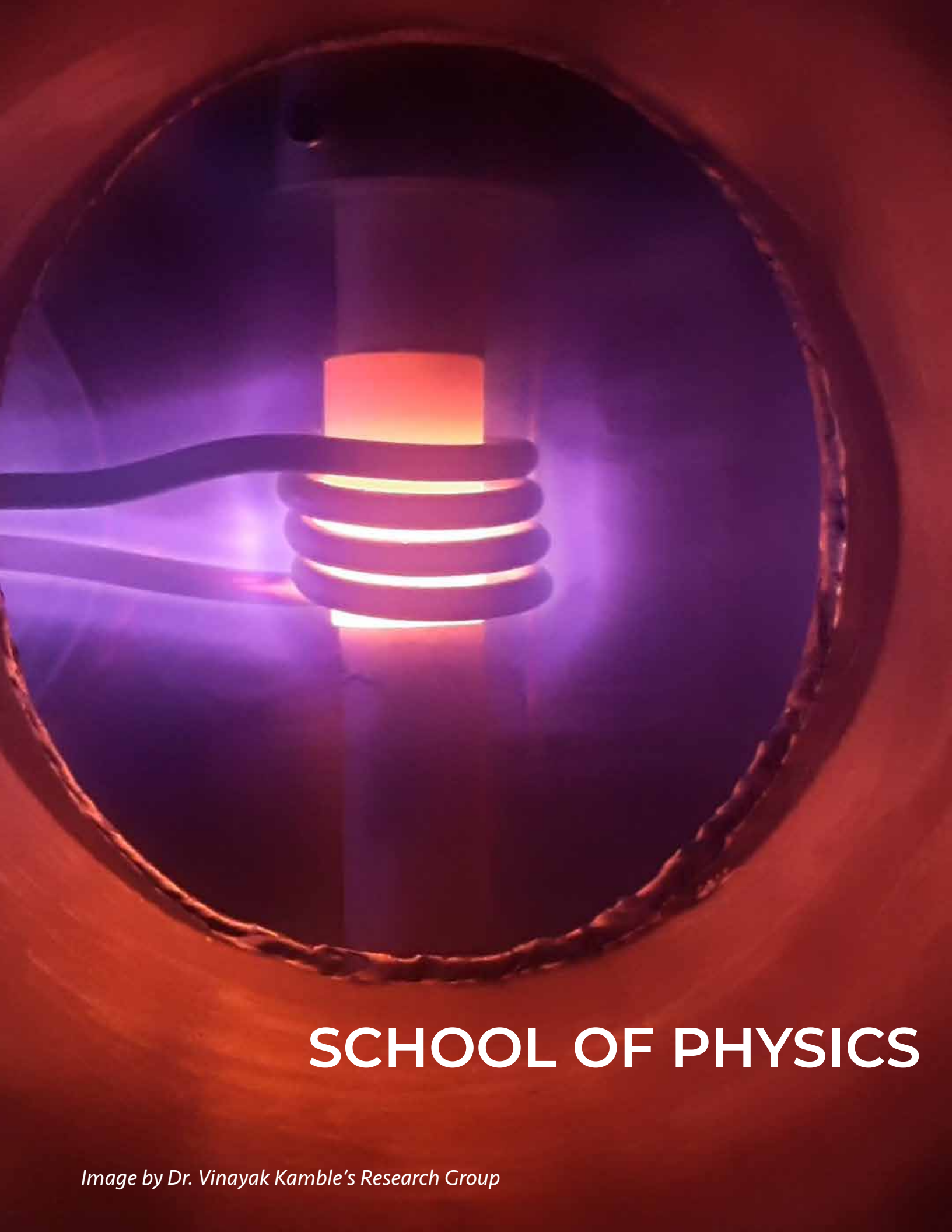


Image by Dr. Arun K R's Research Group



SCHOOL OF PHYSICS

Image by Dr. Vinayak Kamble's Research Group

CONDENSED MATTER: SUPERCONDUCTIVITY, MAGNETISM, TRANSPORT, FUNCTION MATERIALS & MATERIALS MODELLING

Dr. Amal Medhi

How does the Hund's exchange coupling, affect the electronic phase of a multi-orbital material where electron-electron correlations are strong? Can Hund's coupling lead to itinerant ferromagnetism? Dr. Amal Medhi's group addressed these questions using a multi-band Hubbard model, which they solved using a modified slave-particle mean field theory adapted to obtain symmetry broken phases. They found Hund's coupling to have contrasting effects on the electronic phase depending upon in what regime of phase diagram the system lies. Whereas it pushes a weakly correlated material into a bad metal phase, it promotes metallicity when the electron correlations are strong, also reducing the critical interaction strength for a paramagnetic to ferromagnetic transition. In the machine learning approach to quantum many body systems, Dr. Amal Medhi's group studied the ground state of the fermionic Hubbard model in one dimension using a wave function represented in terms of a feed forward neural network (FFNN). A simple FFNN on its own fails to approximate the wave function of a fermionic system due to its antisymmetric nature. However, progress can be made by using an auxiliary neural network to represent the sign of the wave function and this was demonstrated in their work where they showed that the properties predicted by such a neural network wave function are in good agreements with known results.

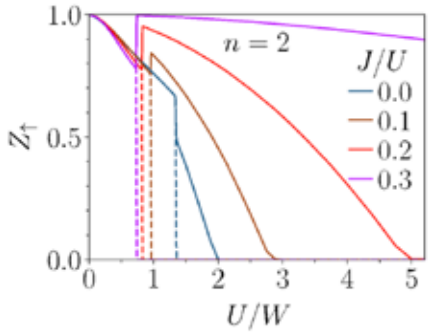


Figure: In a 3-band Hubbard model with n=2 electrons per atom, Hund's coupling J reduces quasi-particle weight Z at smaller Hubbard interaction strength U while increasing it at higher U. Ferromagnetic ordering appear at small U for higher J

On another topic on thermoelectric transport properties of materials, Dr. Amal Medhi's group examined how doping which is used to control carrier densities in thermoelectric (TE) materials affects its lattice thermal conductivity. Does doping always reduce lattice thermal conductivity via enhanced phonon scattering and thus leads to a high thermoelectric efficiency? By using first-principles calculations on one promising thermoelectric materials SnTe, they showed that the answer depends upon how the doping affects two crucial phonon properties – allowed

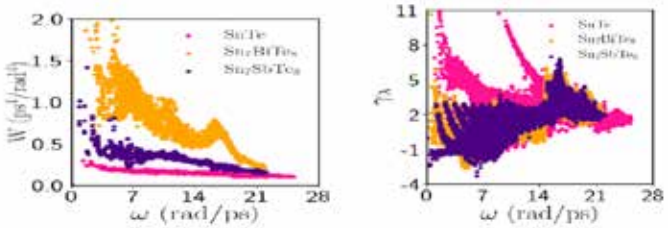


Figure: Effects of Bi and Sb doping on the three-phonon processes (left) and anharmonicity (right) of SnTe, a promising TE material.

phase space volume for three-phonon processes and the anharmonicity of the material. While doping increases the former enhancing the phonon scatterings, it can lower the overall thermal conductivity giving rise to a higher thermoelectric efficiency only if doping does not reduce the anharmonicity substantially.

Dr Vinayak Kamble

Dr Vinayak Kamble's research group seeks to develop novel functional materials for smart device applications exploiting chemoresistive, thermoelectric and photothermal responses of solids. The name, SMaRT lab stands for Sensors, Microsystems and Renewable Technologies. Various nanoarchitectures, and hybrid nanomaterials including various composites, thin films, 2D layers etc, are of active interest.

Multi-component (Ag-Au-Cu-Pd-Pt) Alloy Nanoparticles on atomically thin sheets of Molybdenum Disulphide (MoS2) increase its work function making an otherwise ohmic contact into Schottky (non-ohmic) one with gold electrodes. This drastically enhances response towards hydrogen gas showing potential deployment as hydrogen sensor for various technological applications. We use UV as well as X-ray photoelectron spectroscopy to reveal the changes in electron band structure and results backed with density functional theory for calculation of ease of hydrogen adsorption through relevant energies involved. The work was done in collaboration with Dr CS Tiwary, IITKgp, Dr K Biswas IITK and Dr Abhishek Singh from IISc. (Nanoscale 2020) In another work, we showed a giant enhancement in the sensor performance in diffusion limited hydrogen response of protonic Titanate Nanotubes (H2Ti3O7, TNT) by addition of Reduced Graphene Oxide (RGO). The dynamic range as well as response times of the trititanate nanotubes are improved due to Type-I heterostructure formation at the interface of TNT and RGO as seen from x-ray photoelectron spectroscopy. (ACS Appl Nanomaterials 2020)

When light rays are incident on a surface, we get two components of reflection, one is specular and the other is diffuse. The former obeys the law of reflection what we have studied in school; while the latter varies with solid angle (it is angle dependent). However, if the wavelength of light is sufficiently longer compared to the surface roughness, one can completely ignore the latter and say that the reflection is purely specular.

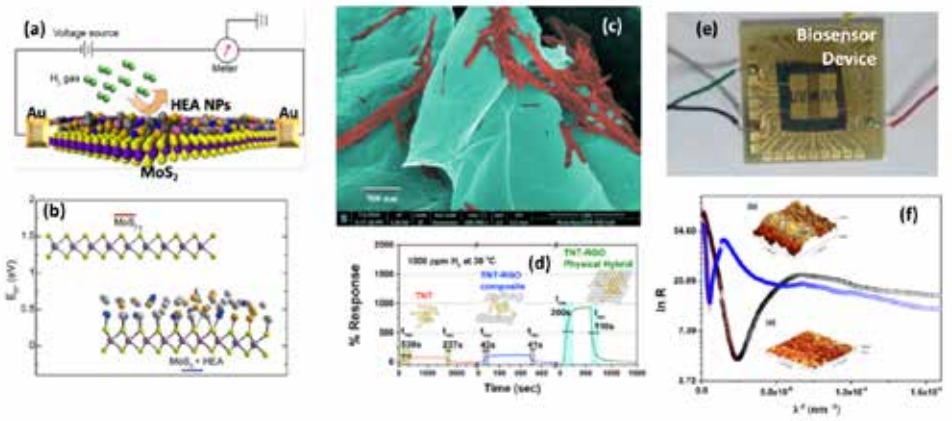


Figure: (a) The schematic of the MoS2/High Entropy (Ag-Au-Cu-Pd-Pt) Alloy Nanobybrids with Au electrodes for hydrogen sensor device application. (b) The Density functional theory calculated adsorption energies of hydrogen on bare and HEA functionalized MoS2 flakes. (c) SEM image of hydrogen Trititanate NanoTubes (TNT) on Reduced Graphene Oxide(RGO) sheets and (d) the response to hydrogen gas from bare TNTs, an in-situ composite with RGO and a physical hybrid showing giant enhancement in sensor response. (e) A Biosensor device fabricated with collaborators for demonstration of novel Olive pheromone sensing for early detection of fruit pests. (f) wavelength dependence of Reflectance in different surface roughness of copper cobalt oxide films deposited by spray coating, studied for their photothermal energy conversion.

We use this principle to analyze the effect of surface roughness on the photothermal conversion efficiency of solar (thermal) absorber coatings.

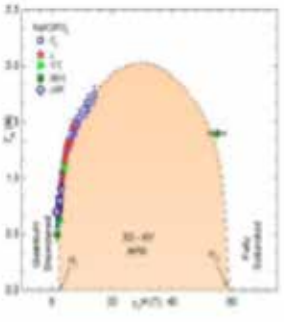
These coatings are supposed to have a spectral selectivity for efficient conversion of solar energy into heat. Which means they need to absorb all the visible wavelengths, which results into heat through lattice excitation and have minimum thermal emissivity to retain this heat for end use. (J. Appl. Phys. 2020)

Thus, we have so far successfully developed various chemical, biochemical and optical sensor devices, explored novel oxide materials for sustainable power generations such as thermoelectric and solar-thermal applications etc. The functional response optimization through atomistic, structural and electronic transport engineering is the forte of the group as demonstrated from our publication records. These are of tremendous technological utilities including Internet of Things (IoTs), defense, space, domestic as well as industrial applications.

Dr Vinayak Kamble received to honor to present a talk at the Golden Year Alumni Network (GYAN) Lecture series as a part of the Golden jubilee celebrations of the Department of Physics of Mumbai University. He was the youngest alumni to receive this honor.

Prof. Ramesh C. Nath

Prof. Ramesh Nath's group focuses on discovery of new materials based on transition metal and rare-earth ions and investigate their structural, electronic, magnetic, thermal, and dynamical properties using various experimental tools under extreme conditions i.e. at ultra-high and low temperatures, under high magnetic field, and under high pressure. His research group aims at the fundamental understanding of the complex and emergent electronic and magnetic phenomena in strongly correlated electron systems and frustrated quantum magnets. In these materials, the charge, orbital, spin, and lattice degrees of freedom are often found to be intertwined with each other in such a way that it leads to a variety of macroscopic properties which are having both fundamental and applied importance such as high temperature superconductors, spin liquids etc. One of the main research focus of his group is to investigate the novel quantum phases stabilized by competing exchange interactions in different low-dimensional (i.e. spin chain, spin-ladder) and frustrated lattices (i.e. triangular, kagome, pyrochlore etc.) Various experimental methods (such as magnetization, heat capacity etc.) are used to investigate the physical properties of the materials. To probe the microscopic spin-dynamics of these quantum materials, they use NMR as a powerful local tool. They also apply various external non-thermal parameters such as high magnetic fields, chemical pressure (doping) etc. to manipulate the ground state, which can eventually drive the system towards quantum critical point and in some cases even leads to exotic quantum phase transitions. They are also working on several intermetallic compounds with high temperature magnetic transitions to understand the nature of the magnetic transition and the associated magnetocaloric properties.



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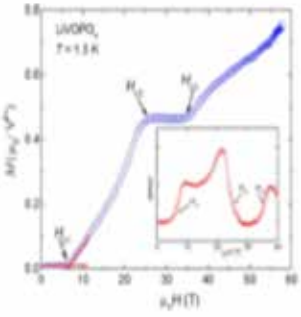

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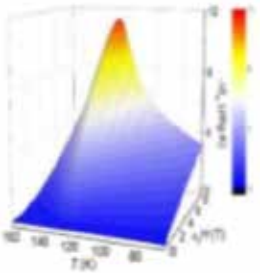

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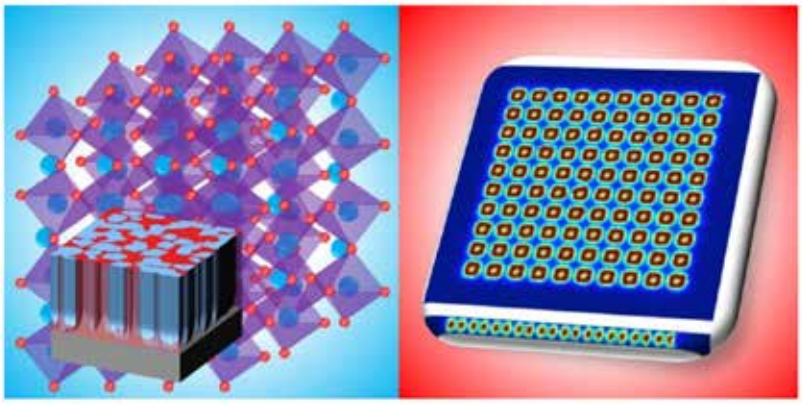
Currently, they are also working on several rare-earth based quantum magnets. Strong competition between spin-orbit, on-site Coulomb and crystalline electric field interactions, which are unique to these group of materials, can trigger various non-trivial quantum states such as Kitaev model, quantum spin-liquid state, mott-insulating state etc.

Dr. Tuhin Maity

The Functional Materials & Devices (FMD) group of Dr. Tuhin Maity engineers nanoscale functional materials (with at least one dimension below 100 nm) for use in energy-efficient electronic, magnetic, energy storage and energy harvesting devices. Their focus is on manipulating metallic alloy and strongly correlated oxide materials, and their spin-ion-charge interactions at nanoscale. The materials are prepared by various state of the art deposition facilities such as DC/RF sputtering, Pulsed Laser Deposition (PLD) and thermal evaporation. Recently, in a Nature Communications paper (2020), Dr. Tuhin Maity demonstrated room temperature ferroelectricity using 3D straining in nanocomposite films of SMO/BSO. PhD student of the group Manisha has been selected to receive $5,000 educational seed funding from the IEEE Magnetics Society. The funding is for a collaborative project with Louise Colfer/Dr. Lynette Keeney from Tyndall National Institute (Ireland). The project will focus on the optimization of a multiferroic system for the exploitation of the future energy storage applications. In the same field, Dr. Tuhin Maity has published an another 'IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency control' paper in the same year. The group is dedicated to stepping up the efforts in addressing the socio-economic technological challenges. It focuses on device (Emerging Memory Devices for Neuromorphic Computing, low-power sensors, etc.) fabrication using the new materials systems it invents. These challenges are by no means an easy feat, but through cooperation and community empowerment FMD group believes they can facilitate progress in this area.



Dr. Madhu Thalakulam

Electrical transport at quantizing dimensions is enriched by a number of exotic phenomena: quantum Hall effect, fractional quantum Hall effect, conductance quantization, flux-quantization, Aharanov-Bohm effect, single-electron tunneling, topologically protected states etc., are a few to mention. One important figure-of-merit of any scientific phenomena is its applicability in device technology. Device technology invariably involves measuring and manipulating electrical signals. Though today's devices mostly use classical electrical transport phenomena the technology has already reached the grey-area between the 3-dimensional and the 2-dimensional (2D) world. Any further progress requires one to harvest the benefits of exotic physics offered by quantum mechanical behavior rather than combating it. The outlook of the lab

is to study, tailor and utilize various quantum transport phenomena for addressing fundamental problems, pushing the limits and revolutionizing the device technology. The short-term focus of the group is geared towards implementation of quantum-dot spin-qubits on Si/SiGe heterostructures, quantum limited electrical amplifier and devices exploiting spin-valley states on transitional-metal dichalcogenide systems. As a part of the quantum electrical amplifier project, a hybrid electrical amplifier consisting of a semiconducting quantum point contact galvanically coupled to a superconducting λ/2 transmission-line resonator for ultra-fast and ultra-sensitive charge amplification.

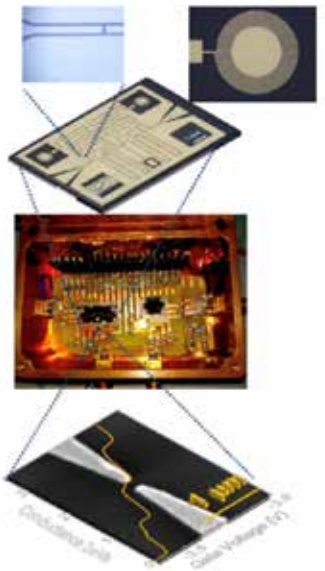


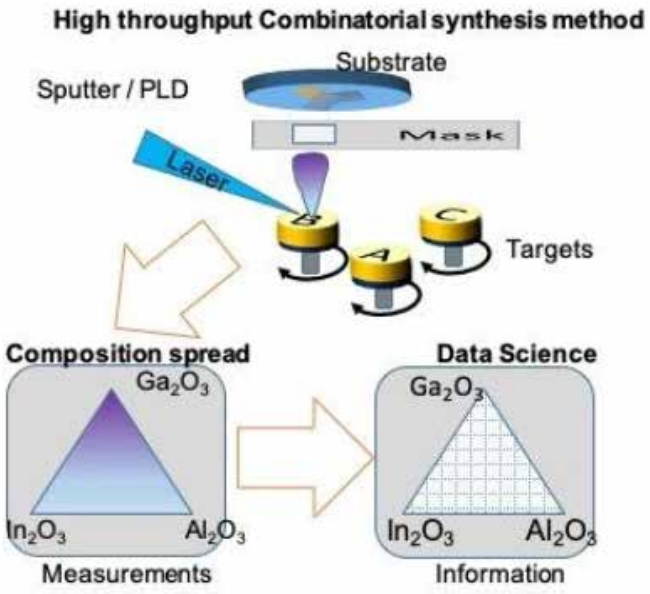
Figure: Superconducting resonator - Quantum point contact system

The resonator, made of Aluminium with a coplanar waveguide geometry, is designed to operate at its first harmonic resonant mode ~ 3.4 GHz, where the reflected power from the resonator is amplitude-modulated by the conductance changes in the quantum point contact channel. From the sidebands of the amplitude modulated reflected signal we extract a conductance sensitivity of 2.85×10-7 e2/h/Hz (11.05 pS□Hz). This sensitivity translates to a unit signal-to-noise measurement time ~ 1.62 ns for a variation of 0.01 (e2/h) in the conductance. The extremely high sensitivity, ultra-fast operation reaching the nanosecond time-scales, and the circuit QED architecture makes this scheme an attractive choice for single charge detection and counting experiments for spin-qubit readout and quantum electrical metrology.
Recently [Nanotechnology 31 275703(2020)], the role of uniaxial tensile-strain on the electrical transport properties of bi- and few-layered MoS2, a promising 2D semiconductor is explored. Raman shifts corresponding to the in-plane vibrational modes show a redshift with strain indicating a softening of the in-plane phonon modes. Photoluminescence measurements reveal a redshift in the direct and the indirect emission peaks signalling a reduction in the material bandgap. Transport measurements show a substantial enhancement in the electrical conductivity with a high piezoresistive gauge factor of ~321 superior

to that for Silicon for our bi-layered device. The simulations conducted over the experimental findings reveal a substantial reduction of the Schottky barrier height at the electrical contacts in addition to the resistance of MoS2. Our studies reveal that strain is an important and versatile ingredient to tune the electrical properties of 2D materials and also can be used to engineer high-efficiency electrical contacts for future device engineering.

Dr. Kumaragurubaran

Dr. Kumaragurubaran research focuses on the wide band gap materials and related devices and the applications currently targeted are high power, high frequency and high temperature operational devices and components. To this direction, a three-member team is constructed and Ga2O3 based device development is in progress which begins from the characterization of the basic substrate quality, defects, doping and surface electronic properties. In parallel, to modify the structural, electrical, optical and other physical properties, a ternary system of Ga2O3 - In2O3 - Al2O3 is being investigated by forming the ternary thinfilm employing novel 'Combinatorial Synthesis method', a fast materials screening technique illustrated in the figure. For this purpose, a collaboration is established with a team in National Institute for Materials Science (NIMS), Tsukuba, Japan through a bilateral program between Department of Science and Technology, India and Japan Society for Promotion of Science, Japan. A large number of structure-property data sets will be available for future materials modeling through information integration.



Dr. Deepshikha Jaiswal-Nagar

Dr. Deepshikha Jaiswal-Nagar's group has a wide-ranging research interest in Superconductivity, Strongly correlated electron systems, Nanocluster Physics, Solid State hydrogen storage and Hydrogen sensors. Some of the broad sub-areas of interest include vortex state of superconductors, quantum phase transitions, entanglement in low dimensional spin systems, charge transport at nanoscales etc. Her group is also working actively on the synthesis and characterization of green energy storage materials (nanocluster films, metal hydrides, intermetallic, and metal organic frame works) to meet up the DOE targets. Besides, high performance hydrogen gas sensors are also being developed in her lab. Recently, her group has published a high performance chemiresistive hydrogen sensor which has shown better sensitivity than the previously reported sensors.

Dr. Deepshikha has established her laboratory with home-built setups like nanocluster deposition system, Surface acoustic wave sensor, resistivity-based hydrogen sensor, capacitive dilatometry, detwinner-cum-annealing assembly etc. These projects are funded by the Department of Science and Technology and Indian Space Research Organization, Government of India.

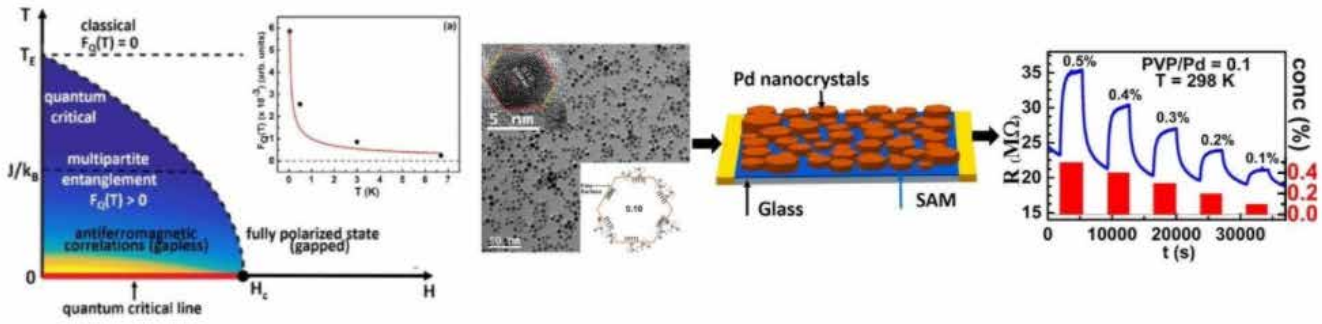


Figure: Multipartite entanglement driven quantum criticality and highest reported sensitivity chemiresistive hydrogen sensor.

ENERGY: PHOTO VOLTAICS, THERMOELECTRICS, STORAGE

Dr. Bikas C Das

Dr. Bikas C. Das's research group explored various significant research directions during 2019-20 based on device physics and related applications using different types of advanced materials, including semiconducting quantum dots (QDs), two-dimensional transition metal dichalcogenides (2D TMDs), and organic semiconductors. We reported ultralow voltage operated organic thin-film transistors OTFTs) using unconventional redox electrolyte gating. Here, the redox reaction among P3HT polymer and ethyl viologen diperchlorate (EV(ClO4)2) plays the role of forming the conducting polarons into the channel, which is entirely different from the conventional OTFTs. We also developed another variety of ultralow voltage operated OTFTs in collaboration with Dr. Leszek Majewski's group at the University of Manchester, UK, utilizing ultrathin anodized metal (Al2O3 and Ta2O5) gate dielectrics. Considering the importance of 2D layered materials for novel properties and numerous application capabilities, our group developed a method to tune the energetics of liquid-phase exfoliated few-layered MoS2 by forming 0D-2D nanohybrid with Rose Bengal organic molecules utilizing Coulomb interaction and vdW coupling among them. Suppression of the intrinsic n-type nature of 2D MoS2 flakes in nanohybrid has been probed by measuring I-Vs with a RHK UHV-STM system at room temperature.

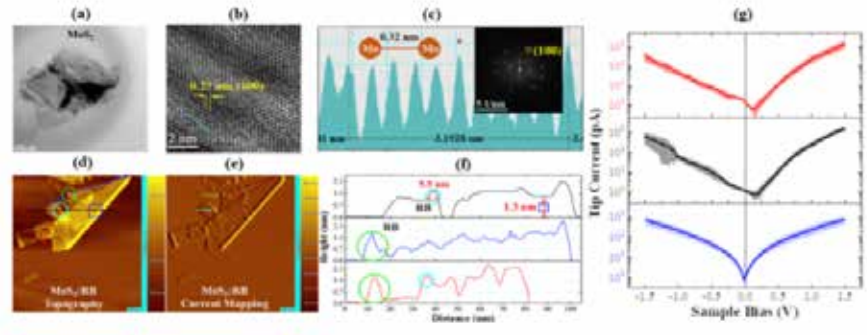


Figure: (a) TEM image of exfoliated MoS2 flakes under low magnification. It has scale bar of 100 nm. (b) The HR-TEM image of an exfoliated MoS2 flake. (c) Atomic height profile generated from the dashed line drawn on the HR-TEM image in (b) showing the Mo-Mo spacing of 3.2 Å. This is produced using free Digital Micrograph tool by Gatan, Inc. Inset, FFT pattern of the HR-TEM image shown in (b) containing the bright spots in reciprocal space for the different lattice planes. (d) & (e) STM topographic and current mapping image of a MoS2:RB nanohybrid flake lying on the smooth floor of HOPG substrate, respectively. Images are recorded with a scale bar of 20 nm. (f) Line profile obtained along the various lines (black, red, and blue line) drawn on the 2D hybrid MoS2:RB flakes as shown in (d). These are clearly indicating the attachment of RB molecular clusters along the edges of the flake appearing as like little bulges/humps. (g) Tunneling current vs sample bias (I-V) characteristics obtained through averaging of 40 data set measured at 10 different locations on MoS2 (red line, upper) flake, 2D nanohybrid of MoS2:RB (black line, middle), and RB (blue line, lower) film deposited over freshly cleaved HOPG substrates. (Dr. Bikas C. Das's Group)

The band edges are identified by measuring the local density-of-states (LDOS) as differential tunnel conductance (dI/dV), which strongly emphasizes the formation of type-II heterojunction between 2D MoS2 as acceptor and 0D RB as donor.

Our group introduced the fabrication of high-efficient P3HT/PC61BM based standard organic solar cells in the ambient laboratory environment and studied their performance stability in another research direction. Conducting AFM is utilized here to visualize defects in the active layer more prominently, which are impossible to see in typical AFM topography and significantly contribute to performance parameters degradation with aging time. Generation of hot carriers from nonradiative surface-plasmon decay and subsequent injection into the semiconducting nanomaterials is crucial in the field of optoelectronics and photocatalysis. However, the role of phonons in the plasmon-induced charge-transfer process is mostly unexplored. Our group utilized a technique called photoassisted scanning tunneling spectroscopy (PATS) to probe it by measuring the photoconductivity of CdSe QDs deposited over plasmonic substrates. In this study, phonons impersonate an essential role in a higher generation rate and ultrafast injection of hot carriers into CdSe QDs interfaced with gold substrate. Scanning tunneling spectroscopy results recorded under the light with band-edge-like peaks located inside the forbidden gap of CdSe QDs on gold substrate manifest the quantum tunneling of plasmonic hot carriers to the defect levels of CdSe QDs directly, which has contributed significantly to enhance the photoresponse property of CdSe QDs.

Dr. Manoj A. G. Namboothiry

Dr. Manoj A. G. Namboothiry's research work is primarily focussed on the fabrication and photophysical studies of organic and perovskite solar cells, organic light emitting diodes, organic field effect transistors, and photodetectors. His recent research work also includes the optoelectronic studies of 2D materials and its incorporation in organic and perovskite solar cells. During 2019-20, his group has worked on understanding the processes like charge carrier recombination and transport that affect the open circuit voltage and fill factor of organic solar cells, utilizing steady-state, impedance and transient spectroscopic techniques. They have also analyzed the effects of shape, material and location of incorporation of metal nanoparticles on the performance of plasmonic organic solar cells. The group has also experimented on improving the open circuit voltage and fill factor values of organic solar cells by introducing the concept of ternary solar cells. The group has succeeded in achieving an efficiency of~13.2% in organic solar cells utilizing non-fullerene acceptors. Much research has been done to understand the role of charged defects/ions that cause the anomalous behaviour like light soaking effect, J-V hysteresis and negative capacitance in perovskite solar cells under operational conditions. The interplay of electronic-ionic transport causing the internal field alternation of the device is investigated using impedance, transient photovoltage and photocurrent measurement techniques. The group has also achieved an efficiency of ~ 17% in perovskite solar cells. Collaborating with NI-

IST, Trivandrum, the group has fabricated unsymmetrical squaraine dye-based organic photodetector exhibiting enhanced near-infrared sensitivity. The photodetector exhibited a broad spectral response extending to 950 nm and specific detectivity of 6 × 1011 cm Hz1/2 W–1 (Jones) @ 840 nm with an ultrafast photoresponse in the range of □15 ns. In collaboration with NIT, Trichy, the group has tested the efficacy of transparent conducting Cu–Zn–S thin film as hole transport layer in organic solar cells. Efforts have been made to understand the photocurrent generation mechanisms and to improve the photoresponse behavior of 2D MoS2 nanosheets. A model based on recombination centers and shallow trap states is put forward to explain the photoconductive response of the 2D MoS2 based device. The group has also realized the fabrication of PDMS-based solution-processed OFETs using a liquid crystal (LC), 2-decyl-7-phenyl-benzothienobenzothiophene (Ph-BTBT-10), as a semiconducting channel material, exhibiting high electrical performance such as a high hole mobility of □22 cm2 V–1 s–1, a low threshold voltage (<1 V), and a high current on/off ratio of 105.

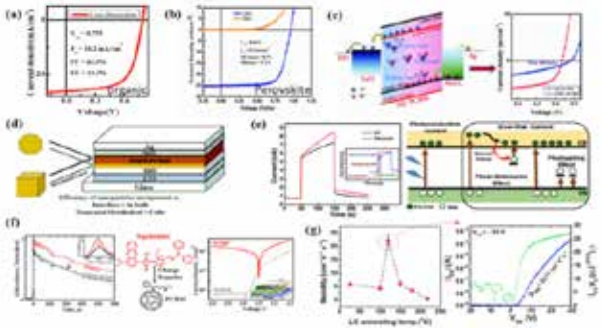


Figure: Depicting research works from Dr. Manoj's group. Photovoltaic performance of (a) organic and (b) perovskite solar cells. (c) Charge carrier dynamics that affect the open circuit voltage and fill factor of organic solar cells. (d) Study on the effect of nanoparticle shape, material and incorporation location on the performance of P3HT:PC71BM based organic solar cells. Photoresponse of (e) 2D MoS2 and (f) unsymmetrical squaraine based photodetectors. (g) Performance of PDMS and liquid crystal based OFETs.

Dr. M.M. Shaijumon

Dr. Shaijumon's research group focuses on the materials science and physics of various energy storage and conversion systems that will have great impact on our society. Some of the broad areas of interest include controllable synthesis of 2-dimensional layered nanostructures, electro-/photo-catalysis, energy storage devices such as supercapacitors, lithium and sodium ion batteries. During 2019-2020, the group worked on couple of projects on synthesis of 2D layered nanomaterials, and kinetics studies of Na ions in certain Ti-based oxides for hybrid ion capacitor applications. The research activities on 2D materials were primarily focused on exploring various strategies to engineer few-layered transition metal dichalcogenide nanostructures (TMDs) for their applications in electrocatalytic hydrogen generation. One of the studies shed light on the role of SDD line defects in spiral WS2 domains, which contribute to large number of edge sites without compromising the vertical electrical conduction, on their electrocatalytic properties for hydrogen evolution. The group showed that the large number of active

edge sites connected together by dislocation lines in vertical direction for a spiral WS2 domain result in unprecedented catalytic properties toward hydrogen evolution reaction (HER). The work was done in collaboration with Dr. Madhu Thalakulam's and Dr. Joy Mitra's research groups in School of Physics [P. V. Sarma et al., ACS Nano 13, 10448, 2019]. In another effort, the group demonstrated a simple and controllable route to synthesize ultrathin nanoparticles of tungsten oxysulfides (WOxSy) that exhibit highly enhanced electrocatalytic activity towards hydrogen evolution reaction (HER) with excellent stability. The sulfur-rich tungsten oxysulfides with engineered anionic species can offer multiple functionalities including abundant active sites and improved conductivity that synergistically contribute to superior electrocatalytic activity for HER (P. V. Sarma et al., ACS Catalysis, 10, 6753, 2020). Further, 0-D/2-D hybrids made up of phosphorene quantum dot (PQD)-interspersed few-layered MoS2 nanosheets were demonstrated to be efficient electrocatalysts with remarkable bifunctional electrocatalytic activity for oxygen and hydrogen evolution in an alkaline medium (Prasannachandran et al., Chem Commun., 56, 8623, 2020). Shaijumon's group has also been involved in exploring kinetics and diffusion characteristics of lithium ions in TiO2 and TiNb2O7 anodes (Babu and Shaijumon, Electrochimica Acta 345, 136208, 2020).

Figure: Schematic representation of a spiral WS2 domain with large number of active edge sites for electrocatalytic hydrogen evolution.

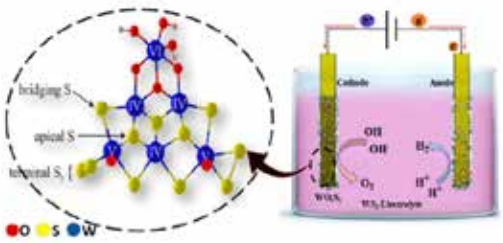


Figure: Schematic representation of the electrophoretic deposition process for obtaining tungsten oxysulfide nanostructures.

Dr. Shaijumon has been invited to join the editorial board of the journal InfoMat (Wiley publications).

LIGHT-MATTER SOUND-MATTER INTERACTIONS: NON-LINEAR OPTICS, ULTRAFAST PROCESS, PLASMONICS & BIOMEDICAL ENGINEERING

Dr. Joy Mitra

Dr Joy Mitra's Scanning Probe Microscopy and Plasmonics group primarily studies fundamental physical phenomena realised at surfaces and interfaces, and researches avenues for harnessing them for novel applications. In recent investigations they have shown that photonic and plasmonic properties of meta-materials may be realised in ubiquitous homogeneous media like metal-oxide semiconductors (indium tin oxide, zinc oxide), even in ultra-thinfilm dimensions. Further, their coupled optical and electrical properties may be continuously tuned either by chemical doping or by electrostatic gating, with potential applications in optical modulation and controllable reflective coatings.

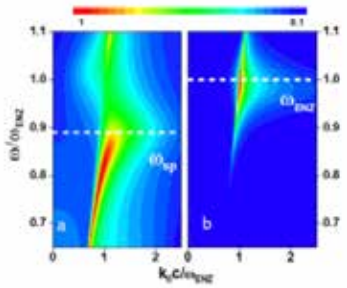


Figure: Colour map showing frequency and wave vector (parallel component) dependence of absorbance of ITO films, in the Kretschmann configuration, for thickness (a) 120nm and (b) 20 nm. ΩSP and ΩENZ are the surface plason and epsilon near zero frequencies respectively. J.APPL. PHYS. 127, 043102 (2020)

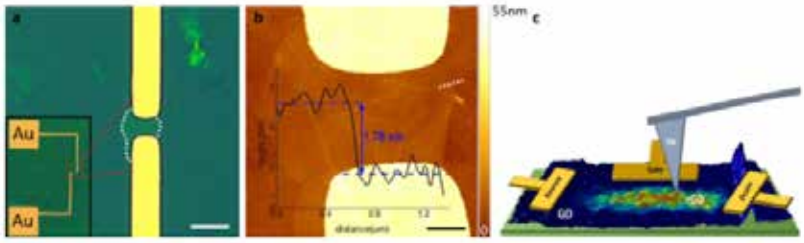


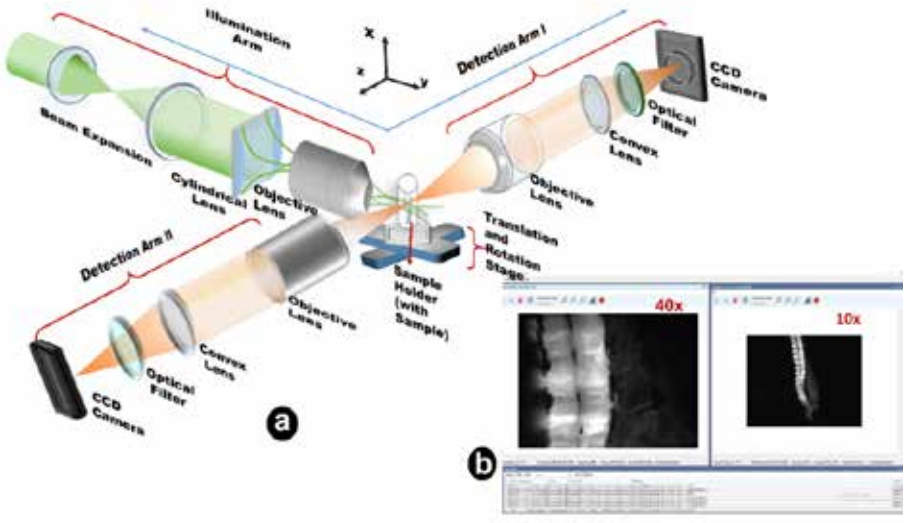
Figure: Scheme of GO device fabrication and reduction. (a) Optical image of a source-drain terminal on a GO flake (dotted line) scale bar 10 μm. Inset shows low magnification image of Au-pads. (b) AFM topography of the same device overlaid with line scan showing height along the dashed line across the edge of monolayer flake. Scale bar: 2 μm. (c) Schematic of AFM tip-based reduction technique and proposed device architecture. Colour contrast shows a real change in local conductance induced by the tip-based reduction.

Realisation of all carbon electronics has been touted to offer various advantages but has remained rather difficult to fabricate. Dr Mitra's group has demonstrated that the readily available graphene oxide (GO) may be selectively and controllably converted to graphene by nanoscale reduction using the conducting tip of an atomic force microscope.

Backed by a UKIERI project the results open a new approach to realising all carbon electronic devices.
In another manifestation of investigating metaloxides, the group were able to tune the luminescence properties of nanostructured ZnO embedded with plasmonic gold nanoparticles to explore the complex plasmon – exciton landscape in these novel hybrid systems.

Dr. Mayanglambam Suheshkumar Singh

Study and understanding of biological phenomena has been being significantly advanced – from observatory (with naked eye) to recorded image-based study, i.e., in terms of length scale, from tissue and organism (of macroscopic length scale) to molecular and cellular biology (at micro and Angstrom scales) – since the advent of imaging technology in the past half a century. This advance in understanding of the subject demands the imaging technology, for visualization of the biological specimen of interest, at various levels of spatial resolution and magnification, i.e., molecular and organelle (at Angstrom scale), cellular (at sub-microscopic level), tissue (at microscopic level), organs and organism (at mm to cms). In other words, imaging technology at various spatial scales or resolution is mandated for understanding biological complexity of living organisms, diseases and progression. Similar is true for the case of clinical diagnosis and therapeutic treatments of various and diversified diseases. In the present world, imaging technology becomes as an indispensable clinical tool/aid for diagnosis, staging, and therapeutic treatments (coupled with continuous monitoring).



Our research group – at Biomedical Instrumentation and Imaging Laboratory (BIIL), School of Physics (SoP), IISER-TVM – focuses on study of interaction of light and/or sound with soft matter (more particularly, biological samples and soft tissues) and its exploitation for development of novel imaging modalities suitable for imaging of sample at wider range of size from biological specimens (of the order of um-mm) to clinical tissue sample (~cms). In other words, the research group focuses on design and development (instrumentation) of non-destructive

(multi-dimensional) imaging system – based on optical and/or acoustic signals – for diverse applications including Biology, Chemistry, and clinical diagnosis and therapeutic treatments. The research areas can be broadly grouped into:

(1) speckle contrast imaging that is primarily focused on addressing the challenges in developing an intraoperative scanning device which can serve as a visual aid to surgeons for real-time assessment (at operation bedside) and detection of blood vessels that remains challenge to physicians for injection of drugs at the time of illness or skin burn.

(2) selective plane illumination microscopy (SPIM) imaging (also know as light sheet microscopy) that mainly aims to address the long-standing challenges of non-destructive and minimally invasive multi-dimensional (three or more) imaging of living and larger biological specimens for advance understanding of biological phenomena.

(3) photoacoustic imaging (both microscopy and tomography) that aims to achieve microscopic resolution at imaging depth of the order of ~cms – beyond optical diffraction limit (~1-2mm). It is to note that – to the best of our knowledge – our research group was the first in India to report development of photoacaustic imaging system (from experimental aspects) while it is the second (2nd) research laboratory – next to Indian Institute of Science (IISc), Bangalore – in India that develops SPIM imaging system.

Dr. Rajeev N Kini

Ultrafast Spectroscopy Group led by Dr Rajeev N. Kini focusses on fundamental studies of novel materials using femtosecond and terahertz optical techniques. Recent activities of the group centred on semiconductor nanocavities, two-dimensional layered materials and strongly correlated materials.

The interaction of a two-level electron system (TLES) and phonons in an acoustic cavity could lead to a new quantum entity called ‘Phoniton’. In a recent work they proposed a ‘Phoniton’ structure using an acoustic phonon cavity with a tunable TLES. The TLES is based on a moderately doped, GaAs-AlAs double quantum well (QW). Energy levels of this TLES can be externally tuned by changing the electrical bias across the QWs. The TLS is enclosed in a high-quality factor (Q) phonon cavity formed using GaAs-AlAs distributed Bragg mirrors. In the strong coupling regime, when the stark splitting between the ground states of the QWs exactly matches the cavity phonon energy, the electrons should continuously shuttle between the ground state of the two QWs with the absorption and emission of longitudinal acoustic phonons, leading to the observation of Rabi splitting of the cavity phonon mode. Experimental realization of a Phoniton system could open a path to study nanoscale mechanical systems. They could act as mechanical sensors because it is formed by combining mechanical and electronic properties of matter. It could possibly find applications in quantum

computing to store and process the data. From a fundamental research perspective, this could open up a new field of research namely, sound-based cavity Quantum electrodynamics.

Antiferromagnetic spin-1/2, two-leg ladders show intriguing magnetic and superconducting properties. In a more recent work the Dr Kini's group provided spectroscopic evidence for the charge density wave (CDW) phason mode at ≈ 0.93 THz in the two-leg, spin-1/2 ladders of Sr14Cu24O41 (SCO) using terahertz time-domain spectroscopy. The two distinct degrees of freedom associated with the CDW (amplitude and phase fluctuations) give rise to two modes, the amplitudon and phason mode, respectively. The amplitudon is Raman active, and its dispersion is like that of an optical phonon. The dispersion relation for the phason is acoustic-like. Upon illumination with electromagnetic radiation, the CDW phason mode becomes visible in the complex optical spectrum. Since the CDW phason mode appears in the millimeter frequency range, the CDW phason mode can be studied using THz spectroscopy. They showed that annealing SCO in an oxygen atmosphere or doping with a low concentration of Co (1%) does not affect the CDW phason mode. However, Co doping at higher concentrations (10%), wherein the Co enters the ladder layers, destabilizes the CDW and the CDW phason mode disappears.

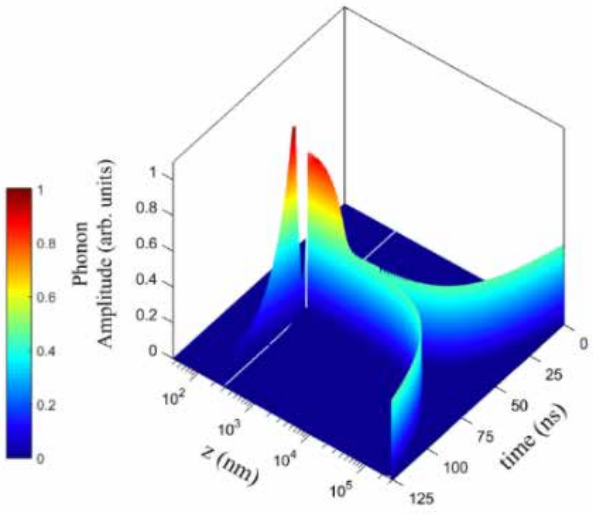


Figure: Time dependence of the acoustic displacement across the phoniton device.

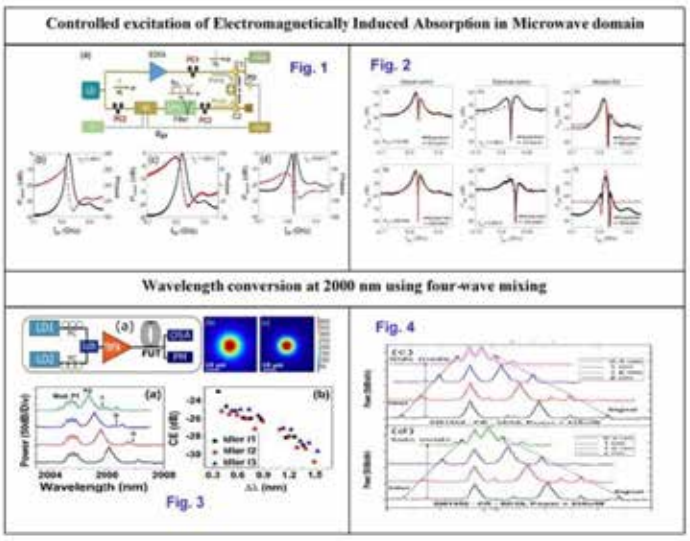
Apart from this Dr Kini's group has also been working on exploring the use of Terahertz spectroscopy for non-destructive evaluation (NDE) of thermal barrier coatings (TBCs). This work was supported by GE India. TBC, which consists of a ceramic layer, is applied to gas turbine blades to protect them from high-temperature combustion gases and increase their lifetime. NDE of such TBC layers helps lower the maintenance cost and is part of the condition-based maintenance strategy.

Dr. Ravi Pant

The group conducts experimental research in the broad area of nonlinear optics with specific focus on microwave photonics, frequency combs, slow-light, and high coherence lasers. Over the last year the group demonstrated controlled excitation of electromagnetically induced absorption in the microwave domain and all-optical wavelength conversion at 2000 nm. Electronics based microwave signal processing suffers from problems such as electromagnetic interference (EMI), lack of wide frequency tunability, large weight and high-loss. Photonic processing of microwave signals alleviates these issues. For some of the applications e. g. microwave photonic switch, it is important to have dynamically controllable microwave photonic signal processing.

In this work, we demonstrate an analogue of electromagnetically induced absorption (EIA), which was first demonstrated in quantum systems, in the microwave domain. We developed a model to analyze our results and explain the concept of EIA and its various features. Dynamic control over the EIA feature frequency and depth was demonstrated using electrical and optical means, which paves the way for high-resolution microwave photonic switch and notch filter. The sharp dispersion that accompanies EIA enables large tunable group delay.

(See Figure 1 and 2: https://doi.org/10.1038/s42005-020-0367-6)



With increase in data demand, optical communications using the 1550 nm wavelength window is fast reaching its bandwidth limit. While attempts are being made to increase the spectral efficiency for 1550 nm fiber optics communication systems, new wavelength windows are also explored for future communication systems. Availability of wide bandwidth (~ 400 nm) thulium-doped fiber amplifiers and hollow core fiber transmission systems have made the wavelength region around 2000 nm as a potential wavelength window for fiber optic communications. We demonstrate efficient single and multi-channel wavelength conversion at the 2000 nm window, which will enable all-optical signal processing needed to realize fiber optic communications at 2000 nm.

(See Figure 3 and 4: https://doi.org/10.1109/LPT.2020.2983452)

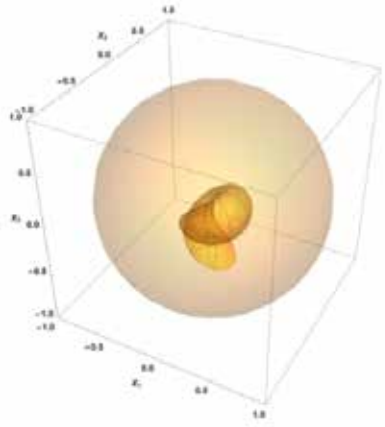
QUANTUM TECHNOLOGIES: QUANTUM DEVICES, QUANTUM INFORMATION & QUANTUM MATERIALS

Prof. Anil Shaji

The research activities of the quantum information theory group lead by Prof. Anil Shaji were focused on topics like non-classical correlations in quantum systems, dynamics of open quantum systems with emphasis on non-Markovian open dynamics, experimental simulation of open quantum dynamics using photonic systems, quantum steering, quantum limited measurements etc. Quantum information can lie delocalized across well-defined physical systems unlike classical information which remains always tied to its physical representations like transistors on a chip, markings on a piece of paper etc. Exploring how this property can allow transformation and processing of quantum information in ways that are exponentially faster than what can be done with classical algorithms was a main focus of research of the group during the year. A comprehensive mathematical description of non-Markovian evolution of open quantum systems is still not known because of the challenging nature of the problem. The main thrust of the research on open quantum dynamics done by the group was on exploring the ways in which non-Markovian master equations can be decomposed into convex combinations of Markovian evolutions or in some cases even as a combination of unitary evolutions. It was found that such combination of Markovian master equations that, in turn, arise from collision models can describe several types of non-Markovian behaviors. It was also found that such master equations often describe evolution in which the generator becomes singular and undefined at finitely many points in time. Construction of an alternate form of the master equation that removes this singular behavior was another direction of research that was pursued. A third project that was successfully completed in the topic of open quantum dynamics had to do with working out the details of a possible simulation of such dynamics experimentally using a two photon system. The polarization degrees of freedom of the photons serves as the open system that is being studied while the frequency degree of freedom of the same photons serves as the 'environment' which can be manipulated in order to simulate various types f open dynamics. Even the type of open dynamics wherein the generator of evolution is singular at certain times can be reproduced using this system. Further work is progressing to facilitate the realization of the proposed experiment through a collaborator.

Quantum steering refers to the rather counter-intuitive phenomena by which measurement of one sub-system of a composite quantum system can influence the state of the other sub-system even if the two are non-interacting and far removed at the time of the measurement. Exploring quantum steering in the case where the measured system is a mode of light while the one that gets steered is a quantum bit was one

of the projects taken up. The set of states that the qubit can be steered into by doing practically realizable measurements on the mode of light were visualized in terms of quantum steering ellipsoids and these were explored for a wide variety of initial states of the qubit-light mode system. A representative image of the quantum steering ellipsoid obtained in this manner is given below.



Other projects in the broad field of quantum information theory that were taken up included exploring the limits of measurement precision achievable using a Michaelson type interferometer that is immersed in a nonlinear medium. In particular the system was analyzed in the presence of realistic photon loss noise and an optimal input state of light that minimizes the detrimental effects of the noise was found.
In addition to the research centered around quantum information theory, the group also involved in work on interesting chemical and biological systems that are amenable to quantitative mathematical analysis. Modeling the type of noise that limits the duration of time for which quantum coherences in large molecules may be detected using ultrafast spectroscopy was one of these projects. Another one was on numerical modelling of the mechanisms through which a plant leaf repairs the vascular structure that transports materials once it is damaged.

Dr. Manik Banik

Dr. Manik Banik's research interest is focused on devising new information protocols and understanding the quantum foundations using the language of quantum information theory. During 2020, in one of his collaborative work, he has proposed a framework to compare the strength of nonlocality without entanglement in different theories and show that such behaviour in quantum theory is limited. This suggests towards a specific topological feature of quantum theory, namely, the continuity of state space structure [Phys. Rev. Research 2, 012068(R) (2020) {Rapid Communication}]. In a different work, a communication task is proposed where quantum theory exhibits advantage over a class of generalized probability theories allowing stronger than quan tum spatial or/and temporal correlations. This result hints towards the possibility of singling out quantum mechanics from the space of non-classical theories [Annalen der Physik 532, 2000334 (2020) {Rapid Research Letter}]. In a separate work he introduced finer characterization

of multipartite nonlocal correlations [Phys. Rev. A 102, 052218 (2020) {Editors' Suggestion}].

Apart from these he has ongoing collaborations with several groups in India as well as abroad focusing on harnessing indefinite causal order of quantum processes to devise enhanced quantum communication links between different spatially separated regions. This study has important implications in distributed protocols, such as multipartite quantum state transfer, quantum network, and entanglement distribution which have enormous practical relevance in the emerging new technology of quantum internet.

NON-EQUILIBRIUM SYSTEMS: QUANTUM FIELD THEORY, COMPLEX SYSTEMS, NON-LINEAR DYNAMICS & FLUID DYNAMICS

Dr. D.V. Senthilkumar

Dr. Senthilkumar's group is largely focussed on emerging dynamics from coupled oscillator networks with various topologies and their relevance to real world phenomena. In particular, recent focus is on chimera states, a hybrid state with coexisting coherent and incoherent domains emerging from an ensemble of identical nonlinear oscillators by adopting various network topologies and models. Recently, this group is also working on enhancing the robustness of coupled oscillator networks despite the presence of a large fraction of local deterioration/ failures in node dynamics by framing alternate mechanisms. For instance, the group introduced a simple limiting factor in the diffusive coupling, processing delay and adaptive coupling in terms of low-pass filters to improve the robustness of the macroscopic dynamics of the coupled oscillator networks. Nonlinear dynamics group is also working on the prey-predator interactions to understand the persistence and extinction of the ecological communities under global environmental change and to come up with strategies to improve the persistence of the ecological communities.

Dr. Sreedhar Dutta

The main emphasis of Sreedhar Dutta's research group is on topics in Nonequilibrium Physics and Effective Field Theories. One of the major activities currently pursued by the group is towards establishing appropriate framework to describe periodically driven macroscopic systems and to investigate thermodynamics of such systems. Motivated to understand the asymptotic behavior of periodically driven thermodynamic systems, the group has studied the prototypical example of Brownian particle, overdamped and underdamped, in harmonic potentials subjected to periodic driving. They have obtained the asymptotic distributions almost exactly treating driving nonperturbatively by exploiting the underlying SL2 symmetry, and have studied the dynamics and fluctuations of energies and entropy. They have further obtained various correlation functions and investigated the responses to drift and diffusion perturbations in the presence of driving. The work has been reported in Physical Reviews E 101, 042106 (2020). In addition, one of the PhD students of the group has investigated anisotropic properties of the critical dynamics of a genuine nonequilibrium system and has reported various critical exponents in Physical Review E 102, 062150 (2020).

HIGH ENERGY PHYSICS, ASTRONOMY & ASTROPHYSICS: COSMOLOGY, PARTICLE PHYSICS, STRING THEORY & GRAVITATIONAL WAVES

Dr. Bindusar Sahoo

The construction of an action for N=4 conformal supergravity was long desired since the discovery of the N=4 Weyl multiplet in the 1980's. In a series of three papers that culminated in a research paper in JHEP in 2020 [JHEP01(2020)029], Dr. Bindusar Sahoo's group along with his collaborators devised the required technical machinery for the construction of the action for N=4 conformal supergravity and were able to give the most general class of actions for N=4 conformal supergravity. This opens up the door for constructing higher derivative invariants in N=4 Poincare supergravity which could be used to understand the structure of anomalies and divergences in N=4 supergravity as well as to study the entropy of the N=4 black holes arising in the compactification of string theory.

The technical machinery developed for the construction of N=4 conformal supergravity action is also useful in generalizing the density formulae necessary for constructing invariant actions in any extended conformal supergravity. Working along this direction, in JHEP 01, 070 (2020), Dr. Sahoo's group devised a new density formula for N=2 conformal supergravity in four dimensions and used it to construct new higher derivative action for the N=2 tensor multiplet.

Dr. Sahoo's group also worked on extending the N=2 relaxed hypermultiplet known in flat space supersymmetric field theory to conformal supergravity which was published in Phys Rev D.101.066012. This combined with the earlier work of Dr. Sahoo's group on real scalar multiplet from 2018 lays the foundation for studying N=2 hypermultiplet in conformal supergravity in a complete off-shell manner.

Dr. Tanumoy Mandal

Dr. Tanumoy Mandal's main research interest lies in the area of theoretical particle physics and phenomenology. He is mainly interested in various signatures and predictions of new physics models at the Large Hadron Collider (LHC). In 2020, he has published three papers in reputed international journals. In one work which is published in Physical Review D 101, 11, 115015 (2020), he has proposed a new search channel for vector leptoquarks using boosted top quark and light leptons. This channel can significantly improve the LHC reach. In Journal of High Energy Physics, 06, 111 (2020), he showed the role of higher-dimensional operators in the context of anomaly-free U(1) extensions of the Standard Model. In that work, a detailed discussion on Z' and right-handed neutrinos is presented. The third work is a big collaborative work with the ATLAS group of Uppsala University that was published in Journal of High Energy Physics, 05, 028 (2020). In that work, new signatures of vector-like top partners decaying into new

neutral scalar or pseudoscalar bosons are presented. Collaborators from several other universities were involved in that project. Apart from these, he has initiated a few projects which will be published in the coming year. He has active collaboration in various Indian and international universities. His ongoing works are very relevant in the context of the LHC experiments which are trying to reveal the mysteries of nature.

Dr. Soumen Basak

Dr. Soumen Basak's research work is primarily focused on the observation of the CMB, the afterglow of the Big Bang, and the analysis of cosmological and astrophysical data sets. His recent research work is devoted to investigating the best options for detecting signatures of Gravitational waves in the CMB polarization from the multi-frequency observations of the sky. He is primarily interested in the scientific content of the B-modes of CMB polarization, the level of primordial power in cosmological Gravitational Waves as well as the Gravitational Lensing of the CMB in particular. His research group is currently involved in the activities "Foreground Working Group" of LiteBIRD (http://litebird.jp/eng) and CMB-Bharat (http://cmb-bharat.in) satellite mission. The objective of these groups is to forecast the potential of these missions and investigate the ways in which a combination of space-based and ground–based observations of sky can be optimized to the B-modes of CMB.

Laser Interferometer Satellite Antenna (LISA) is a space based Gravitational wave detector. Objective of LISA (https://lisa.nasa.gov) is to detect Gravitational waves from astrophysical sources (such as supermassive black holes, extreme mass ratio inspiral) unseen by the preceding ground based mission (LIGO-Virgo https://www.ligo.org). Dr. Basak has ongoing collaboration with LISA and access to its considerable resources of the consortium. Currently Dr. Basak's group is participating in the activities of the "Artefact Working Group" of LISA. The primary objective of this working group is to investigate the impact of scheduled and unscheduled gaps in the data on the analysis of Massive Black Hole Binary (MBHB) signal.

List of Publications
for the period 2019-20 FY

LIST OF PUBLICATIONS

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1. P. Agarwal, U. Manna, and D. Mukherjee, “Stochastic Control of Tidal Dynamics Equation with Levy Noise,” (in English), Applied Mathematics and Optimization, Article vol. 79, no. 2, pp. 327-396, Apr 2019, doi: 10.1007/s00245-017-9440-2.
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12. Angamuthu, Sathish Kumar ; Ponnaian, Devaraj . Approximation by generalized bivariate Kantorovich sampling type series. J. Anal. 27 (2019), no. 2, 429--449.

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1. K. N. Balasubramaniam, Kodandaramaiah, Ullasa et al., “Impact of anthropogenic factors on affiliative behaviors among bonnet macaques,” (in English), American Journal of Physical Anthropology, Article vol. 171, no. 4, pp. 704-717, Apr 2020, doi: 10.1002/ajpa.24013.
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Humanities

1. S. Kloos, H. Madhavan, T. Tidwell, C. Blaikie, and M. Cuomu, “The transnational Sowa Rigpa industry in Asia: New perspectives on an emerging economy,” (in English), Social Science & Medicine, Article vol. 245, p. 12, Jan 2020, Art no. 112617, doi: 10.1016/j.socscimed.2019.112617.

STUDENT PUBLICATIONS

School of Physics

1. M. Anagha, A. Mohan, T. Muruganandan, B. K. Behera, and P. K. Panigrahi, “A new scheme of quantum teleportation using highly entangled brown et al. state: an IBM quantum experience,” (in English), Quantum Information Processing, Article vol. 19, no. 5, p. 12, Mar 2020, Art no. 147, doi: 10.1007/s11128-020-02635-3.
2. D. Bhatt, Sulochana, R. et al., “Detection of self-generated nanowaves on the interface of an evaporating sessile water droplet,” (in English), Optics Express, Article vol. 27, no. 22, pp. 31900-31912, Oct 2019, doi: 10.1364/oe.27.031900.
3. S. Jana, K. Sharma, and P. Samal, “Improving the Performance of Tao-Mo Non-empirical Density Functional with Broader Applicability in Quantum Chemistry and Materials Science,” (in English), Journal of Physical Chemistry A, Article vol. 123, no. 29, pp. 6356-6369, Jul 2019, doi: 10.1021/acs.jpca.9b02921.
4. A. Mishra, Chaturvedi, R (et al., “Measurement of Static and Dynamic Magneto-Viscoelasticity in Facile Varying pH Synthesized CoFe2O4-Based Magnetic Fluid,” (in English), Ieee Transactions on Magnetics, Article vol. 55, no. 12, p. 7, Dec 2019, Art no. 4601107, doi: 10.1109/tmag.2019.2936802.
5. S. Pal, S. Bawari, T. V. Vineesh, N. Shyaga, and T. N. Narayanan, “Selenium-Coupled Reduced Graphene Oxide as Single-Atom Site Catalyst for Direct Four-Electron Oxygen Reduction Reaction,” (in English), Acs Applied Energy Materials, Article vol. 2, no. 5, pp. 3624-3632, May 2019, doi: 10.1021/acsaem.9b00364.
6. A. B. Puthirath, Prasannachandran, R et al., “Complementary behaviour of EDL and HER activity in functionalized graphene nanoplatelets,” (in English), Nanoscale, Article vol. 12, no. 3, pp. 1790-1800, Jan 2020, doi: 10.1039/c9nr08102j.
7. V. Singh, S. Karmakar, R. Rawat, and P. Kushwaha, “Giant negative magnetoresistance and kinetic arrest of first-order ferrimagnetic-antiferromagnetic transition in Ge doped Mn 2Sb,” (in English), Journal of Applied Physics, Article vol. 125, no. 23, p. 6, Jun 2019, Art no. 233906, doi: 10.1063/1.5097020.

School of Mathematics

1. T. Kathiravan, “Some congruences modulo power of 2 for Andrews’ singular overpartition pairs,” (in English), Journal of the Ramanujan Mathematical Society, Article vol. 35, no. 1, pp. 95-108, Mar 2020.
2. S. Mecheri and T. Prasad, “Triangular n-isometric operators,” (in English), Linear & Multilinear Algebra, Article vol. 67, no. 6, pp. 1132-1145, Jun 2019, doi: 10.1080/03081087.2018.1450346.
3. Prasad, T. ; Chō, M. ; Rashid, M. H. M. ; Tanahashi, K. ; Uchiyama, A. Class p-wA(s,t) operators and range kernel orthogonality. Sci. Math. Jpn. 82 (2019), no. 1, 45--55.

School of Biology

1. N. Chazot, Sahoo, RK et al., “Priors and Posteriors in Bayesian Timing of Divergence Analyses: The Age of Butterflies Revisited,” (in English), Systematic Biology, Article vol. 68, no. 5, pp. 797-813, Sep 2019, doi: 10.1093/sysbio/syz002.
2. A. Thomas, “Lectotypification of Themeda helferi Hack. (Andropogoneae, Poaceae),” (in English), Phytotaxa, Editorial Material vol. 416, no. 2, pp. 197-199, Sep 2019, doi: 10.11646/phytotaxa.416.2.7
3. V. P. Cyriac, A. Johny, P. Umesh, M. J. Palot, and P. D. Campbell, “Rediscovery of Cnemaspis nilagirica Manamendra-Arachchi, Batuwita and Pethiyagoda, 2007 (Squamata: Gekkonidae) from Kerala, India with notes on morphology and distribution,” (in English), Zootaxa, Article vol. 4586, no. 1, pp. 98-108, Apr 2019, doi: 10.11646/zootaxa.4586.1.4.
4. V. P. Cyriac, M. J. Palot, K. Deuti, and P. K. Umesh, “A preliminary 16S rRNA phylogeny of the Indian Cnemaspis Strauch, 1887 (Squamata: Gekkonidae) with the description of two new cryptic species from the C. wynadensis clade,” (in English), Vertebrate Zoology, Article vol. 70, no. 2, pp. 171-193, 2020, doi: 10.26049/vz70-2-2020-06.
5. H. Dogra and K. G. S. Dani, “Defining features of age-specific fertility and seed quality in senescing indeterminate annuals,” (in English), American Journal of Botany, Article vol. 106, no. 4, pp. 604-610, Apr 2019, doi: 10.1002/ajb2.1265.
6. P. K. Sahu, S. Salim, P. P. Mubthasima, S. Chauhan, and R. S. Tomar, “Reverse genetic analysis of yeast YPR099C/MRPL51 reveals a critical role of both overlapping ORFs in respiratory growth and MRPL51 in mitochondrial DNA maintenance,” (in English), Fems Yeast Research, Article vol. 19, no. 6, p. 11, Sep 2019, Art no. foz056, doi: 10.1093/femsyr/foz056.
7. A. Sayyed, V. P. Cyriac, and R. Dileepkumar, “A new cryptic species of Cnemaspis Strauch, 1887 (Squamata: Gekkonidae), in the C. littoralis complex, from Anakkal, Palakkad, Kerala, India,” (in English), Amphibian & Reptile Conservation, Article vol. 14, no. 3, pp. 31-45, 2020, Art no. e251.

School of Chemistry

1. S. Francis, K. M. Nair, N. Paul, E. P. Koshy, and B. Mathew, “Green synthesized metal nanoparticles as a selective inhibitor of human osteosarcoma and pathogenic microorganisms,” (in English), Materials Today Chemistry, Article vol. 13, pp. 128-138, Sep 2019, doi: 10.1016/j.mtchem.2019.04.013.
2. Y. Kada, “Quantum-chemical characterization of ion-pairing effect on the linear and third-order nonlinear optical response in cyanine dyes,” (in English), Journal of Molecular Structure, Article vol. 1186, pp. 127-136, Jun 2019, doi: 10.1016/j.molstruc.2019.03.030.
3. P. E. Karthik, I. Alessandri, and A. Sengeni, “A Review on Electrodes Used in Electroorganic Synthesis and the Significance of Coupled Electrocatalytic Reactions,” (in English), Journal of the Electrochemical Society, Review vol. 167, no. 12, p. 13, Jan 2020, Art no. 125503, doi: 10.1149/1945-7111/abb0f2.
4. R. Mathew, S. Kayal, and A. L. Yapamanu, “Excited state structural dynamics of 4-cyano-4 ‘-hydroxystilbene: deciphering the signatures of proton-coupled electron transfer using ultrafast Raman loss spectroscopy,” (in English), Physical Chemistry Chemical Physics, Article vol. 21, no. 40, pp. 2240

Former faculty's publications

1. S. Bhattacharyya and S. Shankaranarayanan, "Distinguishing general relativity from Chern-Simons gravity using gravitational wave polarizations," (in English), Physical Review D, Article vol. 100, no. 2, p. 9, Jul 2019, Art no. 024022, doi: 10.1103/PhysRevD.100.024022.

PROCEEDINGS PAPER

School of Biology

1. S. S. K. Kaburu, Sadananda, S et al., "Interactions with Humans Reduce Resting and Grooming Time in Commensal Rhesus Macaques (Macaca mulatta)," Folia Primatologica, vol. 91, no. 3, pp. 260-260, May 2020.

AWARDS AND GRANTS

AWARDS & ACHIEVEMENTS

Research Group	Recognitions
Prof. S. Murty Srinivasula	• Research article selected for cover page of Journal of Cell Science (2020).
Prof. Tapas K Manna	• S. Ramachandran National Bioscience Award 2019
Prof. Hema Somanathan	• Associate Editor - Frontiers in Insect Science • Editorial Board - Current Science • Chairperson - Developing Neuroethology Fund, International Society for Neuroethology • Jury Member - Inspiring Science Award • Erasmus Mundus Teaching Exchange • Founding Member - Indian Pollinator Initiative
Dr. Nishant K.T	• Invited Guest Editor for a special issue of the journal Yeast (Publisher: John Wiley & Sons Ltd, USA), 2020 • Jury member for Inspiring Science Award for the best published scientific paper in the Life Sciences from India (Cell Press, 2019, 2020) • Editorial board member for the Journal of Genetics (Publisher: Indian Academy of Science) (2018-present) • Sagar Salim, PhD student - Best Poster Award at the XIth International Conference on Biology of Yeast and Filamentous Fungi, Hyderabad, 2019
Dr. Kalika Prasad	• Mabel Maria Mathew, PhD student received the prestigious Prime Minister's Research Fellowship (PMRF). • Our research group was chosen to write a leading-edge Primer Article on "PLANT Regeneration" by Development. • Radhakrishnan et al., 2020 Development o Featured on the Cover Page. o Selected for the Highlights of the issue. o Selected as most celebrated Image of the issue by Editor. o Cover image was chosen as most Celebrated Image of the year 2020 by Company of Biologists (Cambridge) o Featured by American Society of Plant Biologists (Plantae.org) • Durgaprasad et al., 2019 Cell Reports o featured on the Cover Page, o Covered by various International Media outlets. o Recommended by F1000 Prime. o Featured by American Society of Plant Biologists (Plantae.org)
Dr. Ullasa Kodandaramaiah	• Associate Editor of Proceedings of Royal Society B, Editor of Current Science
Dr. Ramanathan Natesh	• Founding President of Cryo Electron Microscopy and 3 Dimensional Image Processing(CEM3DIP) Society of India (2018-2021). • EMBO cryoEM course grant Award (2019)
Dr. Jishy Varghese	• Member of the Indian Drosophila Board • Chair of a session of Asia-Pacific Drosophila Research Conference 2020 • Jervis Fernandes, PhD student - Special Poster Mention, Asia-Pacific Drosophila Research Conference 2020 • AWSAR-DST 2020 award for best scientific story to Jervis Fernandes
Dr. Nisha N Kannan	• Executive committee member of Indian Society for Chronobiology • Zoological society of Japan awarded Zoological science award 2020 and Fuji award 2020 for the recent publication.
Dr. Sabari Sankar Thirupathy	• Anjali Variyar and Atre Malhar Vivek, PhD students were awarded the Prime Minister's Research Fellowship (PMRF)

EXTRAMURAL GRANTS

NEW EXTRAMURAL GRANTS RECEIVED (2019-20)

Sr. No.	Name of the Project	Project Leader
1	Exploring the active sites of nitrogen and boron containing/ doped materials:N2-C-B type active sites for eclectrocatalytic 4-electron oxygen reduction reaction	DR.A MUTHUKRISHNAN
2	Al(I)/Al(III) Lewis Pairs for the Activation of Inert Chemical Bonds	DR.AJAY VENUGOPAL
3	Electrophilic Aluminium Compounds for Catalytic CO2 Hydro-silylation	DR.AJAY VENUGOPAL
4	Palladium and Magnesium based hybrid nanocluster struc-tures for high gravimetric capacity hydrogen storage	DR.DEEPSHIKHA JAISWAL NAGAR
5	Design and Synthesis of Pie Extended and Ring- Extended Bis-Macrocycle and Investigating their Photophysical Properties for Optoelectronic Applications	DR.GOKULNATH SABAPATHI
6	Infrared Plasmonics of Nanostructured Conducting Oxides for communication and spectroscopic applications	DR.JOY MITRA
7	One-Dimensional Parity-Time (PT) Symmetric Optical Struc-tures With Layered Media	DR.K SHADAK ALEE
8	Control of stem cell heterogeneity during shoot regeneration in Arabidopsis - a functional and mechanistic analysis of is epigenetic regulators	DR.KALIKA PRASAD
9	Graphene Project	DR.M M SHAIJUMON
10	Noble-Metal free Advanced Catalysts for Hydrogen Generation and Fuel Cell Applications	DR.M M SHAIJUMON
11	Multi-wavelenth Selective Plane Illumination Microscope - with simultaneous magnification at mutiple levels: A promis-ing imaging technology for molecular and cellular biology	DR.M SUHESH KUMAR SINGH
12	Quantum point contract charge amplifiers embedded in a planar superconducting microwave resonator: Quantum-limit-ed charge sensing and counting	DR.MADHU THALAKULAM
13	Unravelling the interplay of reorganization energy, driving force and electronic coupling on the rate of electron transfer	DR.MAHESH HARIHARAN
14	Integration of 2D materials in organic and organic-inorganic hybrid solar cells:Insights into charge extraction and transport	DR.MANOJ A G NAMBOOTHIRY
15	Scheme for Promotion of Academic and Research Collabora-tion (SPARC)	DR.NISHANT K T
16	Terahertz spectroscopic studies of layered 2-D materials	DR.RAJEEV N KINI

Project Code	Funding Agency	Period From - To	Funds Received During the Year (Amount in Lakhs)
DST/TMD/HFC/2K18/24[C] & [G]	DST	17.09.2019-16.09.2022	32.96
CRG/2019/005040	SERB	26.12.2019-25.12.2022	7.22
MHRD-STARS/APR2019/CS/250/FS	MHRD	31.12.2019-30.12.2022	6.81
DST/TMD/HFC/2K18/37 (C) & (G)	DST	17.09.2019-16.09.2022	45.70
CRG/2019/006303	SERB	05.02.2020-04.02.2023	26.41
CRG/2019/004965	SERB	31.01.2020-30.01.2023	32.62
CSIR-03 (1457)/19/EMR-II	CSIR	05.08.2019-04.08.2022	17.75
EMR/2017/002503	SERB	21.05.2019-20.05.2022	13.49
402802 dt 24.04.2019	ENGLISH INDIAN CLAYS LTD	07.05.2019-31.03.2020	6.49
DST/TMD/MES/2K18/136 (C) & (G)	DST	23.10.2019-22.10.2022	28.96
BT/PR30005/MED/32/657/2018	DBT	13.09.2019-12.09.2022	83.00
MHRD-STARS/APR2019/PS/363/FS	MHRD	31.12.2019-30.12.2022	32.80
CRG/2019/002119	SERB	31.01.2020-30.01.2023	35.47
MHRD-STARS/APR2019/PS/308/FS	MHRD	31.12.2019-30.12.2022	17.42
SPARC/2018-2019/58/SL (IN)	MHRD	15.03.2019-14.03.2021	27.84
CRG/2019/004865	SERB	18.01.2020-17.01.2023	20.30

Sr. No.	Name of the Project	Project Leader
17	Twistronics with transition metal dichalcogenides	DR.RAJEEV N KINI
18	Epigenetic modulation of centromeres to produce in vivo haploids by triggering uniparental genome elimination in plants	DR.RAVI MARUTHACHALAM
19	Microresonator frequency combs in visible: A path to ultrashort pulse generation and spectroscopy	DR.RAVI PANT
20	Conflict between Replication and Transcription accelerates Mutagenesis and drives Antibiotic Resistance	DR.SABARI SANKAR THIRUPATHI
21	Combinatorial exploration and property control of oxide based power semiconductors	DR.SOMU KUMARAGURUBARAN
22	Atomically precise alloy nanocluster as promising electro-catalyst for carbon dioxide and nitrogen reduction	DR.SUKHENDU MANDAL
23	Structural and thermodynamic study of the phase separation of TIA1 in the presence of Tau protien and the influence of the phase separation on protien aggregation	DR.VINESH VIJAYAN
24	Structural characterization of functional prion domain of mammalian cytoplasmic polyadenylation element-binding protein 3 (CPEB3)	DR.VINESH VIJAYAN
25	FIST PROGRAM	HOD-SOB
26	FIST PROGRAM	HOD-SOP
27	Integrating collective behaviour with biomechanics of social spider webs	PROF.HEMA SOMANATHAN
28	JC BOSE FELLOWSHIP	PROF.K GEORGE THOMAS
29	Study of Exotic Ground States in Frustrated Triangular Lattice Antiferromagnets	PROF.RAMESH CHANDRA NATH
30	Identification and characterization of the molecular factors for the quality-control of kinetochore size and fidelty of spindle-chromosome attachment	PROF.TAPAS KUMAR MANNA
31	The role of colonic hepatic Tumor Over-expressed Gene (ch-TOG) in regulation of kinetochore size and fidelity of mitotic chromosome segregation	PROF.TAPAS KUMAR MANNA

Project Code	Funding Agency	Period From - To	Funds Received During the Year (Amount in Lakhs)
IPA/2020/000021	SERB	26.03.2020-26.03.2025	35.47
MHRD-STARS/APR2019/BS/818/FS	MHRD	31.12.2019-30.12.2022	19.67
CRG/2019/000993	SERB	15.01.2020-14.01.2023	45.55
IA/I/18/2/504037	DBT-WELLCOME TRUST	01.10.2019-30.09.2024	103.30
DST/INT/JSPS/P-288/2019	DST	26.06.2019-25.06.2021	2.73
DST/INT/JSPS/P-285/2019	DST	26.06.2019-25.06.2021	3.05
CRG/2019/004880	SERB	05.02.2020-04.02.2023	9.42
MHRD-STARS/APR2019/BS/708/FS	MHRD	31.12.2019-30.12.2022	16.01
SR/FST/LS-II/2018/217 [C]	DST	27.08.2019-26.08.2024	225.00
SR/FST/CSII-042/2016 [C]	DST	22.07.2019-21.07.2024	245.00
CRG/2019/003805	SERB	19.03.2020-18.03.2023	9.67
SB/S2/JCB-64/2013	SERB	01.06.2019-31.05.2024	19.00
CRG/2019/000960	SERB	20.12.2019-19.12.2022	11.68
BT/PR30271/BRB/10/1740/2018	DBT	29.07.2019-28.07.2022	114.19
BT/HRD-NBA-NWB/38/2019-20(7)	DBT	19.02.2020-18.02.2023	7.00

ONGOING EXTRAMURAL GRANTS RECEIVED (2019-20)

Sr. No.	Name of the Project	Project Leader
1	Directed Site-Selective C-H Functionaization of Aromatic and Heteroaromatic Precursors	DR.ALAGIRI KALIYAMOORTHY
2	N-Heterocyclic (NHC)-mediated Desymmetrization of meso-cyclic Anhydrides and Enantioselective Dearomotive, Conjugate Borylation Reactions	DR.ALAGIRI KALIYAMOORTHY
3	A Detail Study of Electrolyte-Gated Organic Field-effect Transistors	DR.BIKAS C DAS
4	Development of Charge-Transfer Nanohybrids Of 2D Transition Metal Dichalcogenides to Fabricate Thin Film Devices	DR.BIKAS C DAS
5	Brain-like computing-Designing the basic building blocks for artificial neurons and synapses	DR.BIKAS C DAS
6	Conformal approach to supergravity: New Perspectives and Applications	DR.BINDUSAR SAHOO
7	Collective Dynamics of Complex Nonlinear Systems	DR.D V SENTHIL KUMAR
8	Development of solid state hybrid hydrogen using Palladium and Magnesium nanoclusters	DR.DEEPSHIKHA JAISWAL NAGAR
9	Development of hydrogen sensors for extended range of temperatures from 100K to 300K using 2D nano cluster assembled films of Polladium	DR.DEEPSHIKHA JAISWAL NAGAR
10	Effect of size on the superconducting properties of films assembled in nano cluster form in elemental Superconductors Al, Pb and Nb	DR.DEEPSHIKHA JAISWAL NAGAR
11	Study of Convolution Operators on Topological Groups	DR.DEVARAJ PONNAIAN
12	On certain class of diagram algebras arising from Schur-Weyl duality	DR.GEETHA T
13	Fusion and Planarization of Porphyrins Dimers and Timers for Near-IR Applications	DR.GOKULNATH SABAPATHI
14	Functional Analysis for Genetic and Molecular Mechanisms that Maintain Nutrient and Energy Homeostasis	DR.JISHY VARGHESE
15	Nanoscale Writing of Bespoke Graphene Devices for Electronic and Plasnomic	DR.JOY MITRA
16	Functional Characterization of Genetic And Epigenetic Regulatory Networks Involved in the Reproductive Development in Rice	DR.KALIKA PRASAD
17	Hybrid Energy Storage Devices based on Multifunctional Nanocomposite Materials	DR.M M SHAIJUMON
18	Engineered 2-dimensional transition metal Dichalcogenide (TMD) nanostructures for efficient hydrogen generation	DR.M M SHAIJUMON
19	Light Induced Energy Technologies: Utilizing Promising 2D Nanomaterials (Lite Up 2D)	DR.M M SHAIJUMON
20	Van Der Waals superconducting circuits operating at elevated temperatures & magnetic fields	DR.MADHU THALAKULAM

Project Code	Funding Agency	Period From-To	Funds Received During the Year (Amount in Lakhs)
EEQ/2016/000231	SERB	11.05.2017-10.05.2021	6.00
ECR/2016/000202	SERB	14.07.2016-13.07.2019	2.00
EEQ/2016/000045	SERB	21.02.2017-20.02.2021	1.00
ECR/2017/000630	SERB	12.03.2018-11.03.2021	1.50
184-15/2018 (IC)	UGC	01.04.2018-14.09.2020	6.06
CRG/2018/002373	SERB	27.03.2019-26.03.2022	0.00
CSIR-03 (1400)/17/EMR-II	CSIR	01.08.2017-31.03.2020	0.00
ISRO-DS-2B-13012 (2)/42/2017	ISRO	11.12.2017-10.12.2020	10.84
ISRO-B-19012/35/2016-II	ISRO	04.05.2016-03.05.2019	0.47
YSS/2015/001743	SERB	04.06.2016-03.06.2019	0.00
MTR/2018/000559	SERB	12.03.2019-11.03.2022	0.00
MTR/2017/000424	SERB	06.06.2018-05.06.2021	2.20
SB/FT/CS-094/2014	SERB	12.05.2016-11.05.2019	1.36
EMR/2016/004978	SERB	20.03.2018-19.03.2021	10.00
UGC-UKIERI-184-16/2017 (IC)	UGC	30.06.2017-29.06.2019	0.00
BT/PR12394/AGIII/103/891/2014	DBT	20.11.2015-19.11.2021	15.79
DST/TMD/MES/2K16/114 (C) & (G)	DST	23.05.2017-22.05.2020	20.00
EMR/2017/000484	SERB	04.08.2017-03.08.2020	7.00
IUSSTF/JC-071/2017	INDO-US	09.03.2018-30.09.2020	2.70
CRG/2018/004213	SERB	18.03.2019-17.03.2022	0.00

Sr. No.	Name of the Project	Project Leader
21	Charge and Energy Transfer in Molecular Multifunctional Materials	DR.MAHESH HARIHARAN
22	Approaches to improve open circuit voltage and fill factor-Enhancing the power conversion efficiency in organic and organic-inorganic hybrid systems	DR.MANOJ A G NAMBOOTHIRY
23	Application-development of genome editing tools for gene target discovery and understanding regulation of cholesterol metabolism genes	DR.N SADANANDA SINGH
24	CRISPR/CAS9 based whole genome screening for response to drug treatment	DR.N SADANANDA SINGH
25	Development of New and Utilization of Existing Crispr-Cas Tools to Understand Genetic Regulators of Cytoskeleton in Cardiomyocyte	DR.N SADANANDA SINGH
26	Elucidating post-transcriptional regulation of circadian behavior in Drosphila	DR.NISHA N KANNAN
27	Mechanism of meiotic crossing over through the Msh4-Msh5 dependent pthway	DR.NISHANT K T
28	Metal decorated graphynes for molecular absorption	DR.R S SWATHI
29	Tunable azacrown based graphene nanomeshes for gas seperation	DR.R S SWATHI
30	Investigation of the interaction of acoustic phonons with electrons in semiconductor nanostructures	DR.RAJEEV N KINI
31	Ramanujan Research Award	DR.RAJENDAR GORETI
32	Bifunctional Enamine/Transition MetalSynergistic Catalysis for the Formation of New-C-C Bonds:Synthesis and Exploration of New Class of Phosphanyl Amino Ligands for Catalysis	DR.RAJENDAR GORETI
33	Ramanujan Research Award	DR.RAMESH RASAPPAN
34	Asymmetric Catalysis: Exploring Organosilances in Stereospecific and Convergent Reactions	DR.RAMESH RASAPPAN
35	Targeted Editing Of Potato Genome To Develop Variety Specific True Potato Seed (TPS)	DR.RAVI MARUTHACHALAM
36	Apomixis Technologies for Increasing Agricultural Production (FBR)	DR.RAVI MARUTHACHALAM
37	Ramanujan Research Award	DR.RAVI PANT
38	High fluorine content DNA micelle: A Universal “OFF/ON” 19F-NMR-based probe for the detection of miRNA and Telomerase for cancer diagnosis	DR.REJI VARGHESE
39	Solid State Structural analysis of Photoactive molecular assemblies on DNA scaffold through single crystal X-ray diffraction	DR.REJI VARGHESE
40	Guage theory of categorical principal bundles	DR.SAIKAT CHATTERJEE
41	Gerbes and categorical geometry	DR.SAIKAT CHATTERJEE

Project Code	Funding Agency	Period From-To	Funds Received During the Year (Amount in Lakhs)
INT/ITALY/P-9/2016(ER)	DST	16.11.2017-15.11.2020	1.99
DST/TMD/SERI/S15 (C) & (G)	DST	17.05.2017-16.05.2020	12.00
BT/RLF/Re-entry17/2015	DBT	01.08.2017-31.07.2022	0.00
ECR/2016/000979	SERB	17.07.2018-16.07.2021	6.00
EEQ/2018/001090	SERB	20.03.2019-19.03.2022	0.00
IA/I/15/2/502329	DBT-WELL-COME TRUST	01.12.2016-30.11.2021	30.11
CRG/2018/000916	SERB	20.03.2019-19.03.2022	16.10
1640/2017/KSCSTE	KSCSTE	01.10.2018-30.09.2021	0.00
SB/WEA-14/2016	SERB	06.03.2017-05.03.2020	3.00
KSCSTE/431/2018-KSYSA-RG	KSCSTE	01.06.2018-31.05.2021	0.00
SB/S2/RJN-071/2015	SERB	31.10.2016-30.10.2021	6.40
ECR/2016/001580	SERB	28.02.2017-27.02.2020	8.00
SB/S2/RJN-059/2015	SERB	20.01.2016-19.01.2021	7.60
EMR/2015/001103	SERB	11.09.2015-13.04.2019	0.73
NASF/GT-7024/2018-19	ICAR	01.11.2018-31.10.2021	3.67
31-2(281)/2018-19/Budget	CSIR	2019-2020	0.00
SB/S2/RJN-069/2014	SERB	17.12.2015-16.12.2020	3.00
BT/PR30172/NNT/28/1593/2018	DBT	11.02.2019-10.02.2022	0.00
1246/2016/KSCSTE	KSCSTE	21.03.2017-20.03.2020	0.00
MTR/2018/000528	SERB	08.03.2019-07.03.2022	0.00
YSS/2015/001687	SERB	28.03.2017-27.03.2020	2.00

Sr. No.	Name of the Project	Project Leader
42	Moduli Space of Vector Bundles Over Smooth Projective Surfaces and ACM Bundles	DR.SARBESWAR PAL
43	Understanding the role of Periostin-Itgav interactions in adult and fetal hematopoiesis	DR.SATISH KHURANA
44	Investigating post-transcriptional regulation of steroidogenic genes during development	DR.SMITHA VISHNU
45	Insights into the Interplay of H2S and NO at Redox Active Metal sites	DR.SUBRATA KUNDU
46	Cost-Effective Hand Held Medical Device for Real Time Intraoperative Scanning Applications at Operation Beside	DR.SUHESH KUMAR SINGH
47	Tailoring the Catalytic Properties of Atom-Precise Metal Nanoclusters	DR.SUKHENDU MANDAL
48	Some Extremum Eigenvalue Problems Related To Combinatorial PDE	DR.SUMIT MOHANTY
49	Women Scientist Scheme - Novel polymer supported chiral metal catalysts: asymmetric cross-coupling reactions	DR.TAMILSELVI CHINNUSAMY
50	Vanadium Based Hybrid Materials for Electrochemical Energy Storage	DR.THIRUMURUGAN
51	Comparative biogeography of plants of the Western Ghats	DR.ULLASA KODANDARAMAIAH
52	Inspire Faculty Award	DR.ULLASA KODANDARAMAIAH
53	Understanding diversification of Impatiens species in the Northern Western Ghats	DR.ULLASA KODANDARAMIAH
54	Theoretical investigation on relaxation dynamics of ultrafast generated molecular triplet states	DR.VENNAPUSA SIVARANJANA REDDY
55	Inspire Faculty Award - Development of Novel metal oxide-graphene based nanocomposite Materials for Microsensors and Nano electronics device applications	DR.VINAYAK B KAMBLE
56	Junction Barrier modulation study in engineered core-shell oxide heterostructure Gas sensor device	DR.VINAYAK B KAMBLE
57	Study of Novel Oxide and Graphene Core Shell nanoarchitectures for High Temperature Thermoelectric Power Generations	DR.VINAYAK B KAMBLE
58	FIST Program	HOD CHEMISTRY
59	Localization and flow of information in quantum computing and open quantum dynamics	PROF.ANIL SHAJI
60	Community Plant-Pollinator Interactions at the Landscape Level	PROF.HEMA SOMANATHAN
61	Ecology and Conservation of Freshwater Swamp Ecosystems of the Western Ghats-Kerala Region	PROF.HEMA SOMANATHAN
62	The Effect of Interannual Variation in Flowering Intensity, Periodicity and Synchrony on Pollution and Fruit Set in a Highly Seasonal Tropical Forest in the Western Ghats	PROF.HEMA SOMANATHAN

Project Code	Funding Agency	Period From-To	Funds Received During the Year (Amount in Lakhs)
EMR/2015/002172	SERB	15.05.2018-14.05.2021	0.83
IA/I/15/2/502061	DBT-WELL-COME TRUST	01.12.2016-30.11.2021	49.28
SR/WOS-A/LS-457/2017 (G)	SERB	19.02.2019-18.02.2022	0.00
ECR/2017/003200	SERB	06.07.2018-05.07.2021	5.00
ECR/2016/001232	SERB	28.03.2017-27.03.2020	4.00
EMR/2016/007501	SERB	09.07.2018-08.07.2021	10.00
MTR/2017/000458	SERB	29.05.2018-30.09.2020	0.00
SR/WOS-A/CS-105/2016 (C) & (G)	DST	18.08.2017-17.08.2020	9.00
EMR/2016/002637	SERB	01.02.2017-31.01.2020	8.00
BT/PR12720/COE/34/21/2015	DBT	14.05.2015-13.05.2020	4.82
IFA13-LSBM-92	DST	27.06.2014-26.06.2019	0.00
BT/PR27535/NDB/39/600/2018	DBT	24.09.2018-23.09.2021	0.00
ECR/2016/000226	SERB	19.07.2016-20.07.2019	0.62
DST/INSPIRE Faculty Award/2016/ DST/INSPIRE/04/2015/002111	DST	28.07.2016-27.07.2021	19.15
DST/NM/NT/2018/124 (C) & (G)	DST	30.10.2018-29.10.2021	0.00
EEQ/2018/000769	SERB	16.03.2019-15.03.2022	0.00
FIST-SR/FST/CSII-042/2016 [C]	DST	07.03.2017-06.03.2022	0.00
EMR/2016/007221	SERB	13.07.2017-01.04.2021	8.00
BT/PR12720/COE/34/21/2015	DBT	14.05.2015-13.05.2020	5.84
BT/PR12720/COE/34/21/2015	DBT	14.05.2015-13.05.2020	6.52
EMR/2014/000705	SERB	13.03.2018-12.03.2021	0.00

Sr. No.	Name of the Project	Project Leader
63	Design of a Surface-Enhanced Spectroscopy Based Device for the Rapid Detection of Organophosphate Pesticides and Pyrethroid Insecticides in Fruits and Vegetables	PROF.K GEORGE THOMAS
64	JC Bose Fellowship	PROF.K GEORGE THOMAS
65	Dipolar and Multipolar Interactions in Assembled Molecules and Nanostructures: Developing a General Description and its applications	PROF.K GEORGE THOMAS
66	Synthesis of Pseudoprotiens by Topochemical Azide-Alkyne Cycloaddition Reactions	PROF.K M SURESHAN
67	Chemical Biological intervention in Cell Signaling	PROF.K M SURESHAN
68	Synthesis and Characterization of Frustrated Spin-1/2 Chain Compounds	PROF.RAMESH CHANDRA NATH
69	Identification and Characterization of Molecular Pathways involved in Immune –related Autophagy	PROF.SRINIVASA MURTY SRINIVASULA
70	RNF 167, an ubiquitin E3 ligase with several reported mutations in diverse cancers, controls NF-kB activation	PROF.SRINIVASA MURTY SRINIVASULA
71	To Determine the Role of Ubiquitin Ligase Scf-Fbxw7 in Regulation of Centriole Biogenesis and Duplication in Human Cells	PROF.TAPAS K MANNA
72	Eludicating the Role of GTP-Induced Transition of EB1 Dimer to Monomer in the Regulation of Microtubule Plus Ends	PROF.TAPAS KUMAR MANNA
73	Determining the Role of Microtubule Plus Tip Protein Eb1 In Regulation of Spindle-Kinetochore Associated Protein Complex Ska: The Mechanism Underlying the Stabilization of Spindle-Kinetochore Attachment	PROF.TAPAS KUMAR MANNA
74	Study of Stochastic Nematic Liquid Crystal Models and Related Constrained Physical Problems	PROF.UTPAL MANNA

Project Code	Funding Agency	Period From-To	Funds Received During the Year (Amount in Lakhs)
SR/S9/Z-05/2015	SERB	19.08.2017-31.03.2021	54.71
SB/S2/JCB-64/2013	SERB	29.05.2014-28.05.2019	19.00
SR/NM/NS-23/2016 (C) & (G)	DST	01.10.2016-27.03.2020	20.00
CRG/2018/000577	SERB	30.03.2019-29.03.2022	0.00
DST/SJF/CSA-02/2012-13	DST	01.01.2015-31.12.2019	35.00
37(3)/14/26/2017	DAE	29.12.2017-31.03.2021	5.77
BT/PR21325/BRB/10/1554/2016	DBT	15.03.2018-14.03.2021	0.00
EMR/2016/008048	SERB	22.06.2018-21.06.2021	10.00
EMR/2016/001562	SERB	29.03.2017-28.03.2020	26.80
CSIR-37(1688)/17/EMR-II	CSIR	05.05.2017-04.05.2020	3.10
BT/PR12514/BRB/10/1352/2014	DBT	12.09.2016-11.09.2019	0.00
MTR/2018/000034	SERB	14.03.2019-13.03.2022	0.00

DEPARTMENTAL ACTIVITIES

ACADEMIC ACTIVITIES

SCHOOL OF BIOLOGY

Sl. No.	Dates	Event	Short description
1	23 September, 2019	School of Biology Symposium and Department Day	'Biology across kingdoms' the 2nd Chapter of the symposium series consisted of inspiring talks by scientists from IISc Bangalore, NII New Delhi, IISER Pune, IIT Kanpur and IISER TVM. The event included a poster session and concluded with a dinner, hosted by the department, for all the participants.
2	17-18 October, 2019	Tropical Pollination Biology Meeting	This meeting organized by the School of Biology was supported by the Swedish International Development Cooperation Agency. The meeting brought together scientists, organizations, and pollination biologists from India and Sweden, and served as a platform for exchange of ideas, renewing research collaborations and forging fresh partnerships.
3	10-17 January, 2020	Genome Biology - 2020	The first 2 days of this 7-day event featured talks by eminent scientists in the field of genome engineering, dynamics and evolution. This was followed by a 5-day Genome Biology Course that was structured to include both lecture sessions and a computer lab module. At the end of this course, students learnt how to perform full genome assembly and analyze genome variation from NGS data.
4	31 Jan - 01 Feb, 2020	The 1st Frontier Symposium in Biology	This symposium included a series of exciting talks by speakers from across the globe, covering a range of topics and specializations.
5	15 February, 2020	Biology across kingdoms	'Biology across kingdoms' this 3rd Chapter of the symposium series was part of IISER TVMs celebration of the International Day for Women and Girls in Science. There were interesting talks by women scientists from IISER Pune and IISc Bangalore, as well as students and faculty of IISER TVM. The symposium concluded with a panel discussion on "Women and Girls in Science".

SCHOOL OF CHEMISTRY

Sl. No.	Dates	Event	Short description
1	21 September, 2019	One-day Symposium – Chemistry Seminar Series	Scientists from IISER Mohali, University of Hyderabad, IIT Madras, IIT Bombay, TIFR and JNCASR Bangalore attended the seminar and delivered lectures in their respective fields of expertise.

2	17 - 18 January, 2020	The 1st Frontier Symposium in Chemistry	The Frontier Symposium included a series of stimulating talks by speakers from across the globe, covering a number of topics from a wide range of specialized fields.
3	04 February, 2020	IISER TVM – RSC Symposium	The theme for this symposium - 'Advances in Chemical sciences', highlighted the developments in the field of organic, inorganic and chemical biology and explored potential areas for research collaborations between the UK and India.

SCHOOL OF MATHEMATICS

Sl. No.	Dates	Event	Short description
1	22 August, 2019	Half-day Symposium on Mathematics	This half-day symposium was organized by the School of Mathematics and included talks by faculty from IIT Madras, TIFR Centre for Applicable Mathematics, IIT Bombay and ISI Bangalore.
2	01 November, 2019	School of Mathematics Mini Symposium and Department Day	Scientists from IISER TVM, IISc Bangalore, CSI Chennai, JNCASR Bangalore came together to deliver lectures on range of topics including Quantum theory and Stochastic modelling.
3	16 - 21 December, 2019	Winter School in Mathematics for Young Women	This week-long event was organized by the Indian Women and Mathematics (IWM) – a collective of Indian mathematicians. The winter school provided women mathematicians a platform to network with one another and the motivation to pursue a career in mathematics.
4	8 - 23 February, 2020	Lecture Series by Prof. Erika Hausenblas	The 4-part Lecture Series 'Modelling of biochemical processes with randomness' was delivered by Prof. Erika Hausenblas from the Montanuniversitat Leoben, Austria, during her visit to the School of Mathematics.
5	19 February, 2020	Lecture by Dr. Debopriya Mukherjee	Dr. Debopriya Mukherjee, from Montanuniversitat Leoben, Austria, explained the interior solid-fluid interaction problem in harmonic regime with randomly perturbed boundaries, in her lecture titled 'A Shape calculus approach for time harmonic solid - fluid interaction problem in stochastic domains'.
6	09 March, 2020	Lecture by Prof. Carsten Carstensen, Humboldt-Universitat Zu Berlin, Germany	Prof. Carsten in his lecture titled 'Challenges in Computational Calculus of Variations: 3 Examples in 1D', explained the three disaster problems and illustrated the direct method in the calculus of variations and the success or failure of the simplest finite element approximation.

SCHOOL OF PHYSICS

Sl. No.	Dates	Event	Short description
1	22 - 23 July, 2019	International Workshop on Advances in 2D Materials	This workshop, the first-of-its-kind conducted in India, brought together national and international experts to a single platform. The workshop was well attended and included talks by internationally acclaimed experts in this new and emerging interdisciplinary area of research. The talks and poster sessions were well received by all the participants.
2	28 August, 2019	A Day-long Seminar on Thin-Film Electronics and Advanced Materials	The day-long seminar organized under the aegis of the UKIERI, brought together experts from Indian and UK universities to discuss advances in nanoelectronics. The discussions focused on recent advances in thin-film electronics research, how this has enabled miniaturization and helped lower manufacturing costs in the semi-conductor industry.
3	15 October, 2019	Half-day Colloquia in School of Physics	The speakers at the Colloquia were from BARC Mumbai, University of Delhi, IIT Kanpur, IISER Kolkata and CMI Chennai.
4	08 January, 2019	The Unique Blazar OJ 287 and its Massive Binary Black Hole Central Engine	Prof. Achamveedu Gopakumar from TIFR, in his talk, explained the first indirect evidence for the existence of a massive spinning black hole binary emitting gravitational waves.
5	09 January, 2020	Measuring Storms in Space-Time: Astronomy with Gravitational Radiation	Dr. Robert Ward, Australian National University, in his lecture, spoke about gravitational waves, the new form of radiation with which to study the Universe. He reported that gravitational waves propagate over astrophysical distances and can be detected by the modulation imposed on the optical path of a suspended mirror laser interferometer. Dr. Ward also spoke about the technology developed to detect gravitational waves.
6	13 January, 2020	Astronomical Imaging with the Hanbury Brown and Twiss Effect	This lecture was delivered by Prof. Prasenjit Saha, University of Zurich.
7	21 - 22 February 2020	International Conference on Ultrafast Spectroscopy (ICUS 2020)	The conference brought together world leaders in the area of ultrafast spectroscopy, photochemistry and photophysics. The discussions focused on highly advanced and innovative research, involving both theoretical and experimental investigations, on photo-excited state dynamics in functional materials. This conference provided an ideal platform for researchers to interact with experts, exchange ideas and initiate new collaborative studies.

INSTITUTE EVENTS

INSTITUTE EVENTS

Sl. No.	Dates	Event	Short description
1	02 August, 2019	Mass Tree Planting Drive	The Unnat Bharat Abhiyan (UBA) Cell of IISER TVM, together with local educational institutions, local government bodies and the Kerala Forest Department organized a mass tree plantation drive in the campus of IISER TVM. The meeting was inaugurated by Shri Adv K. Raju, Minister for Forest, Animal Husbandry and Zoos, Government of Kerala. The keynote address was delivered by Prof. J N Moorthy, Director, IISER TVM, and the meeting was presided over by Shri K. S. Sabarinathan, MLA, Aruvikara.
2	29 October, 2019	Foundation Day	The 11th Foundation day was celebrated in the presence of Prof. Gautam R. Desiraju, a well-known scientist from IISc Bangalore. Prof. Gautam R. Desiraju delivered the Foundation Day lecture 'Renaissance of Science education and research in Today's India'. Prof. J N Moorthy, Director, IISER TVM addressed the gathering and announced the introduction of 2 new academic programs in data science and interdisciplinary sciences at the Institute.
3	11 December, 2019	Guest house inauguration and talk by Prof. C N R Rao	Bharat Ratna Prof. C N R Rao inaugurated the new guest house ' Visitors Forest retreat' at IISER TVM and delivered a talk titled 'Can India get to the top in Science'.
4	20 - 22 December, 2019	Inter IISER Cultural Meet (IICM)2019	The IICM 2019 was a cheerful and grand 3-day long celebration that had teams from all the 7 IISERs, IISc Bangalore and CEBS Mumbai participating in music, dance, drama, quiz, debates, photography, film making, fashion show events and other competitions. Students from IISc Bangalore bagged the Championship trophy, while IISER Kolkata came a close second followed by IISER TVM.
5	28 February, 2020	Talk on National Science Day	Dr. R. R. Sonde, Executive Vice President, Research Technology & Innovation Centre, Thermax Ltd., delivered an inspiring talk titled 'Transformative developments in the field of energy & environment on the back of new technologies - A great opportunity to create enterprise for young creative minds.'

INSTITUTE ACTIVITIES - OUTREACH & NETWORKING

Sl. No.	Dates	Event	Short description
1	6 - 8 December, 2019	Higher Secondary Level Teachers' Training Program at IISER TVM	This 3-day Teachers' Training program was conducted jointly with the Samagra Shiksha Kerala (SSK) for about 224 teachers from across the state. Lectures by subject matter specialists were attended by teachers of respective subjects while the general lectures were attended by all the teachers. The training program helped raise awareness among school teachers about new resources, tools and methods of teaching. They also became conscious of the need to make teaching and learning a more interactive, engaging and enjoyable experience.
2	10 - 12 January, 2020	Salter's Chemistry Camp	The 3-day residential camp was jointly organized by IISER TVM, Royal Society of Chemistry, India, and the Salters Institute UK, for about 70 school students. This camp provided class IX students from schools in Thiruvananthapuram, Kollam and Pathanamthita, an opportunity to explore practical chemistry. By the end of three days, it was evident that the camp had succeeded in igniting an interest in chemistry in some of the students, allowing them to consider chemistry as a preferred branch of study for higher education and specialization.
3	27 - 28 February, 2020	DST Sponsored Industry-Academia Conclave on Hydrogen and Fuel Cells.	This DST sponsored Conclave brought together industry experts, policy makers, researchers and students to one discussion table to strategize and develop a framework to mitigate the global hydrogen challenge.

NATIONAL EVENTS

Sl. No.	Dates	Event	Short description
1	28 Oct - 02 Nov, 2019	Vigilance Awareness Week	'Integrity - A way of life' was the theme of the Vigilance Awareness Week 2019. This week-long exercise helped raise stakeholder understanding of the harmful and damaging effects of corruption and the need to end corruption at all levels.
2	20 January, 2020	Pariksha Pe Charcha	The Department of School Education & Literacy, Ministry of Education, organizes annually, a unique interactive program of the Hon'ble Prime Minister Shri. Narendra Modi with students, teachers and parents. This program was telecast live at IISER TVM.


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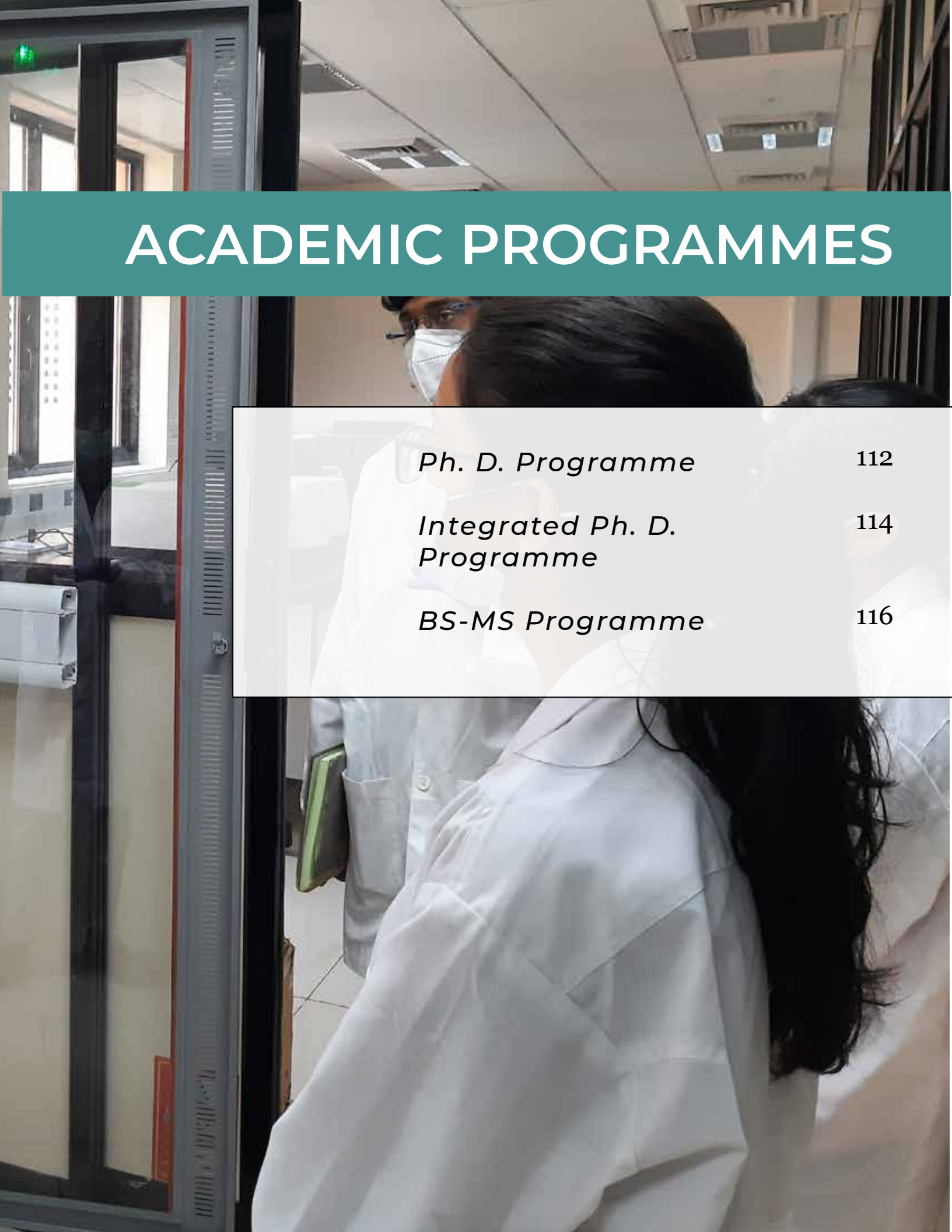


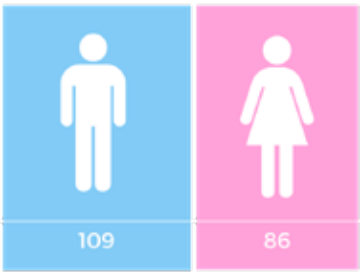
ACADEMIC PROGRAMMES

Ph. D. Programme 112

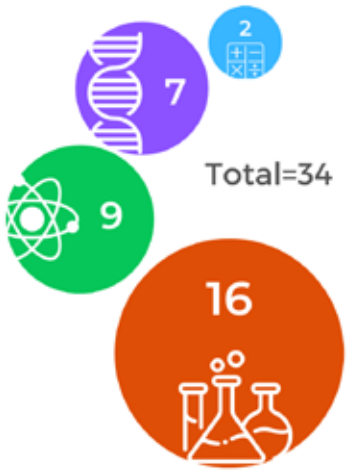
Integrated Ph. D. Programme 114

BS-MS Programme 116

PH. D. PROGRAMME



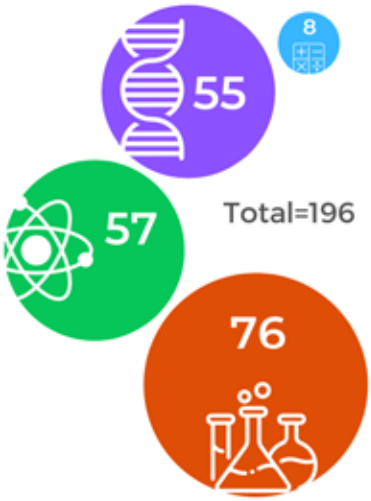
During the August 2019 and January 2020 admission sessions, 34 students were admitted to the Ph. D. programme.



Sources of Fellowship for Ph. D. students

Name of Fellowship	Nos.
CSIR	40
DBT	1
INSTITUTE	104
INSPIRE	26
UGC	25
Total	196

School-wise distribution of Ph. D. students as on March 31, 2020



During 7th Convocation held on 15th June, 2019, 24 students were conferred Ph. D. degree.

Category-wise distribution of Ph.D. students

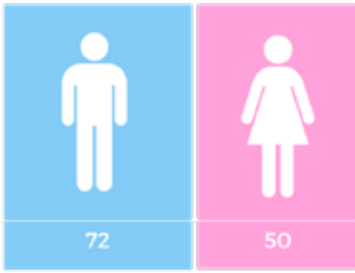
GENDER	EWS	GEN	OBC_NCL	PD	SC	ST
MALE	0	61	41	0	8	0
FEMALE	0	60	26	0	0	0

List of Students who have fulfilled all the requirements for award of Ph. D. degree

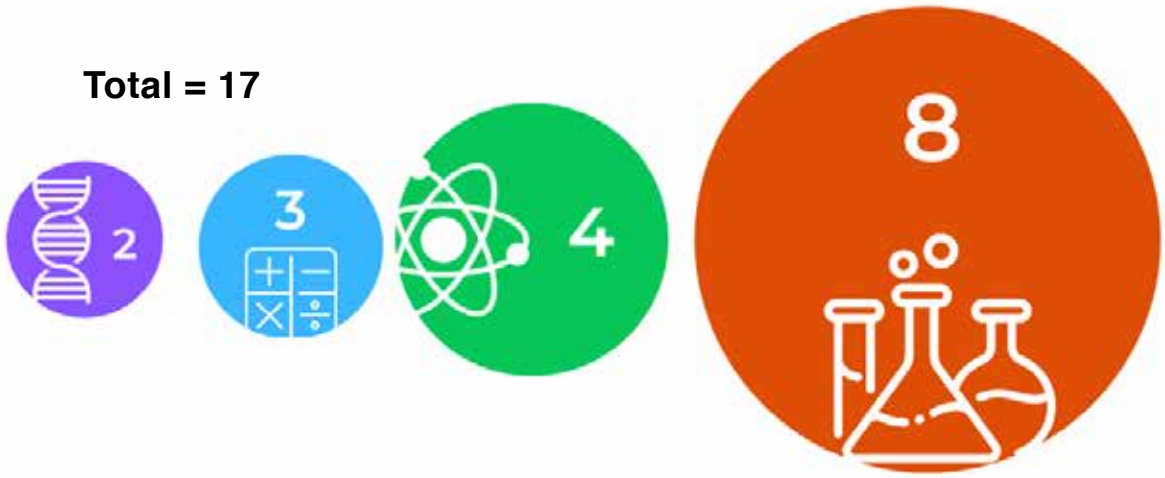
(Successfully completed thesis defense on or before March 31, 2020)

SL. NO.	Roll No	NAME	School	Thesis Supervisor	Title
1	PHD132005	Harshad Vijay Mayekar	Biology	Dr. Ullasa Kodandara-maiah	Evolution of Pupal Colour Plasticity in Tropical Satyrine Butterflies (Nymphalidae: Satyrinae)
2	PHD132007	Kavya Durgaprasad	Biology	Dr. Kalika Prasad	Molecular Mechanisms for imposing a Boundary on organ regeneration potential in plants
3	PHD141020	Vivek Philip Cyriac	Biology	Dr. Ullasa Kodandara-maiah	Evolution underground: Digging into diver-sification and Evolution of Colour Patterns in the Fossorial Snake Family Uropeltidae
4	PHD12101	Selvakumar B	Chemistry	Dr. Ajay Venugopal	Synthesis, Structure and Reactivity of Hydri-dotris (3,5-dimethylpyrazolyl)borato Bismuth (III) Dication
5	PHD12107	Hema K	Chemistry	Dr. Kana M. Sureshan	Synthesis of various Biopolymer Mimics via Topochemical Azide-alkyne Cycloaddition
6	PHD12108	Jobha A. Johnson	Chemistry	Dr. Ajay Venugopal	Coordination chemistry of β-Ketoiminato Ligands with Heavier Pnictogens
7	PHD132006	Nithiyanandan K	Chemistry	Dr. Reji Varghese	Design, Synthesis and Applications of Biomolecule Decorated Two-dimensional Nanosheets
8	PHD142009	Prabu M	Chemistry	Dr. Sukhendu Mandal	Investigation of Physical Properties and Elec-trocatalytic Activities of Inorganic-Organic Hybrid Materials
9	PHD142012	Sumanta Banerjee	Chemistry	Dr. Ajay Venugopal	Alkyl and Amido-Magnesium Cations: Syn-thesis and Reactivity
10	PHD141013	Ramkumar K	Chemistry	Dr. Ajay Venugopal	Taming the Reactivity in Aluminum and Bismuth Cations through Intramolecular Coordination
11	PHD141016	Tania Biswas	Mathematics	Dr. Sheetal Dharmatti	Optimal Control and Related Problems for Fluid Flow Models
12	PHD152011	Vatsalkumar N. Mer	Mathematics	Dr. Sachindranath Ja-yaraman	Semipositivity of linear maps relative to prop-er cones: Structure and Linear Preservers
13	PHD151002	Atma Ram Tiwari	Mathematics	Dr. Shrihari Sridharan	Stability of typical trajectories in Riemann Sphere
14	PHD142002	Arjun U	Physics	Dr. Ramesh Chandra Nath	Singlet Ground State in Spin-1/2 Dimer and Alternating Chain Compounds
15	PHD142003	Reshma Raveendran	Physics	Dr. Manoj A G Nam-boothiry	Surface Modified Poly (dimethylsiloxane) as Gate Dielectric in Solution-Processed Organic Field Effect Transistors: Promises and Chal-lenges
16	PHD141015	Subramanya Hegde	Physics	Dr. Bindusar Sahoo	Aspects of N-extended Conformal Supergrav-ity in Four Dimensions
17	IPHD13008	Gopal M	Biology	Dr. Ullasa Kodandara-maiah	Evolutionary Ecology of Antipredator Strate-gies in Motion
18	IPHD13001	Akash Ashirbad Panda	Mathematics	Dr. Utpal Manna	Stochastic Analysis of Nematic Liquid Crystals and Related Physical Models
19	IPHD13002	Ammu Elizabeth Antony	Mathematics	Dr. Viji Z Thomas	On some structural results on the nonabelian tensor square and Schur's exponent Conjec-ture
20	IPHD13013	Soham Bhattacharyya	Physics	Dr. Sreedhar B Dutta	Distinguishing General Relativity and mod-ified theories of gravity using quasi-normal modes

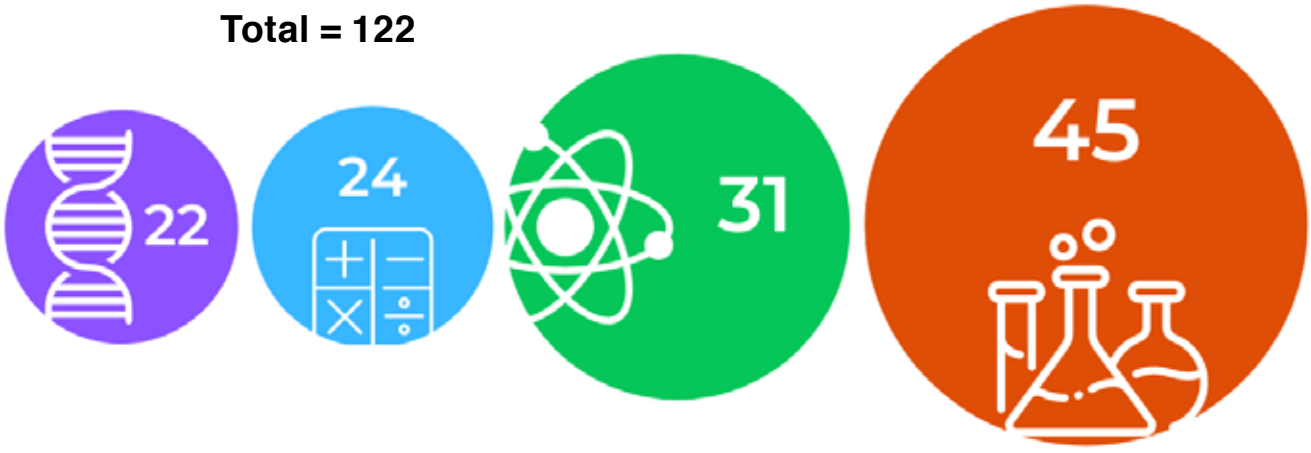
INTEGRATED PH. D. PROGRAMME



The Integrated Ph.D. program is offered by all four schools to students who wish to pursue a career in research and have completed a Bachelor's degree in any one of the sciences, with an excellent academic record. Admission to this program is a 2-stage process, a national level written exam followed by an interview by the respective department. After successful completion of the programme, students receive both a Master of Science degree and a Ph. D. degree. In August 2019, we had 17 students registering for the Integrated Ph. D. program.



Integrated Ph. D. student numbers across schools



Integrated Ph. D. students Anjali Variyar and Atre Malhar Vivek were selected to receive the Prime Minister's Research Fellowship (PMRF) during the year.
In the Seventh convocation held on June 15, 2019, one Integrated Ph. D. student was awarded a dual Master's degree and a Ph. D. degree. Another Integrated Ph. D. student was awarded a Master's degree.

The following 3 students have successfully fulfilled the requirements for the award of Integrated Ph.D. degree
(Successfully completed thesis defense on or before March 31, 2020)

Sl. No.	Name	Registration No.	School	Title of Thesis	Research Supervisor
1	Gopal M	IPHD13008	Biology	Evolutionery Ecology of Antipredator Strategies in Motion	Dr. Ullasa Kodandaramaih
2	Akash Ashirbad Panda	IPHD13001	Mathematics	Stochastic Analysis of Nematic Liquid Crystals and Related Physical Models	Prof. Utpal Manna
3	Soham Bhattacharya	IPHD13013	Physics	Distinguishing general relativity and modified theories of gravity using Quasi-normal modes	Dr. Sreedhar B Dutta

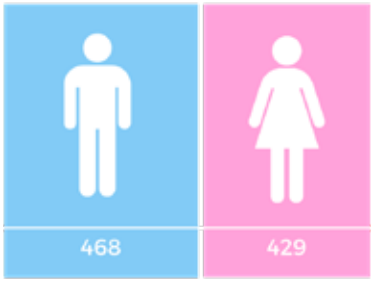
Sources of Fellowship for Integrated Ph. D. students

Name of Fellowship	Nos.
CSIR	2
PMRF	2
INSTITUTE	118
Total	122

Category-wise numbers of Integrated Ph. D. students

GENDER	EWS	GEN	OBC_NCL	PD	SC	ST
MALE	0	62	9	0	1	0
FEMALE	0	36	14	0	0	0

BS-MS PROGRAMME



Category-wise distribution of students enrolled in 2019

GENDER	EWS	GEN	OBC_NCL	PD	SC	ST	TOTAL
MALE	6	49	22	0	13	5	95
FEMALE	8	41	34	1	21	2	107
TOTAL	14	90	56	1	34	7	202

Subsequent to admission, 11 students discontinued from the programme. The number of students enrolled in 2019 stands at 191.

Total BS-MS student strength during 2019-20

GENDER	EWS	GEN	OBC_NCL	PD	SC	ST	TOTAL
MALE	5	235	129	5	62	26	462
FEMALE	8	186	153	5	60	17	429
TOTAL	13	421	282	10	122	43	891

From the 2019 batch, 55 were found eligible to receive the DST-INSPIRE scholarship and 4 students qualified for the KVPY scholarship.

Sources of Fellowship for BS-MS students

Name of Fellowship	Nos.
DST-INSPIRE	391
KVPY	68
Total	459

Details of the Fifth-year projects carried out by the out-going batch of BS-MS students during 2019-20

Sl	Roll Number	Name	School	Supervisor	Title
1	IMS14091	Manas B Sharma	Biology	Dr. Ullasa Kodandaramaiah	Choice of Clock Model is not the Primary Factor affecting Accuracy in Estimation of Lineage Divergence Time Through Bayesian Inference
2	IMS15001	A.K. Avinash	Biology	Dr. S. Murty Srinivasula	Role of CARP2 in Regulation of Oxidative Stress induced Cell Death
3	IMS15004	Abdul Basith T	Biology	Dr. Jishy Varghese	Understanding the Role of Lint Gene in Drosophila Insulin Signaling and Development
4	IMS15022	Amanda Ben	Biology	Dr.Ullasa Kodandaramaiah	Influence of Behavioural Context and Multimodal Integration in the Colour Preference of Catopsilia Pomona
5	IMS15027	Anish Ruban S	Biology	Dr. Sabari Sankar Tirupathy	Investigating the Role of DNA Polymerase Pol Y1 In Promoter Base Substitutions and Indels
6	IMS15030	Anjaly P J	Biology	Dr. Tapas K Manna	Elucidating the role of Spindle and Kinetochore Associated Proteins in Microtubule- Kinetochore Interaction
7	IMS15031	Ann Mary Isaac	Biology	Dr. V. Stalin Raj	Understanding the Entry Mechanisms of Middle East Respiratory Syndrome Coronavirus (MERS-CoV)
8	IMS15036	Arathi Preeth Babu	Biology	Dr. Jishy Varghese	Regulation of Insulin Producing Cells Function by Slimfast
9	IMS15039	Arya Krishnan	Biology	Dr. Tapas K Manna	Structure-Function Studies of Spindle-Kinetochore Associated Proteins
10	IMS15040	Ashwathi Prithviraj	Biology	Dr. Nisha N Kannan	A Study on the Possible Role of CCHamide 1 in the interplay between the Circadian Clock and Metabolism
11	IMS15041	Asif Mohammed A N	Biology	Dr. Nisha N Kannan	Understanding the Molecular Basis of Circadian Clock Precision in Drosophila Melanogaster Populations Selected for Narrow Gate of Adult Emergence
12	IMS15052	Dheeraj K P	Biology	Dr. S. Murty Srinivasula	CARP2 is a Novel Regulator of Lysosomal Distribution and Acidification
13	IMS15056	Divya R	Biology	Dr. Ravi Maruthachalam	Insights of Naturally Occurring Superman Gene Standardising Crispr Mediated Mutation
14	IMS15066	Harikrishan J	Biology	Dr. V Stalin Raj	Production of Replication Incompetent Dengue and Japanese Encephalitis Pseudovirus
15	IMS15069	J. Haritha	Biology	Dr. Nishant K T	Analysis of Meiotic Mutants in Natural Hybrids of Saccharomyces Cerevisiae
16	IMS15072	Jewel Johnson	Biology	Dr. Hema Somanathan	Visual Ecology of the Giant Honeybee, Apis Dorsata
17	IMS15079	Krishnapriya Anirudhan	Biology	Dr. Ravi Maruthachalam	Role of Arabidopsis NNF1 in Polyamine Regulation
18	IMS15092	Mohammed Afsal B	Biology	Dr. Ravi Maruthachalam	Molecular Characterisation of Mini-Chromosome Induced Bushy Mutation in Arabidopsis Thaliana and SUPERWOMAN; A Natural Epiallelic Mutaion In SUPERMAN Gene
19	IMS15100	Nayana J M	Biology	Dr. N Sadananda Singh	Targeting the Uptake of 3- IODO-L-Tyrosine EMGFP in Mammalian Cells.
20	IMS15104	Pawar Omkar Eknath	Biology	Dr. Ullasa Kodandaramaiah	Spontaneous Colour Preferences in Two Satyrine Butterfly Species
21	IMS15115	Rakhshana B Krishnan	Biology	Dr. Ramanathan Natesh	Optimization of Crystallization Conditions Of Rv1377c from Mycobacterium Tuberculosis and other modes of obtaining Protein Crystals

22	IMS15126	Shastri Awanti Milind	Biology	Dr. Hema Somanathan	Understanding Mass Flights in Asian and European Honeybees (Apis Cerana and Apis Mellifera)
23	IMS15128	Siddhartha Yaddanapudi	Biology	Dr. Jishy Varghese	Deciphering the Role of miR-184 in Growth and Development of Drosophila Melanogaster
24	IMS15129	Sneha Santhosh	Biology	Dr. S. Murty Srinivasula	Validation of Antimicrobial Proteins Associated With ALIS (Aggresome Like Induced Structures)
25	IMS15133	Sowmiya B	Biology	Dr. Ramanathan Natesh	X-Ray Diffraction and Data Collection Of Mycobacterium Tuberculosis LexA mut
26	IMS15134	Sowmya S Geetha	Biology	Dr. Nishant K T	Genome-wide association of Slx1/Slx4 during Meiosis in Saccharomyces Cerevisiae
27	IMS15138	Sreerag S Reghu	Biology	Dr. S. Murty Srinivasula	Nuclear Translocation of CARPs
28	IMS15139	Sreerag Sreedhar	Biology	Dr. Satish Khurana	Understanding the Role of Integrin Signalling in Bone Marrow Niche Modulation
29	IMS15140	Srepriya M.S.	Biology	Dr. Sabari Sankar Thirupathy	Role of DNA Polymerase Pol Y2 in Collision-Induced Spontaneous Mutations
30	IMS15143	Suvarna. K	Biology	Dr. Hema Somanathan	Interactions of Optic Flow and Landmark Guidance During Food Search in Stingless Bees and Spatial Resolution and Contrast Sensitivity During Navigation of Tetragonula Iridipennis
31	IMS15147	Tharunya Thankachan	Biology	Dr. Satish Khurana	Effect of Niche Metabolism on the Hematopoietic Stem Cell Function
32	IMS15155	Zayana Ali	Biology	Dr. Nishant K T	An Alternative Hybrid for Meiotic Recombination Studies in Saccharomyces Cerevisiae
33	IMS14114	Rajat Kumar Singh	Chemistry	Dr. Alagiri Kaliyamoorthy.	Synthesis of Sulfonylated Indoles and Other Heterocycles & Recent Advances in Asymmetric 1,6-Conjugate Addition Reactions of para-Quinone Methides (p-QMs)
34	IMS15009	Adil Muhammed	Chemistry	Dr. R. S. Swathi	An Analytical Exploration of Graphene Derivatives for Gas Adsorption
35	IMS15012	Aiswarya M.P.	Chemistry	Dr. R. S. Swathi	A Computational Study on Anion-∏ Interactions involving Graphynes
36	IMS15016	Ajun E Muthu	Chemistry	Dr. Ramesh Rasappan	Acyl Electrophiles in Deaminative Crosscoupling Reactions and Substituted Phenanthroline Synthesis
37	IMS15018	Akhil Dev D	Chemistry	Dr. Kana M Sureshan	Synthesis of Oligomers/Polymers Via Catalyzed/Uncatalyzed Azide-Alkyne Cycloaddition
38	IMS15023	Amina Mohamed	Chemistry	Dr. Ajay Venugopal	Periodic Trends in Trispyrazolylborate Compounds: A Computational nvestigation
39	IMS15026	Ananya S	Chemistry	Dr. Subrata Kundu	A Functional Model For Carbon Disulfide Hydrolase Enzyme
40	IMS15034	Anvy Kuriakose	Chemistry	Dr. R. S. Swathi	Plasmonic Resonances in Ag-Au Nanoparticle Heterodimers: How Accurate are the Analytical Descriptions?
41	IMS15042	Asna V	Chemistry	Dr. Vinesh Vijayan	Aggregation Pathway of K19TH6 through Phase Separation
42	IMS15043	Aswathi Syam	Chemistry	Dr. Rajendar Goreti	A Chiral Pool Approach for Total Synthesis of (+)-Diaportinol and (-)-Peniisocoumarin H
43	IMS15058	Elgin Carlose	Chemistry	Dr. Ramesh Rasappan	Oxidative Cross-Coupling of Amines and Alcohols Catalyzed by Tempo Under Transition-Metal-Free Condition & Nickel-Catalyzed Silylation of Secondary Alkyl Methyl Ether via C–O Bond Activation & Nickel Catalyzed Synthesis of Acylsilanes from Carboxylic Acid Derivatives using Silylzinc Reagent

44	IMS15059	Faina Pinhero	Chemistry	Dr. Vinesh Vijayan	Structural and Aggregation Studies on the Prion Domains of CPEB3
45	IMS15063	Govind Behera	Chemistry	Dr. Gokulnath Sabapathi	Synthesis, Structure and Electronic Properties of P-Phenylene Incorporated Macrocycles
46	IMS15068	Hridya N	Chemistry	Dr. A Muthukrishnan	Oxygen Reduction Reaction Activities of La-Based Perovskite Oxides Incorporated With N- Doped Carbon Material
47	IMS15070	Jemshiya K	Chemistry	Dr. Reji Varghese	Design and Synthesis of Amphiphilic Dual Drug Conjugate for Combination Cancer Therapy
48	IMS15071	Jesni N J	Chemistry	Dr. Kana M. Sureshan	An Attempt to Synthesize 2D Polymer and Regioselectiveazide-Alkyne Cycloaddition In Cocrystals
49	IMS15073	Jithu Krishna	Chemistry	Dr. Reji Varghese	Disassembly Driven Approach for the Specific Detection of Telomerase in the Cancer Cells Using 19F NMR “OFF/ON” Response
50	IMS15083	Lakshmy Priya A	Chemistry	Dr. K. George Thomas	Bimetallic Nanostructures: Dependence of Core (Au) Size and Shell (Ag) Thickness on SERS
51	IMS15085	M S Ahammed Hussain Madhani	Chemistry	Dr. Kana M. Sureshan	An Attempt to Synthesize 2D Polymer via Topochemical Reaction
52	IMS15087	Meera Madhu	Chemistry	Dr. Mahesh Hariharan	Emergent Excited State Properties of Cofacial Chromophores
53	IMS15088	Meghna Sasi	Chemistry	Dr. Gokulnath Sabapathi	Fused Porphyrinoids and Related Macrocycles: A Structure Property Correlation
54	IMS15094	Muhammed Bilal A	Chemistry	Dr. Vinesh Vijayan	Using Saturation Transfer NMR Techniques to elucidate Transient Dark States Involved in Biological Processes
55	IMS15099	Nandita Mohandas	Chemistry	Dr. K. George Thomas	Chirality in Binaphthol Derivatives and Hexapod Oligo(Phenyleneethynylenes)
56	IMS15102	Nilima M	Chemistry	Dr. Reji Varghese	Design and Synthesis of DNA-Oligohexaphenylbenzene Conjugates
57	IMS15108	Priyanka P. Rajan	Chemistry	Dr. Vennapusa Sivaranjana Reddy	Ultrafast Intersystem Crossing in Core-Substituted Naphthalene Diimides
58	IMS15116	Rohith V S	Chemistry	Dr. Rameshrasappan	Synthesis of Pyridinium Salts and Acid Chlorides for Deaminative Cross-Coupling and Synthesis of Starting Materials for Photoredox Enabled Cross Coupling of Aldehydes and Pyridinium Salts
59	IMS15117	Roopesh M	Chemistry	Dr. Sukhendu Mandal	A New Series of Silver Nanoclusters Based on Thiolates & Phosphines Ligands
60	IMS15121	Sanath Raj Kk	Chemistry	Dr. Subrata Kundu	Reactivity Of Nitrite Anion at Copper(Ii) And Nickel(Ii) Sites
61	IMS15124	Shahana Nizar N S	Chemistry	Dr. K. George Thomas	Photophysical Properties of Molecular Aggregates: Theoretical and Computational Studies
62	IMS15131	Soniya Ahammad	Chemistry	Dr. Subrata Kundu	Nitrite Mediated Oxidative Transformations of Aniline at Copper(Ii)
63	IMS15136	Sreelakshmi M	Chemistry	Dr. Rajendar Goretti	Studies Toward the Total Synthesis of Serofendic Acid
64	IMS15142	Suryakanta Tanty	Chemistry	Dr. Sukhendu Mandal	Semi-Conductive Behaviour Of DPTTZ Based Metal-Organic Framework
65	IMS15151	Vishnu V.	Chemistry	Dr. Mahesh Hariharan	Aggregates of Organic Chromophores: Role of Weak-Interactions and Implications in Photophysics/ Opto-Electronics
66	IMS15156	Sravya Surendran	Chemistry	Dr. Rajendar Goretti	Enhanced Selectivity in Julia-Kocienski Reaction Using Quaternary Ammonium Salt

67	IMS15158	Vavilala Veera Bala Manikanta	Chemistry	Dr. Sukhendu Mandal	Synthesis of Ag-Pd Alloy Complex & Study of its Catalytic Activity
68	IMS13045	C H Saraswathy	Mathematics	Dr. Srilakshmi Krishnamoorthy	On Signs of Fourier Coefficients of Certain Modular Forms
69	IMS14084	M. Akhilesh	Mathematics	Dr. Sumit Mohanty	Algebraic Connectivity and Geometry of Trees
70	IMS14116	Richa Singh	Mathematics	Dr. Srilakshmi Krishnamoorthy	Hilbert-Waring Theorem
71	IMS15013	Aji Kurian	Mathematics	Dr. Sumit Mohanty	Moore Penrose Inverse of Incidence Matrix on Some Classes of Graphs
72	IMS15017	Akash Kumar	Mathematics	Dr. Saikat Chatterjee	A Study of Riemannian Geometry
73	IMS15024	Amrutha B Nair	Mathematics	Dr. Sarbeswar Pal	Sysygies of Modules
74	IMS15029	Anjali T C	Mathematics	Dr. M. P. Rajan	A Study on Mask R-CNN Algorithm for Object Detection
75	IMS15060	G Aswin	Mathematics	Dr. Shrihari Sridharan	Statistical Properties of Simultaneous Dynamics
76	IMS15064	Govind S	Mathematics	Dr. Devaraj P	Privacy Preserving Logistic Regression and Deep Learning
77	IMS15077	Kirthana R	Mathematics	Dr. Shrihari Sridharan	Counting of Closed Orbits
78	IMS15090	Mithun P V	Mathematics	Dr. Viji Z. Thomas	Class Field Theory: A Cohomological Approach
79	IMS15095	Muhammed Dilshah U	Mathematics	Dr. Dharmatti Sheetal	Application of Finite Element Method in Computational Nano-Optics
80	IMS15098	Nafia V K	Mathematics	Dr. Srilakshmi Krishnamoorthy	On the Prime Factors of X 2 − 1 & Odd Perfect Numbers
81	IMS15103	Nimisha B	Mathematics	Dr. Srilakshmi Krishnamoorthy	Cryptanalysis of Dual RSA and a Digital Signature Scheme
82	IMS15105	Chandana Deeksha	Mathematics	Dr. Dharmatti Sheetal	Application of the Finite Element Method to Image Processing
83	IMS15122	Sanjeev Nanda P	Mathematics	Dr. M. P. Rajan	A Study on Deep Learning Based Algorithm for Object Detection
84	IMS15135	Sreehari K	Mathematics	Dr. Srilakshmi Krishnamoorthy	Elliptic Curve Cryptography And Lattice Based Cryptography
85	IMS15144	Swetha Ganesh	Mathematics	Dr. Sumit Mohanty	Laplacian Matrix of Graphs With Matrix Weights on Edges
86	IMS15146	Tarini S	Mathematics	Dr. T. Geetha	Dualities in Strict Polynomial Functors
87	IMS15148	Vidya V.Babu	Mathematics	Dr. K. R. Arun	Kinetic Scheme for the Euler Equations
88	IMS15157	Dharmadhikari Ganesh Jayantrao	Mathematics	Dr. Srilakshmi Krishnamoorthy	Some Problems in Number Fields
89	IMS14011	Amit Kumar	Physics	Dr. Joy Mitra	Resistive Switching and ZnO as Memristor
90	IMS14027	Arun Kumar	Physics	Dr. Vinayak B. Kamble	Reduced Graphene Oxide (RGO) Deposition by Spray Pyrolysis
91	IMS14072	Kartike	Physics	Dr. Joy Mitra	Study Of ZnO as a Semiconductor
92	IMS15002	A P Sreehari	Physics	Dr. Bindusar Sahoo	Scattering Amplitudes in Gauge Theory and Gravity
93	IMS15003	Abdu Subahan M	Physics	Dr. Ravi Pant	Investigation of Intensity Modulation Based Frequency Combs in the 2μm Wavelength Regime

94	IMS15008	Adarsh Sudhakar	Physics	Dr. Suhesh Kumar Singh	Finite Element Method Based Scheme for Reconstruction of the Optical Absorption Distribution from Photoacoustic Signals
95	IMS15010	Adithiya Dinesh	Physics	Dr. Soumen Basak	Weak Lensing of Cosmic Microwave Background
96	IMS15011	Adithya Jayakumar	Physics	Dr. Deepshika Jaiswal Nagar	Hydrogen Sensor Based on Palladium Nanoclusters
97	IMS15015	Ajmal S	Physics	Dr. K. Shadak Alee	Coherent Perfect Absorber
98	IMS15019	Akshay S	Physics	Dr. Manoj A G Namboothiry	Area Dependence of Device Parameters in Bulk Heterojunction Organic Solar Cells
99	IMS15020	Aleesha P.A	Physics	Dr. Ravi Pant	Application of Multi-Fano and EIT-Like Resonances in Microwave Photonic Signal Processing
100	IMS15025	Anagha A G	Physics	Dr. K. Shadak Alee	PT-Symmetric Coupled Waveguides With Gain-Loss Asymmetry
101	IMS15032	Anoop K	Physics	Dr. Madhu Thalakulam	Phase Engineering 2D Materials by Ionic Liquid Gating
102	IMS15033	Aparna M. Das	Physics	Dr. M. M. Shaijumon	Transition Metal Based Nanoparticles Dispersed on Carbon Matrix as Efficient ORR Catalysts
103	IMS15035	Aparna Vasudevan K	Physics	Dr. Madhu Thalakulam	Electrostatic Control of Schottky Barrier in 2D Materials
104	IMS15037	Archa A Nair	Physics	Dr. Vinayak B. Kamble	Growth and Optimization of Nanorods for Enhanced Boiling Heat Transfer and Optoelectronics
105	IMS15048	Chandni Babu	Physics	Dr. Rajeev N. Kini	Study of Valley Carrier Dynamics of TMDCs Using Time-Resolved Second Harmonic and THz Generation
106	IMS15049	Ciril S Prasad	Physics	Dr. M. M. Shaijumon	Carbon-Based Materials for Electrocatalytic Co2 Reduction: Effect of Heteroatom Doping
107	IMS15054	Dhruv	Physics	Dr. Vinayak B. Kamble	Mixed Oxide Coatings by RF Magnetron Sputtering for Spectrally Selective Solar Absorbers
108	IMS15055	Disha Brahma	Physics	Dr. Amal Medhi	Restricted Boltzmann Machine Learning of Kitaev Heisenberg Ladder Model
109	IMS15057	Dumpala Tirumalarao	Physics	Dr. Deepshikha Jaiswal Nagar	Synthesis of Phase Pure Nano-Sized Powders Of Ba-ZrO3 by Optimising the pH Conditions in a Sol-Gel Autocombustion Technique
110	IMS15061	Gaayatri Chandrasekharan	Physics	Dr. Sreedhar B. Dutta	Application of Minkowski Functionals in Two-Phase Systems
111	IMS15074	Joyal John Abraham	Physics	Dr. R. C. Nath	Investigation of the Ground State Properties in a Kitaev Honeycomb Lattice BiYbGeO5
112	IMS15075	Jyothis Chandran	Physics	Dr. Soumen Basak	Harmonic Domain Internal Linear Combination (ILC) for Analysis of CMB Data and the effect of Its Bias
113	IMS15078	Krishna Kumar	Physics	Dr. D. V. Senthilkumar	Effect of Adaptive Couling Using Low Pass Filters in Mean-Field Diffusive Coupled Dynamical Oscillators
114	IMS15093	Muhammad Arshad T P	Physics	Dr. K. Shadak Alee	Whispering Gallery Mode Based Light Amplification in Micro-Droplets
115	IMS15096	Muhsin Vannan Chalil	Physics	Dr. M. M. Shaijumon	Investigation of Ni Based Materials for Energy Storage and Conversion Applications
116	IMS15097	Muthusamy R	Physics	Dr. Bindusar Sahoo	A New Density Formula in N = 2 Conformal Supergravity
117	IMS15101	Neha K	Physics	Dr. Deepshikha Jaiswal Nagar	Thermal Expansion Measurements of Solids using Capacitive Dilatometry

118	IMS15107	Praseeda M S	Physics	Dr. Anil Shaji	Non-Markovianity and Divisibility in Open Quantum Dynamics
119	IMS15110	R. Naveen Kumar	Physics	Dr. K. Shadhak Alee	Random Lasers
120	IMS15112	Raghav Chaturvedi	Physics	Dr. Amal Medhi	A Study of Metal-Insulator Transitions in Twisted Bilayer Graphene using Z2 Slave Spin Theory
121	IMS15118	S.Kalyani	Physics	Dr. Vinayak B. Kamble	Thermoelectric Study of LaCoO3/La1-xSrxCoO3 Super-lattice Thin Films by RF Magnetron Sputtering
122	IMS15119	Saddal Kuljeet Singh	Physics	Dr. Sreedhar B. Dutta	Relativistic Hydrodynamics
123	IMS15125	Shahla Yasmin M	Physics	Dr. Rajeev Kini	Non-Linear Terahertz Spectroscopic Studies in Sr-14Cu24O41
124	IMS15127	Sheena Shaji	Physics	Dr. Anil Shaji	Electronic Study of 2-D Electron Gas in Si/SiGe Hetero-structures
125	IMS15132	Sharath Sasiku-mar	Physics	Dr. Joy Mitra	Use of Axially Symmetric Polarized Light for Spectral Analysis of Plasmonic Focusing
126	IMS15137	Sreelekshmi Pillai	Physics	Dr. Sreedhar B Dutta	Periodically Driven Kinetic Ising Models
127	IMS15141	Sulochana R	Physics	Dr. Amal Medhi	Ab-Initio Determination of Thermoelectric Properties of ZrIrSb
128	IMS15145	Syam Prasad S	Physics	Dr. M. Suhesh Kumar Singh	Finite Element Method(FEM) Based Study on Diffuse Optical Tomography
129	IMS15149	Vinu K. Vijaya-kumar	Physics	Dr. Deepshikha Jaiswal Nagar	Detection of Chemicals Using Surface-Enhanced Ra-man Spectroscopy
130	IMS15152	Vishnulal C	Physics	Dr Soumen Basak	Emission of Gravitational Waves and Post-Newtonian Approximation

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ACTIVITIES

- The Open mike sessions that were organized to welcome the old and new students provided students a platform to showcase their talents.
- Students at IISER TVM are constantly reading scientific papers, monographs, textbooks as part of their academic pursuits, it is also important for them to look at more relaxed/general reading material. The Book Club of IISER TVM provides students the right ambience for sharing views and having open discussions on books, articles, short stories, essays, poems that they enjoyed reading and consider it a safe space for social interaction and free exchange of ideas and opinions.
- To celebrate Hindi Divas, many competitions such as solo and group song, JAM, debate, story writing and poem recitation were conducted. The events were not limited to students, a memory test competition was conducted exclusively for the staff of IISER TVM
- The 2019 Independence Day celebrations was a colourful mix of cultural events, quiz, debates, essay writing and patriotic song competitions.
- IISER TVM celebrated India's 71st Republic Day by organizing a quiz, essay writing competition and patriotic song competition.

School quiz - Utsuk

Collaborated with Kappa TV, a prominent Malayalam music and entertainment channel, to provide an opportunity to students to perform in an episode.

SPICMACAY

- The Independence Day celebrations at the Institute came alive to the strings of the sitar and the beats of the tabla by none other than the Sitar Maestro Pandit Kushal Das and the noted Tabla player Shri. Sandip Ghosh. The program was well attended and had the audience spell bound to the soulful music. Pandit Kushal Das has performed in music festivals all across the globe and it was indeed a privilege to have him amongst us. This event was organized under the auspices of Spic Macay.

MOVIE CLUB

Several films were screened in the first half of the year, ranging from recent hits like Jojo Rabbit and Gully Boy to cult classics like Monty Python and the Holy Grail.


IISER THIRUVANANTHAPURAM PRESENTS


IISER THIRUVANANTHAPURAM PRESENTS

INTER IISER CULTURAL MEET 2019

IICM 2019 (Inter IISER Cultural Meet) was held from 20th to 22nd of December, 2019. Students from all seven IISERs (Berhampur, Bhopal, Kolkata, Mohali, Pune, Thiruvananthapuram, Tirupati), IISc Bangalore, and CEBS Mumbai attended the event.

The following competitions were conducted as part of IICM 2019:

- Battle of bands
- Mudra (Group dance competition)
- Debate
- Synchro (Split screen dance competition)
- Short story writing
- Face painting
- Vyaktitva (Personality Contest)
- JAM (Just A Minute)
- Drama
- Afreen (Fashion Show)
- Aalap (Duet Singing)
- Quiz
- Poem writing

Online events:

- Short film
- Photography

The program concluded with IISc Bangalore bagging the championship of the meet, followed by IISER Kolkata as the first runner up and IISER Thiruvananthapuram as the second runner up. A live performance by the popular band 'When Chai Met Toast, at the closing ceremony of IICM 2019 was a fitting finale to the 3-day long festivities

IICM 2019 was a runaway success because of the enthusiastic support from the Director, Prof. J N Moorthy; the Registrar, Prof. S. Murty Srinivasula; DoSA, Prof. R C Nath; faculty members and the collective effort and exemplary team work of 130+ volunteers.

ISHYA 2020

ISHYA, the annual cultural meet of the Institute began in March 2020. Literary events such as Short Story writing, Essay writing, and Poetry competitions were conducted in English, Hindi, and Malayalam. The rest of the planned events had to be called off due to the imposition of the nation-wide lockdown to prevent the spread of COVID 19.
However, a few events were partially resumed online by the title e-ishya; "Show Off: WOW" (a competition to celebrate feminist icons around the world), and a vine event.

Science & Technology Council

ANVESHA

Crime Scene Investigation

CSI 8.0 has several firsts to its credit. For the first time it was an inter-collegiate event, the preliminaries were conducted exclusively online, and the finals was completely offline. We had an overwhelming response to the event with 120 teams participating in the preliminary round. Teams from various academic institutions from different districts in Kerala and a few from outside the state participated in the event. About 25 teams were from outside the Institute, the remaining teams were from IISER TVM.

Public lecture - Entanglement

As part of its Outreach activity IISER TVM engages with schools and other educational institutions, and interacts with the students, parents and teachers of these institutions. Invitations were sent to 16 schools requesting them to nominate 15 students from class 9/10 and 15 from class 11/12, to participate in the Public Lecture Entanglement.Our Outreach programs are given sufficient publicity in the print media to ensure wider reach and participation.

About 400 students from 8 schools - 5 from Thiruvananthapuram, 1 from Kollam and 2 from Vithura - participated in the event. Lectures by faculty/students from all four departments of IISER TVM were followed by a presentation on how to secure admission to IISER TVM.

School quiz - Utsuk

Around 40 teams (about 75 participants) participated in the open school quiz competition. The traction was largely due to the individual invitations sent to a number of schools and the advertisements issued in the print media.

Prize money worth Rs. 10000 (Rs. 3500 - 1st + Rs. 2000 - 2nd + Rs. 1000 - 3rd + 5*Rs.500 - a consolation prize for the rest of the finalists) was distributed among the winners. All the students and parents stayed till the finals was over. Both parents and students were equally appreciative of the efforts taken by IISER TVM to conduct the quiz, and of the quality of the quiz programme.


Plants in Motion
Secret lives of plants
Ravi Maruthachalam
School of Biology
IISER-TVM


MATHEMATICS

Expo: Affiicionados

All the exhibits at the Expo -
Physics -12 exhibition stalls; Chemistry -16 experiments;
Mathematics - 14 posters and 5 working models;
Biology - 18 exhibition stalls
received good reviews from everyone who visited the Expo.
The UBA took special interest in bringing school children from neighbouring villages to the exhibition and allowed them to conduct simple experiments, which was enthusiastically received by the students. In addition, these school children were also provided pens and notepads and lunch at IISER TVM giving them a fun-filled and exciting learning experience.

Contraption

The Ruthberg Gold Machine was an attention grabber even though the process had a few glitches and was not completely successful. This contraption that lasted for 1.5 minutes was built by 25 highly motivated and enthusiastic students from Batch 18 &19.

Nobel lecture series

In this event, faculty members presented the path-breaking research of Nobel Prize 2019 winners in Biology, Chemistry, Mathematics and Physics .This was a major crowd puller and a record number of faculty and students participated in the event . In fact, the seating arrangement provided, fell short of the requirement and students gathered around the corridors so as not to miss out on these lectures.

Black Box

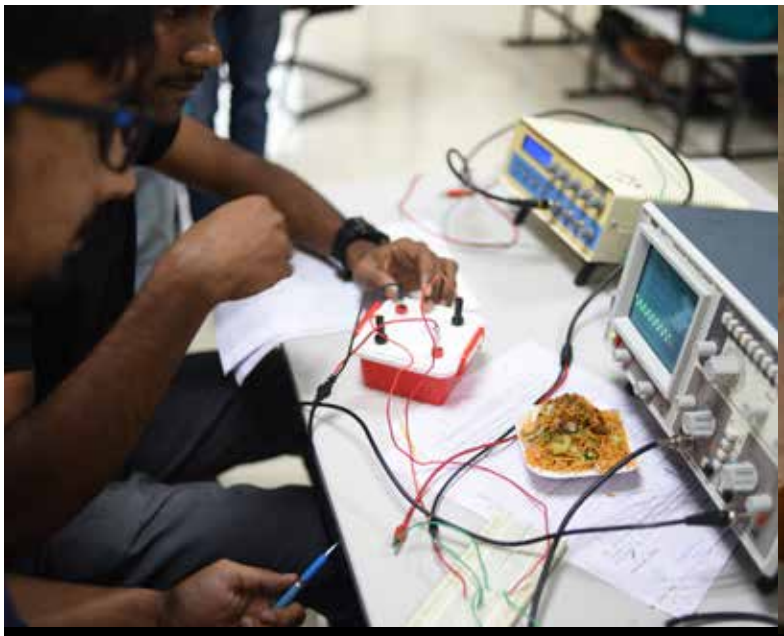
A brand-new activity designed exclusively for Anvesha 2019 had about 15 teams participating in the event. The teams had to solve an unknown circuit with the electrical instruments provided to them. All participants were excited and enthusiastic to share their feedback on this event.

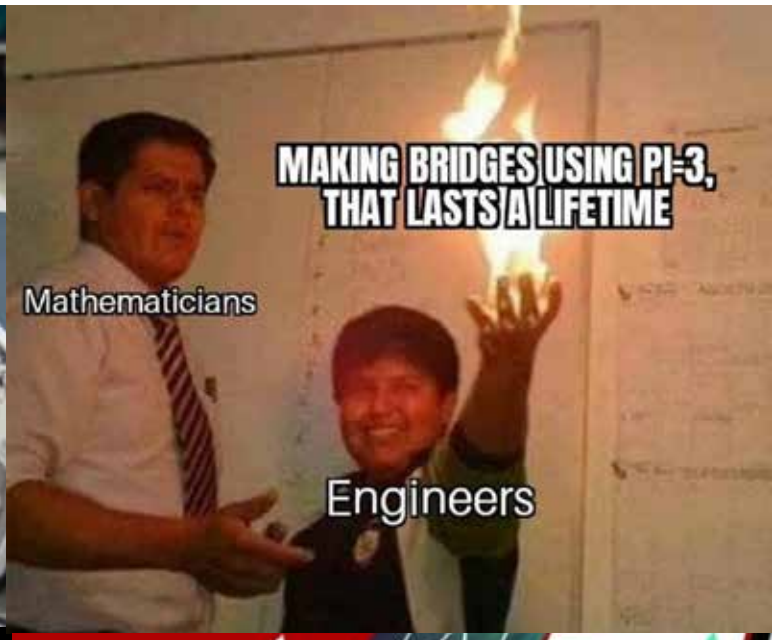
Bad ad Hoc hypothesis presentation

This was another totally new relaxing event introduced this year. The event had 4 witty and fun-loving participants performing to about 80 odd spectators, who seemed to have thoroughly enjoyed the presentations.

Memecon

Online meme submission. Reach of over 10k audience and around 50 original submissions.




MAKING BRIDGES USING PI=3,
THAT LASTS A LIFETIME
Mathematicians
Engineers


Into Their Minds


1 YEAR OF
EXHIBIT
ISSUE NO. 2
EXHIBIT
ISSUE NO. 10
ISSUE NO. 12

Resenseo

The scientific review writing competition had 80 registrations this year, with more than 50% of them from outside the Institute. Students from varied backgrounds including IISERs, IITs, Medicine, Engineering and regular government-run colleges participated in the event.

Pi Day

We celebrated Pi- Day on March 14, 2020. A memecon on Pi was conducted as part of the celebrations. About 50 entries were received of which Ankit Pradhan's (Batch 16) received the maximum number of likes (877) followed by Gokul Prabhu's (Batch 17) with 629 likes.

Into Their Minds (ITM)

ITM is the brainchild of Gokul Prabhu (Batch 17) and the Council. It provides a peep into the minds of people who have made significant and remarkable contributions to science and society. It is an effort to not only understand their academic and professional accomplishments, but also learn first-hand, what motivates and excites them, how they deal with roadblocks/setbacks, tips on how to stay focused and grounded in reality at all times, pitfalls to avoid in the pursuit of success and recognition. Prof J. N. Moorthy, Prof. Vikram Patel, Dr. Rakesh Mishra, Mr. Bittu Sahgal and Dr. Bivash Pandav have featured in ITM.

Exhibit A

The first edition of Exhibit A, the monthly Science Newsletter of the Science & Technology Council was released on September 2019. The current editor in chief, Balram Vishnu Subramani, heads a team of writers and editors who regularly contribute to the newsletter. Students outside the content creation team are also encouraged to contribute photographs, cartoons, comics and so on. A large section of the newsletter is devoted to new discoveries/research, reviews, interviews with scientists and high achievers in science. The newsletter helps students stay abreast and up-to-date on emerging sciences, technologies and products.


Wildlife Quiz 2020
- Naveen and Anumit

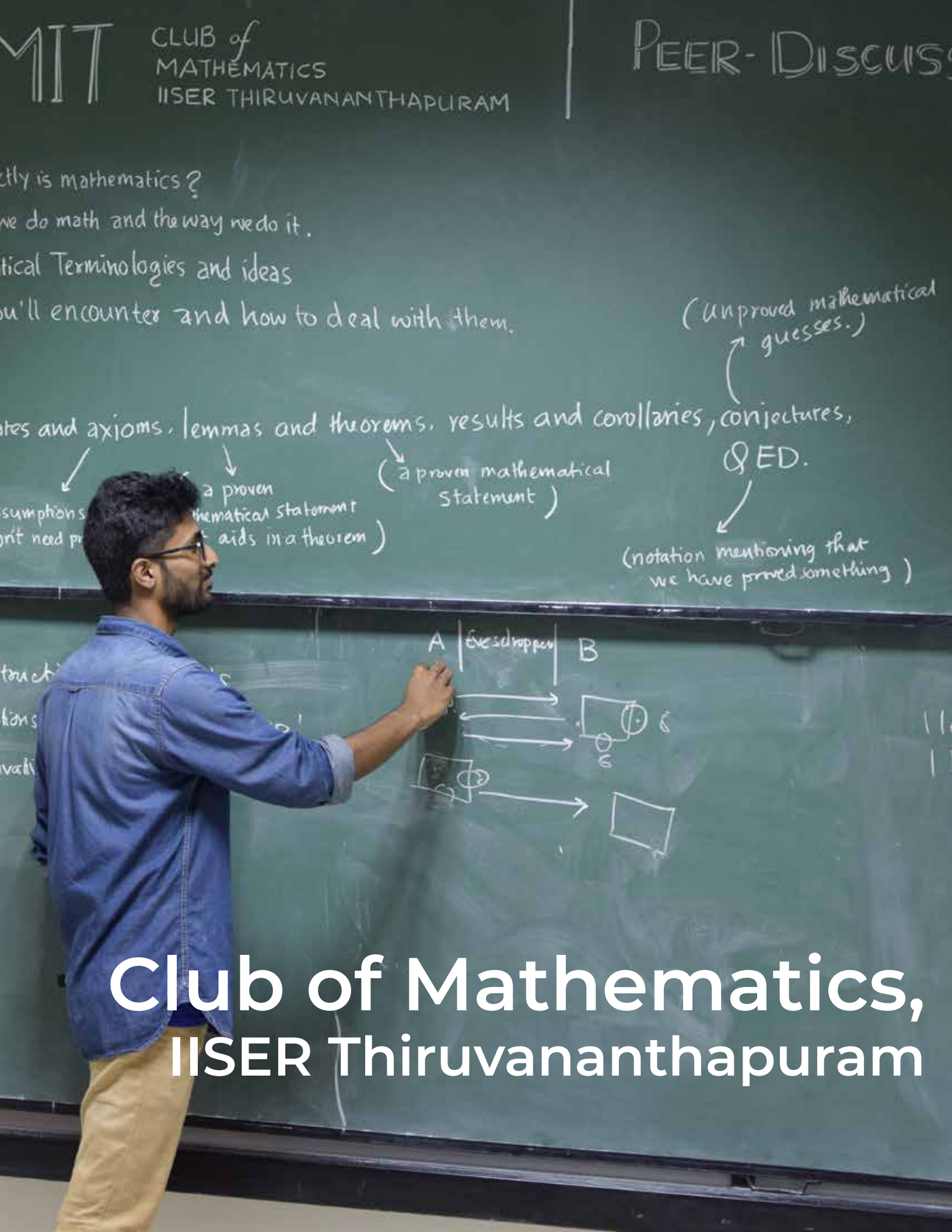

Why are we afraid of snakes ?

ECOLOGICAL SOCIETY OF IISER

Ecological Society of IISER-TVM conducted Wildlife Week celebrations in the first week of March 2020 (3/3/20 to 11/3/20). The following events were conducted:

- ***Wildlife Quiz*** (3/3/20): hosted by Naveen B (B'19) and Anumit S (B'17) was won by Kartik Bhide and Gayatri Anand from Batch 17 while Siddhartha Y from Batch 15 was the runner-up.
- ***Speak Up*** (4/3/20): an event where participants speak about any topic of their choice for a specified length of time and are judged on the content quality, fluency and delivery. J. Vishwathiga from Batch 19 won the competitiopn, the runner up was Siddhartha Y from Batch 15.
- ***BAHFest*** (5/3/20): Bad Ad-Hoc Fest is where the speaker provides support to an absurd incorrect hypothesis while being challenged by the judges and the audience. Kartik Bhide (Batch 17 was judged the winner and Siddhartha (Batch 15) was the runner-up.
- ***Birding Experiences with Sudeep R*** (6/3/20): Sudeep R talked about how he got interested in studying birds and also included a short sequence on introducing newcomers to bird-watching.
- ***Vazhvanthol excursion*** (7/3/20): A group of thirty nature-enthusiasts hiked to Vazhvanthol waterfalls while appreciating the richness of one of the biodiversity hotspots closest to IISER-TVM.
- ***Bonacaud excursion*** (8/3/20): A group of 25 people went to Bonacaud to learn about the flora and fauna of the location.
- ***Herping Adventures by Sreejith Allipra*** (9/3/20): Sreejith Allipra conducted an informative session on snakes and his adventures in the field while looking for snakes and other reptiles.
- ***JAM*** (10/3/20): JAM challenges participants to speak continuously for a minute on a given topic without pausing, repeating, deviating or faltering. This event hosted by Siddhartha Y (Batch 15) was won by Sharang Iyer (Batch 18) and Kartik Bhide (Batch 17) was the runner-up
- ***Documentary Screenings:*** The following documentaries were also screened at the Indoor Stadium Classroom every evening:
    - Racing Extinction
    - The Real Black
    - Panther The Cove
    - Dancing with the Birds
    - Wild Karnataka
    - Chasing Ice
    - The Last Honey Hunters.

All winners would receive customised coffee mugs, when the Institute resumes classes from the campus once the lock-down is lifted. ESI also released laptop stickers and badges as a part of ESI Merchandise. These will be distributed when students return to campus.



Club of Mathematics,
IISER Thiruvananthapuram

Vasanth 2019

With the Vasanth 2019 semester nearing an end, CMIT had just concluded Epiphany, the annual pre-PhD level mathematics tournament of the Club of Mathematics. Epiphany was conducted as a part of the π-Day celebrations in March and had exciting prizes.

Varsha 2019

The new batch of students joining the Varsha semester 2019 were introduced to the Club of Mathematics and to its agenda and activities. With the start of the Varsha 2019 semester, CMIT resumed the Weekly Problems Contest. The Problems for Week 04 were posted on August 05th. A bonus problem was posted on August 06, 2019 in memory of the Norwegian mathematician Niels Henrik Abel, and the ones to solve the problem first received a piece of the rare, highly sought after and treasured Hagoromo Fulltouch White chalk.

The club resumed the CMIT Peer Discussion Sessions for the semester and the first session was conducted on August 16th, followed by sessions on August 27, September 04 and 13th, October 31 and November 15th. These sessions were followed by meetings to discuss potential projects and activities for Aficionados, the science expo event of Anvesha 2019. CMIT took charge of the mathematics section of Aficionados with an energetic group of presenters who made this year's event one of the biggest and best so far. There were fifteen exhibits spanning various areas of mathematics and its applications and they also had a special series of posters commemorating the contributions of Michael F Atiyah, Karen Uhlenbeck (Abel Prize 2019 winner) and Vincent Lafforgue (Breakthrough Prize 2019 Winner). CMIT also conducted Integration Bee on September 20th as a part of the institute science fest. The Grand Integrators received exciting cash prizes sponsored by Anvesha. CMIT was overwhelmed with the response from visitors to this years exhibits at the Aficionados.

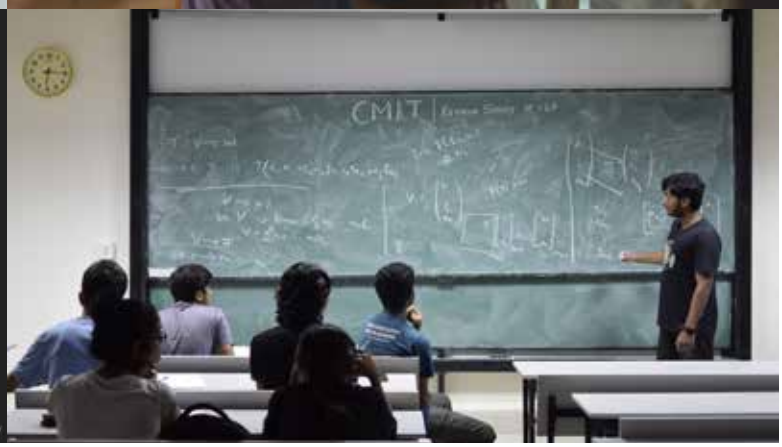
CMIT introduced a new short math activity series for interested people, called the CMIT Review Series to be conducted over two weeks with about 2 classes per week. The primary intent of this activity was to recap the concepts frequently used in advanced courses. The first session was held on August 17 focusing on topics in Linear Algebra.

The CMIT website started a new page 'SoM Department Events' that provided information on seminars/colloquia/events organised by the School of Mathematics, IISER TVM.

The discussion portal of CMIT was set up as a space for students to share/discuss/clarify math related queries/doubts/problems in any section of the subject. Considering the extensive use of this space and the high quality of discussions in its pages and acknowledging its potential to serve as good reference and resource material, the portal was upgraded to a CMIT official discord server in the later part of 2020.


2019
ABEL PRIZE
WINNER


2019
2019
2019


CMIT

On November 5th, a live-streaming of the public lecture by Professor Bruce C Berndt (UIUC) titled 'Living with Ramanujan for 40+ Years' was screened by CMIT. The club resumed the CMIT talk series, with a talk by Joyentanuj Das, a Ph. D. student at the institute, titled 'Turan's Theorem' on November 6th.

Vasanth 2020

The Faculty Coordinator for CMIT submitted a proposal outlining the structure, agenda, activities and requirements of the Club to the Math Department at IISER TVM. January 2020 saw the resumption of the Peer Discussion Sessions in its new focused structure. The first session was on January 10th (MMC Special), followed by sessions on January 17th (Pigeonhole Principle and Group Theory), January 24th (Invariance Principle and Group Theory), January 31st (Probability, Geometry, Linear Algebra).

Continuing with the CMIT talk series from the previous semester, a guest talk by Prof. Chandan Singh Dalawat (HRI, Allahabad) was hosted on January 28th. It was titled 'Two footnotes to Galois's Memoirs'.

Keeping in mind the needs of mathematics major students preparing for national graduate level competitive exams, CMIT introduced a new program from February 01, 2020 - Preparation for national graduate level exams in Math. The program hosted several group discussions and problem-solving sessions that greatly helped students.

Ph. D. students from the CMIT mentored an outreach program that not only provided information on the Mathematics department at IISER TVM but also put up some demos detailing the kinds of research activities carried out at the Institute.

The Pi- day celebrations at the institute was cut short due to the sudden imposition of a nation-wide lock down lock. This did not completely dampen the spirits of the CMIT members, contests were conducted online which was enthusiastically received by students. The events were π liners! : A battle of puns, Freehand Bourbakis! : Freehand circle drawing contest, and Chasing the radii : A unique photography competition.

Student Welfare Council

MESS

Since 2013, the Mess at IISERTVM has been a completely student-run enterprise, and has been one of the most successful student endeavors at the Institute. The Mess Committee handles all aspects of the mess, starting from procuring groceries, managing staff, handling finances to waste disposal. This fully operational mess provides a variety of meals, three times a day for more than 1200 students and guests. In addition to the mess, the committee also manages 2 fully operational cafes that serve a wide variety of short-eats/snacks/mini meals at very affordable costs. The Mess committee also coordinates food arrangements for special events such as Convocation day, IICM, Foundation day and other important Institute functions/events.

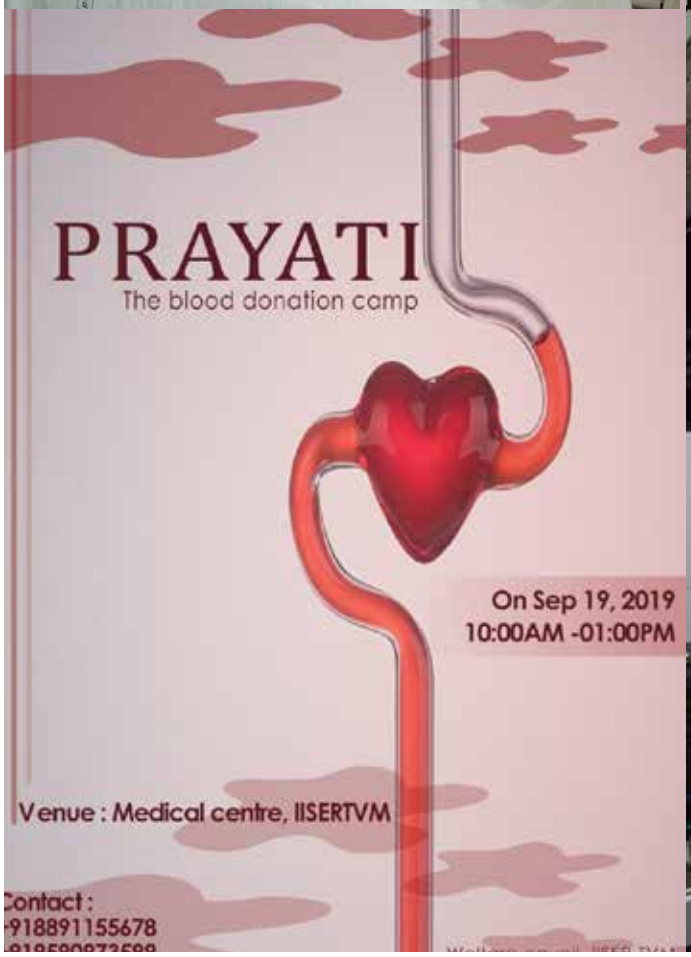
PLACEMENT AND ALUMNI AFFAIRS

In October 2019, the Student Welfare Council along with student volunteers, set up the Career Development and Placement Cell of IISER TVM. The SWC is working on developing an ongoing relationship with industrial/scientific establishments, R&D organizations and other institutions where graduating students can find meaningful and fulfilling employment. The alumni database is also being updated and there are plans to establish regional chapters of the Alumni Association.

MEDICAL CENTRE

The Medical Centre of the Institute organized two blood donation camps in 2019, the first one on April 03, 2019 and the second one on September 19, 2019 where students of the institute voluntarily came forward to donate blood.


What's that snake?
A photographic guide to the snakes of IISER-TVM


PRAYATI
The blood donation camp
On Sep 19, 2019
10:00AM -01:00PM
Venue : Medical centre, IISERTVM
Contact :
+918891155678

COUNSELLING CENTRE

The Counselling Centre at IISER TVM extends professional counselling support to students who need assistance to work through their problems and overcome emotional/social/mental health issues. Dr Anju Mathew, Associate professor of Psychiatry delivered a talk on January 23, 2020 titled 'Healthy ways of coping with crisis in life'. This talk was jointly organized by the SWC and the Counselling Centre.

OTHER ACTIVITIES

The SWC was also actively involved in creating awareness about a range of issues that could greatly improve the quality of life in IISER TVM. A cleanliness drive was conducted in the campus, separate waste bins for biodegradable and non-degradable waste, ensuring segregation of waste at source, were set up along the walkways to ensure there was no littering inside the campus.

Water scarcity is a hard reality today and it is every individual's responsibility to use water judiciously. A campaign to Save Water was organized by the SWC on April 19, 2020.

IISER TVM adjoins a natural reserve and snakes are a common sight in the campus. To stall any mis-information/fear being spread about snakes, the SWC brought out a set of posters that helped students distinguish poisonous snakes from non-poisonous ones, do's and don'ts when one spotted/encountered snakes, and also shared a helpline number in case of any emergency related to snakes.

The SWC was also proactively involved in spreading awareness about the corona virus within the campus, they not only displayed posters in strategic locations but also distributed these posters among the campus population.

Sports Council

IISM

The Inter IISER Sports Meet 2019 was hosted by IISER Pune from December 10-14, 2019 and included teams from the 7 IISERs, NISER Bhubaneswar, IISc Bangalore and the CEBS Mumbai. The Medal tally of IISER TVM in individual events included 4 gold, 3 silver and 8 bronze medals. In the team events our boys team won the gold medal in the 4x400 m relay and a silver medal in the 4x100m relay and bronze medal for basketball. Our girls' team performed well in the team events winning a silver medal in table tennis, and bronze medal in football and kho-kho events. Competition was tough and our teams were neck to neck in the quarter finals rounds in most events, and in most cases missed getting to the semi-finals by a whisker! Our athletic team was declared the Athletics Champion of IISM 2019 and in the overall tally we were placed in the 6th position. Akshay Raj was our star performer, winning the Best Athlete award for 2019.

ITSAV

This is the annual sports fest of IISER TVM and is usually a month-long event with the 4 teams Ruby, Sapphire, Diamond and Emerald competing in about 11 sports events including team sports, track and field events and indoor games. Inclement weather played spoilsport and all outdoor sports events were cancelled. Indoor games like chess, basketball, table tennis and badminton were conducted in tournament format starting from August 22, 2019.

INTRA IISER TOURNAMENTS

These events are conducted annually, usually spread over the months of January, February and March. Students from different batches compete for the championship in the following sporting events - cricket, football, basketball, badminton, volleyball and chess. Unfortunately, none of the league matches/ tournaments progressed beyond the semi-finals stage due to the imposition of a nation-wide lockdown from March 25, 2020 to prevent the spread of COVID 19. The two exceptions were the Boys Football tournament and the Intra batch badminton tournament. Six teams, one each from each year of the BS-MS program, and one team of Ph.D. students participated in the Boys Football tournament. The finalists were B-15 and B-16. The defending champions B-16 retained the championship title but it was not won without fierce competition and a nail-biting finish from B-15.

The Intra-batch Badminton tournament had participants not only from BS-MS and Ph.D. batches, but also faculty and staff of IISER. The Finals was conducted on January 26, 2020. Batch -17 emerged winners in the boys' team and PHD 1 as runners-up. In the girls' team, Batch -15 won the championship and Batch-17 were the runners-up.

OUTREACH PROGRAM

OUTREACH

The outreach programs of IISER TVM takes several forms- presentations, public talks, lab visits, workshops, training programs. Each of these programs are announced in advance and participation in these events is growing. We take interest and pride in talking about our research with teachers, school and college students, researchers, faculty from other institutions, industry and general public and explain to them the benefits of research to society. Between September 2019 and March 2020, we had more than 1235 visitors to the Institute, about 60-70% of who were from different parts of our state. We also had visitors from Maharashtra and Tamil Nadu.

The primary focus of our outreach programs with school and college teachers is to introduce them to new resources, tools and methods of teaching which would make both teaching and learning a more interactive, engaging and enjoyable experience. Our interaction with students is different, we introduce pure sciences as an appealing and fascinating branch of study and kindle student interest with quizzes, lab experiments and interactive talks. Visitors are taken to the various schools and facilities - labs, library, CIF within the campus and allowed to interact with students and faculty. The training programs, camps, talks that IISER TVM organizes are well attended and requests for such interactions has been growing over the years.

Schools visited
under the program

School/College	State	Visitors
Govt. College for Women	Kerala	32
Cholan Matric Hr Sec School	Tamilnadu	42
Springs Int'l School	Kerala	78
Mar Athanasius College	Kerala	44
Rajagiri Public School	Kerala	121
Sigaram Academy of Excellence	Tamilnadu	54
Nanjil Catholic College of Arts and Science	Tamilnadu	98
Sndp Yogam Arts and Science College	Kerala	16
Nanjil Catholic College of Arts and Science	Tamilnadu	27
St.Teresa's College	Kerala	32
Thiagarajar College	Tamilnadu	58
Mar Thoma College for Women	Kerala	33
St Behanans HSS Vennikulam	Kerala	47
Mar Ivanios College (Autonomous)	Kerala	57
St.John's College	Kerala	45
St. Thomas College(Autonomous)	Kerala	33
St.Georges VHSS	Kerala	89
University of Kerala	Kerala	20
University College, Tvm	Kerala	14
Government Vidarbha Institute of Science and Humanities	Maharashtra	27
Holy Cross College (Autonomous)	Tamil Nadu	46
St Berchmans College	Kerala	49
Sri Paramakalyani College	Tamil Nadu	21
Holy Cross College (Autonomous)	Tamil Nadu	39
MES Ponnani College	Kerala	53
St. Paul's College, Kalamassery	Kerala	25
Sri Vyasa Nss College	Kerala	35
	Total	1235


GO MAD! WITH ANVESHA, 19

SUPPORT STRUCTURE

IT SECTION

During the year, Padmanabha, the high performance computing cluster with a peak computing power of 141 Teraflops was made operational. The cluster is being used for computations involving Gaussian, Quantum Expresso, GROMACS, MATLAB, Bio informatics freeware, Intel Parallel Studio XE, Python, Perl etc.

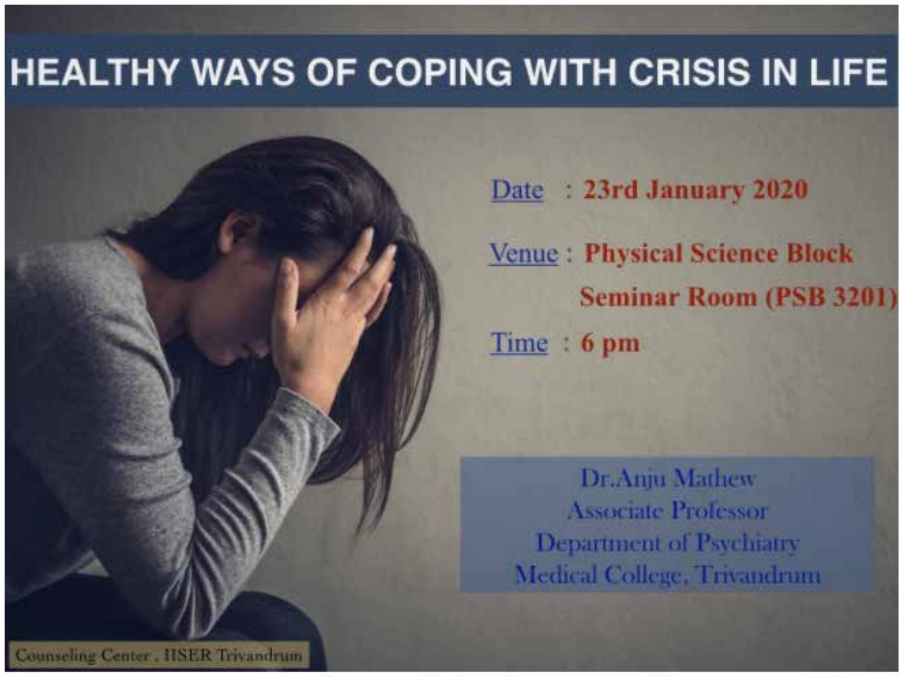
All class rooms in the institute are provided with state of the art audio visual equipment. The institute has a fully functional virtual classroom funded by the NKN project. The classroom has been in use for course exchange between IISER Thiruvananthapuram, IISER Pune, IISER Bhopal, NCBS Bengaluru and TIFR Centre for Applicable Mathematics in Bengaluru. The virtual classroom facility also allows for streaming of research talks and colloquia from other premier institutes in the country. It also allows for the recording and storage of lectures and seminars organized by the institute.

The NKN provides 1Gbps Internet connection to the Institute. The secondary Internet connection of 1Gbps is provided by M/s BSNL. The IT Section manages the dual Internet connections, Firewall, LAN, campus wide wireless network, Email Service, DNS, ADS and related network services in addition to the management of the Padmanabha cluster. The IT personnel of the Institute provide both hardware and software support to the faculty, staff and students and manages the computer labs. The IT Section also manages all the IP phones and IP cameras installed in the campus.

COUNSELLING CENTER

Mental health problems are very common among college students. Student mental health services are not only needed to support the psychological well-being of students, they are also an important part of academic success and retention. The IISER Thiruvananthapuram Counselling Centre provides mental health services to students, to help them cope/overcome their psychological problems and associated distress. The Centre has well qualified and experienced professionals Dr. Neelima Gopinath, (consulting Psychologist) and Dr. Mary P.R, (consulting Psychiatrist) who have been providing excellent counselling and treatment to students. Students seeking professional help have reported enhanced mental health, overall well-being and a definite improvement in the quality of their life.

The stigma attached to mental health is slowly decreasing and students who need support are not shying away from seeking help. Between April 2019 and March 2020, the Centre had about 135 students seeking professional help, of which 55 were follow-up consultations and the remaining 80 were students seeking help for the first time. The number of counselling sessions needed varies from student to student. While some are able to get back to normal life with a few sessions, some others need extended support. Of the 80 new students, 12 of them were referred to the consulting Psychiatrist for further evaluation and treatment.



The Centre conducted 305 counselling/psychotherapy sessions in the past year. The number of BS-MS students seeking counselling (93 students) was higher than the combined (42 students) number of Ph. D., IPh. D., Post-Docs and Project students. The Centre maintains detailed case files of every student who seeks counselling /treatment at the Centre. The case files are kept strictly confidential in adherence to Doctor-Patient confidentiality.

Most students seek counselling for one or more of the following - stress related to academic demands, relationship and family issues, personal problems. The most common diagnosis included primary mood disorder and adjustment disorder, while a few students also exhibited borderline personality traits. Based on the diagnosis, students are supported through counselling, psychotherapy, stress management programs and medication whenever necessary.

The Counselling Centre invited Dr. Anju Mathew, Associate Professor, Department of Psychiatry, Medical College, Trivandrum, to deliver a talk to students of IISER TVM. Her talk “Healthy Ways of Coping with Crisis in Life”, on 23 January, 2020, was well attended and students actively participated in the discussions that followed. The Centre plans to organize more seminars, talks and lectures throughout the academic sessions.

An orientation program is organized, by the Centre, for every fresh batch that joins the Institute, where students are informed of the facilities available at the Centre, and how students can benefit from these services. The Centre also has a counselling web page where information relating to mental health is shared, and students are made aware of mental health issues and ways to deal with them. The activities of the Centre have helped break the stigma attached to mental health and we see more students seeking support to break free from the conditioning and beliefs that are holding them back from achieving their full potential.

HUMAN RESOURCES

Faculty	Regular and Contractual Faculty		73
	Emeritus/Honorary/Visiting/ Adjunct Faculty		11
Technical and Non-Technical Personnel	Officers	Regular	14 (Group A)
		Contractual	02 (Security Officers)
	Subordinate	Regular	56 (Group B – 30 & Group C – 26)
		Temporary & Contract	14

FACULTY

Professor	School of Biology	03
	School of Chemistry	03
	School of Mathematics	02
	School of Physics	02
Associate Professor	School of Biology	04
	School of Chemistry	05
	School of Mathematics	04
	School of Physics	08
Assistant Professor Gr. I	School of Biology	08
	School of Chemistry	11
	School of Mathematics	10
	School of Physics	11
Assistant Professor Gr. II	School of Biology	00
	School of Chemistry	00
	School of Mathematics	01
	School of Physics	01

School of Biology

SNo	Name of the Faculty	Designation	Remarks
1	Dr. Srinivasa Murty Srinivasula	Professor	
2	Dr. Tapas Kumar Manna	Professor	
3	Dr. Hema Somanathan	Professor	

4	Dr. Kalika Prasad	Associate Professor
5	Dr. Nishant K T	Associate Professor
6	Dr. Stalin Raj	Associate Professor
7	Dr. Ullasa Kodandaramaiah	Associate Professor
8	Dr. Ramanathan Natesh	Assistant Professor Gr.I
9	Dr. Ravi Maruthachalam	Assistant Professor Gr.I
10	Dr. Jishy Varghese	Assistant Professor Gr.I
11	Dr. Satish Khurana	Assistant Professor Gr.I
12	Dr. N Sadananda Singh	Assistant Professor Gr.I
13	Dr. Sabari Sankar Thirupathy	Assistant Professor Gr.I
14	Dr. Nisha N K	Assistant Professor Gr.I
15	Dr. Poonam Thakur	Assistant Professor Gr.I

School of Chemistry

SNo	Name of the Faculty	Designation	Remarks
1	Dr. K George Thomas	Professor	
2	Dr. Sureshan K M	Professor	
3	Dr. Mahesh Hariharan	Professor	
4	Dr. Sukhendu Mandal	Associate Professor	
5	Dr. Swathi R S	Associate Professor	
6	Dr. Vinesh Vijayan	Associate Professor	
7	Dr. Reji Varghese	Associate Professor	
8	Dr. Ajay Venugopal	Associate Professor	
9	Dr. Thirumurugan A	Assistant Professor Gr.I	
10	Dr. Vennapusa Sivaranjana Reddy	Assistant Professor Gr.I	
11	Dr. Ramesh Rassappan	Assistant Professor Gr.I	
12	Dr. Alagiri Kaliyamoorthy	Assistant Professor Gr.I	
13	Dr. Gokulnath Sabapathi	Assistant Professor Gr.I	
14	Dr. Rajender Goretti	Assistant Professor Gr.I	
15	Dr. A Muthukrishnan	Assistant Professor Gr.I	
16	Dr. Subrata Kundu	Assistant Professor Gr.I	
17	Dr. Veera Reddy Yatham	Assistant Professor Gr.I	
18	Dr. Soumen De	Assistant Professor Gr.I	
19	Dr. Basudev Sahoo	Assistant Professor Gr.I	

School of Physics

SNo	Name of the Faculty	Designation	Remarks
1	Dr. Anil Shaji	Professor	
2	Dr. Ramesh Chandra Nath	Professor	
3	Dr. Manoj AG Namboothiry	Associate Professor	
4	Dr. M M Shaijumon	Associate Professor	
5	Dr. Joy Mitra	Associate Professor	
6	Dr. Kumaragurubaran S	Associate Professor	
7	Dr. Soumen Basak	Associate Professor	
8	Dr. Rajeev N Kini	Associate Professor	
9	Dr. Madhu Thalakulam	Associate Professor	
10	Dr. Bindusar Sahoo	Associate Professor	
11	Dr. Sreedhar Babu Dutta	Assistant Professor Gr.I	
12	Dr. Deepshikha J Nagar	Assistant Professor Gr.I	
13	Dr. Amal Medhi	Assistant Professor Gr.I	
14	Dr. Ravi Pant	Assistant Professor Gr.I	
15	Dr. Bikas Chandra Das	Assistant Professor Gr.I	
16	Dr. M Suheshkumar Singh	Assistant Professor Gr.I	
17	Dr. D V Senthilkumar	Assistant Professor Gr.I	
18	Dr. Vinayak B Kamble	Assistant Professor Gr.I	
19	Dr. Tanumoy Mandal	Assistant Professor Gr.I	
20	Dr. Manik Banik	Assistant Professor Gr.I	
21	Dr. Tuhin Subhra Maity	Assistant Professor Gr.I	
22	Dr. Shadak Alee	Assistant Professor Gr.II	

School of Mathematics

SNo	Name of the Faculty	Designation	Remarks
1	Dr. Rajan M P	Professor	
2	Dr. Utpal Manna	Professor	
3	Dr. Shrihari Sridharan	Associate Professor	
4	Dr. Devaraj P	Associate Professor	
5	Dr. Sachindranath Jayara-man	Associate Professor	
6	Dr. Viji Z Thomas	Associate Professor	

7	Dr. Sheetal Dharmatti	Assistant Professor Gr.I	
8	Dr. K R Arun	Assistant Professor Gr.I	
9	Dr. Saikat Chatterjee	Assistant Professor Gr.I	
10	Dr. Sarbeswar Pal	Assistant Professor Gr.I	
11	Dr. K Srilakshmi	Assistant Professor Gr.I	
12	Dr. Geetha T	Assistant Professor Gr.I	
13	Dr. Dond Asha Kisan	Assistant Professor Gr.I	
14	Dr. Dhanya Rajendran	Assistant Professor Gr.I	
15	Dr. Sudarshan Kumar K	Assistant Professor Gr.I	
16	Dr. Mithun Mukherjee	Assistant Professor Gr.I	Technical resignation on 01.01.2020
17	Dr. Sumit Mohanty	Assistant Professor Gr.II	

Emeritus/Honorary/Visiting/Adjunct Faculty

SNo	Name of the Faculty	Designation	Remarks
1	Dr. Suresh Das	Chemistry	2019-20 (for 2 years)
2	Dr. Harilal Madhavan	Economics	2019-20
3	Dr. Ganga Devi	Biology	2019-20
4	Prof. P Vijayakumar	Humanities	Varsha Sem 2019-20
5	Prof. Yashwant D Vankar	Chemistry	2019-20 (for 2 years)
6	Prof. M R N Murthy	Biology	2019-20 (for 2 years)
7	Prof. Mathew K Mathew	Biology	2019-20 (for 2 years)
8	Dr. Thomas Kuruvill	Humanities	Vasanth Sem 2019-20
9	Dr. Kutty Krishnan	Mathematics	Vasanth Sem 2019-20 & Varsha Sem 2020-21
10	Dr. Erika Hausenblas	Mathematics	08 to 26 Feb 2020
11	Prof. P Vijaya Kumar	Humanities	Varsha Sem 2019-20

ADMINISTRATIVE & SUPPORT PERSONNEL

SNo	Name of the Official	Designation
1	Shri. B V Ramesh	Deputy Registrar (Finance & Accounts)
2	Shri. Siva Dutt V K	Superintending Engineer
3	Dr. Sainul Abideen P	Assistant Librarian
4	Shri. Hariharakrishnan S	Deputy Registrar (Academics)

5	Shri. P Y Sreekumar	Scientific Officer (IT)
6	Shri. Priji E Moses	Assistant Executive Engineer (Civil)
7	Dr. Goldwin Hemalatha M	Medical Officer
8	Dr. Thiraviam P	Medical Officer
9	Shri. Sreehari S	Assistant Executive Engineer (Electrical)
10	Shri. Sudin B Babu	Deputy Registrar (Purchase & Stores)
11	Shri. Manoj Kumar S	Assistant Registrar (Estb & HR)
12	Smt. Divya V J	Technical Officer
13	Smt. Nimi Joseph Chaly	Assistant Registrar (Project Finance)
14	Shri. Satya Srinivas Narahari-setti	Assistant Registrar (Admin & Facilities)
15	Smt. Darli K G	Private Secretary
16	Smt. Navya Paul	Senior Technical Assistant
17	Shri. Vijesh K	Senior Technical Assistant
18	Shri. Krishna Kumar A	Senior Technical Assistant
19	Shri. Sangeeth M	Senior Technical Assistant
20	Shri. Alex Andrews P	Technical Assistant
21	Smt. Nafeesa C K	Library Information Assistant
22	Shri. Jayaraj faleJ R	Library Information Assistant
23	Shri. Praveen Peter	Junior Engineer (Civil)
24	Shri. Arun Reghunath	Superintendent
25	Smt. Mini Philip	Personal Assistant
26	Shri. Adarsh B	Technical Assistant
27	Shri. Anilkumar P R	Technical Assistant
28	Shri. Naveen Sathyan	Technical Assistant
29	Shri. Ajith Prabha	Superintendent
30	Shri. Manoj M T	Accountant
31	Shri. Satheesh Raghavan	Superintendent
32	Smt. Veena P P	Personal Assistant
33	Smt. Suja V R	Office Assistant (Multi Skill)
34	Smt. Vidya Senan I	Office Assistant (Multi Skill)
35	Smt. Archana P R	Office Assistant (Multi Skill)
36	Smt. Beena N K	Office Assistant (Multi Skill)
37	Shri. Muruganandam A	Office Assistant (Multi Skill)
38	Shri. Rajesh A P	Office Assistant (Multi Skill)
39	Shri. Rakesh M V	Office Assistant (Multi Skill)
40	Shri. Jins Joseph	Nurse
41	Smt. Divya A T	Nurse
42	Shri. Arun Kumar M	Attendant –Electrical

43	Shri. Ratheesh C	Attendant –Plumber
44	Smt. Sarika Mohan	Junior Technical Assistant
45	Shri. Vivek V G	Junior Technical Assistant
46	Shri. Pradeep Kumar G T	Junior Technical Assistant
47	Shri. Nibith Kumar K P	Junior Technical Assistant
48	Ms. Lakshmi C	Junior Technical Assistant
49	Shri. Packiya Rajan	Junior Technical Assistant
50	Shri. Muthukumaran A	Junior Technical Assistant
51	Smt. Sruthi U.A	Junior Hindi Translator
52	Shri. Arun Raj J R	Physical Education Instructor
53	Shri. Ashinraj D	Junior Engineer (Civil)
54	Shri. Sarath Kumar R	Junior Engineer (Electrical)
55	Smt. Sandhya P S	Technical Assistant
56	Shri. Aneesh A	Technical Assistant
57	Smt. Nithya Rani	Technical Assistant
58	Smt. Lekshmi Thampi	Technical Assistant
59	Smt. Deepthi P	Technical Assistant
60	Smt. Lekshmi Devi L	Technical Assistant
61	Ms. Amritha Sivan	Junior Technical Assistant
62	Smt. Lincy Varghese	Junior Technical Assistant
63	Ms. Aathira S	Junior Technical Assistant
64	Shri. Subin S	Junior Technical Assistant
65	Smt. Sruthi R Balu	Office Assistant (Multi Skill)
66	Shri. Anil Prakash M	Office Assistant (Multi Skill)
67	Shri. Pradeep Kumar C	Office Assistant (Multi Skill)
68	Shri. Santhosh B S	Office Assistant (Multi Skill)
69	Shri. Nagarjuna Paidisetty	Office Assistant (Multi Skill)
70	Shri. Anas A Z	Office Assistant (Multi Skill)

CONSULTANTS AND CONTRACTUAL OFFICERS

SNo	Name of the Official	Designation
1	Shri. Gopakumaran Nair	Assistant Security Officer
2	Shri. Jayan V	Assistant Security Officer

ACCOUNTS

BALANCE SHEET AS AT 31st MARCH 2020 Amount-Rs.

SOURCES OF FUNDS	Schedule No	2019-20	2018-19
UNRESTRICTED FUND			
CORPUS/ CAPITAL FUND	**1**	7,40,42,57,321	7,35,12,44,980
DESIGNATED/ EARMARKED FUNDS	**2**		
CURRENT LIABILITIES AND PROWVISIONS	**3**	57,06,25,342	59,33,05,491
UNSPENT BALANCE OF EXTERNAL PROJ-ECTS	**3A**	20,83,23,455	13,26,28,379
SPONSORED FELLOWSHIPS & SCHOLAR-SHIPS	**3B**	1,51,53,502	(93,63,980)
UNSPENT BALANCE OF GRANT - MHRD	**3C**	1,58,90,28,180	1,15,31,16,891
TOTAL		**9,78,73,87,800**	**9,22,09,31,761**
APPLICATION OF FUNDS			
FIXED ASSETS	**4**		
TANGIBLE ASSETS		3,98,97,24,211	4,06,24,20,799
INTANGIBLE ASSETS		3,75,19,526	4,07,36,766
CAPITAL WORK-IN-PROGRESS		2,61,18,13,191	2,60,02,38,026
INVESTMENTS FROM EARMARKED / EN-DOWENT FUNDS	**5**		
LONG TERM INVESTMENT			
SHORT TERM INVESTMENT			
INVESTMENT - OTHERS	**6**		
CURRENT ASSETS	**7**	98,27,92,988	73,22,75,413
LOANS, ADVANCES & DEPOSITS	**8**	2,16,55,37,884	1,78,52,60,757
TOTAL		**9,78,73,87,800**	**9,22,09,31,761**
SIGNIFICANT ACCOUNTING POLICIES	**23**		
CONTINGENT LIABILITIES AND NOTES TO ACCOUNTS	**24**		

INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/YEAR ENDED 31st MARCH 2020

PARTICULARS	Schedule	2019-20	2018-19
INCOME			
Academic Receipts	9	4,68,02,380	3,66,97,980
Grants & Subsidies	10	56,88,47,409	63,37,82,143
Income from Investments	11		
Interest Earned	12		30,23,308
Other Income	13	6,49,23,008	2,38,69,868
Prior Period Income	14		
TOTAL (A)		**68,05,72,797**	**69,73,73,299**
EXPENDITURE			
Staff Payments & Benefits	15	28,88,40,751	31,60,49,267
Acadamic Expenses	16	10,21,21,679	11,06,50,799
Administrative & General Expenses	17	11,40,82,398	14,82,00,788
Transportation Expenses	18	1,10,38,962	1,57,04,697
Repairs & Maintanence	19	5,16,57,455	4,17,75,921
Finance cost	20	11,06,164	14,00,671
Other Expenses	21		
Depreciation	4	31,73,69,687	30,26,02,466
Prior Period Expenses	22	8,67,802	16,18,08,148
TOTAL (B)		**88,70,84,898**	**1,09,81,92,757**
Balance being excess of Income over Expenditure (A-B)		**20,65,12,101)**	**40,08,19,458)**
Transfer to/ from Designated Fund			
Building Fund			
Others (Specify)			
BALANCE BEING SURPLUS/(DEFICIT) CARRIED TO CAPITAL FUND		**(20,65,12,101)**	**40,08,19,458)**
Significant Accounting Policies	23		
Contingent Liabilities & Notes on Accounts	24		

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 1- CORPUS/CAPITAL FUND:

(Amount-Rs.)

	2019-20		2018-19	
Balance as at the beginning of the year		7,35,12,44,980		7,08,56,62,522
Add: Contributions towards Corpus/Capital Fund			2,96,35,801	
Add: Grant from UGC, Government of India and State Government to the extent utilised for capital expenditure	25,38,98,827		62,65,05,924	
Add: Assets purchased out of Earmarked funds				
Add: Assets purchased out of sponsored projects, where ownership vests in the institution				
Add: Assets donated/ gifts received				
Add: Other additions	56,25,615		1,02,60,191	
Add: Excess of income over expenditure transferred from income and expenditure account	(20,65,12,101)		(40,08,19,458)	
Total		**7,40,42,57,321**		**7,35,12,44,980**
Less: Deficit transferred from the income and expenditure account				
BALANCE AT THE YEAR-END		**7,40,42,57,321**		**7,35,12,44,980**

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDUEL 2-DESIGNATED/ EARMARKED FUNDS (Amount-Rs.)

	FUND-WISE BREAK UP				TOTAL	
	Fund AAA	**Fund BBB**	**Fund CC**	**Endow-ment Funds**	**2019-20**	**2018-19**
A						
a) Opening balance of the funds						
b) Additions to the Funds:						
c) Income from investments made on account of funds						
d) Accrued interest on investments of the funds						
e) Interest on savings Bank Ac-count						
f) Other additions (specify nature)						
TOTAL (A)	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**
B						
Utilisation/Expenditure towards objectives of funds						
i. Capital Expenditure						
ii. Revenue Expenditure						
TOTAL (B)						
CLOSING BALANCE AS AT THE YEAR-END (A-B)	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**
Represented by						
Cash and bank balances						
Investment						
Interest accrued but not due						
Total						

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 2 (A)-ENDOWMENT FUNDS

(Amount-Rs.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sl. No	Name of the Endow-ment	Opening Balance		Additions during the year		Total		Expen-diture on the object during the year	Closing Balance		Total
		Endow-ment	Accu-mulated Interest	Endow-ment	Interest	Endow-ment	Accu-mulated Interest		Endow-ment	Accu-mulated Interest	
						(3)+(5)	(4)+(6)				(10)+(11)
1											
	Total	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 3- CURRENT LIABILITIES AND PROVISIONS

	Sub Sch No.	2019-20	Sub Sch No.	2018-19
A. CURRENT LIABILITIES				
1. Deposits from staff				
2. Deposts from students				
3. Sundry Creditors:				
a) For Goods & Services	1		1	5,04,817
b) Others	2	5,33,76,393	2	6,46,74,285
4. Deposits Others (including EMD, Security Deposits)	3	4,90,87,680	3	4,64,08,821
5. Statutory Liabilities(GPF,TDS,WC TAX, CPF, GIS,NPS) :				
a) Overdue				
b) Others	4	38,07,468	4	34,05,893
6. Other current Liabilities	5	38,25,77,469	5	40,90,26,797
a) Salaries				
b) Receipts against sponsored projects				
c) Receipts against sponsored fellowships and scholorships				
d) Unutilised Grants				
e) Grants in advance				
f) Other Funds				
g) Other liablities				
Total (A)		**48,88,49,010**		**52,40,20,613**
B. PROVISIONS				
1. For Taxation				
2. Gratuity				
3. Superannuation/Pension				
4. Accumulated Leave Encashment	6	8,17,76,332		6,92,84,878
5. Trade Warranties/Claims				
6. Others (Specify)				
Total (B)		**8,17,76,332**		**6,92,84,878**
Total (A+B)		**570,625,342**		**593,305,491**

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 3 (a)-ENDOWMENT FUNDS (Sponsored Projects)

(Amount in Rupees)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sl. No	Name of the Project	Opening Balance 2018-19		Receipts / Recoveries during the year	Total	Expen-diture during the year	Closing Balance 2019-20	
		Credit	Debit				Credit	Debit
1	AMIL LIMITED- Dr.Suhesh Kumar Singh	0	0	25000	25000	25000	0	
2	CEFIPRA-DR.Archana Pai	4641	0	168	4809	0	4809	
3	CSIR-Dr. D.V.Senthil Kumar	450329	0	8276	458605	253346	205259	
4	DAE-Dr.Ramesh Chandranath (37(3)/14/26/2017)	273105	0	580865	853970	822012	31958	
5	DBT-A1-Prof.Hema Somanathan	83411	0	593592	677003	20000	657003	
6	DBT-A2-Prof Hema Somanathan	344770	0	663963	1008733	209129	799604	
7	DBT-A3-Dr.Ullasa Kodandara-maiah	790970	0	490672	1281642	793597	488045	
8	DBT-Prof.Mahesh Hariharan - BT/PR/5761/NNT/28/599/2012	126958	0	1832	128790	0	128790	
9	DBT-Dr.Sadananda Singh - BT/ RLF-RE-ENTRY/17/2015	731915	0	21401	753316	423821	329495	
10	DBT-Dr.Ullasa Kodandaramaiah - BT/PR7713/NDB/39/261/2013	373793	0	0	373793	252838	120955	
11	DBT -IISc-Mohammed Aiyaz	644397	0	376100	1020497	766793	253704	
12	DBT-RICE Dr.Kalika Prasad	915134	0	1596170	2511304	994893	1516411	
13	DBT-Prof Srinivasa Murty Srinivasula - BT/PR21325/ BRB/10/1554/2016	1353699	0	18108	1371807	1743340		371532
14	DBT-Prof Tapas Kumar Manna - BT/PR12514/BRB/10/1352/2014	501780	0	6697	508477	479704	28773	
15	DST-Dr.Tamil Selvi - SR/WOS-A/ CS-105/2016(G)	71518	0	909866	981384	901757	79627	
16	DST-FIST-Prof.Mahesh Hariharan - 5751/IFD/2016-2017	36574478	0	246941	36821419	1574478	35246941	
17	DST-INSPIRE FACULTY - Dr.Ullasa Kodandaramaiah	606810	0	0	606810	522526	84284	
18	DST INSPIRE FACULTY Dr.Mama-ta Sahoo		0	2048	2048	1813	235	
19	DST-INSPIRE FACULTY-Dr.S.Gokul Nath	0	107172	0	-107172	0		107172
20	DST-INSPIRE FACULTY-Dr.Vinayak Kamble	1168280	0	1930329	3098609	1627894	1470715	
21	DST-INSPIREFACULTY- Dr.Mithun Mukherjee	58110		1448	59558	33449	26109	

22	DST (Nano Mission) Prof K George Thomas - SR/NM/NS-23/2016-C	5172314	0	2180187	7352501	4715829	2636673	
23	DST-RAMANUJAN-Dr.Jishy Varghese	1235772	0	17548	1253320	1220512	32808	
24	DST-RAMANUJAN-Dr.Ramesh Rasappan		270080	770541	500461	442309	58152	
25	DST-RAMANUJAN-DR.Ravi Pant	506532	0	307659	814191	168775	645416	
26	DST-RAMANUJAN- Dr.Rajendar Goretti	122469	0	655079	777548	434962	342586	
27	DST SERB- Prof Anil Shaji - EMR/2016/007221	152612	0	804276	956888	165506	791382	
28	DST- SERB-Dr.Alagiri Kaliyamoorthy - EEQ/2016/000231	148028	0	612434	760462	577499	182963	
29	DST-SERB -DR.Deepshikha Jaiswal Nagar - YSS/2015/001743	62771	0	2264	65035	0	65035	
30	SERB - Dr.Gokul Nath - SERB/F/181/2016-17	365593	0	1381	366974	360758	6216	
31	DST SERB- Dr.M.M.Shaijumon - EMR/2017/000484	125920	0	703763	829683	369913	459770	
32	DST SERB - Dr.Rajendar Goretti - ECR/2016/001580	233540	0	806302	1039842	863667	176175	
33	DST-SERI-Dr.Maoj Namboothiry - DST/MD/SERI/S15(G)	4066514	0	1252122	5318636	4998839	319797	
34	DST-SJF- Prof Kana M Sureshan - DST/SJF/CSA-02/2012-13	3204761	0	3540599	6745360	4488967	2256393	
35	DST-SJF-Dr.Sunish Kumar Radhakrishnan - DST/SJF/LSA-01/14-15	15724172	0	275029	15999201	15999128	73	
36	DST-TMD-MES-Dr.M.M.Shaijumon - 2K16/114(G)	1290875	0	2015690	3306565	1606230	1700335	
37	DUPONT Young Professor - Dr.Ravi Maruthachalam	1250114	0	17833	1267947	2950	1264997	
38	INDO-ITLIAN-Dr.Mahesh Hariharan - -INT/ITALY/P-2016(ER)	148053	0	202699	350752	184849	165903	
39	ISRO-Dr.Deepshikha Jaiswal Nagar - DS-2B-13012(2)/42/2017	0	93117	1091373	998256	1025956		27700
40	ISRO-Dr.Deepshkiha Jaiswal Nagar (19012/35/2016-II)	125620	0	54551	180171	49742	130429	
41	JC BOSE-Prof K.George Thomas	243926	0	1073333	1317259	1302019	15240	
42	KSCSTE-Dr.Mahesh Hariharan - 007/KSYSA-RG/2014/CSTE	305717	0	10559	316276	96933	219343	
43	KSCSTE(KSYSA)-Dr.Reji Varghese - 008/KSYSA-RG/2015/CSTE	444255		4656	448911	474133		25222
44	MHRD-COE-Dr.Amal Medhi	0	107561	358749	251188	0	251188	
45	RAENG-Dr.Joy Mitr	1779697	0	1312932	3092629	273323	2819306	
46	SERB-Dr.Bikas Das (ECR/2017/000630	129165	0	156709	285874	172093	113781	
47	SERB-Dr.Bikas Das EEQ/2016/000045	223231	0	113402	336633	283803	52830	

48	SERB-Dr.P.Chiranjeevi - SERB/ EEQ/2016/000549	455997	0	16440	472437	0	472437
49	SERB-Dr.Alagiri Kaliyamoorthy ECR/2016/000202	461440	0	207136	668576	667724	852
50	SERB-Dr.Jishy Var-ghese-EMR/2016/004978	0	38604	1014856	976252	669967	306285
51	SERB-Dr.Madhu Thalakulam SB/ S2/CMP-008/2014	2539716	0	34	2539750	2413357	126393
52	SERB-Dr.Ramesh Rasappan-EMR/2015/001103	158215	0	80136	238351	83708	154643
53	SERB-Dr.Ravi Pant -EMR/2015/000363	66239	0	11331	77570	10381	67189
54	SERB-Dr. R.S.Swathi - SB/WEA-14/2016	443565	0	307565	751130	716226	34904
55	SERB-Dr.Sukhendu Mandal -EMR/2016/007501	5242938	0	1076408	6319346	1170765	5148581
56	SERB-Dr.Tapas Kumar Manna - EMR/2016/001562	0	37537	2682394	2644857	2100303	544554
57	SERB-Dr.Vinesh Vijayan - EMR/2015/000111	126545	0	2613	129158	85518	43640
58	SERB-Dr.V.Sivaranjana Reddy - ECR/2016/000226	615667	0	74530	690197	683531	6666
59	SERB- Prof Hema Somanathan - /EMR/2014/000705	524695	0	7975	532670	227671	304999
60	SERB-IMPRINT Prof K George Thomas - SR/S9/Z-05/2015	5466136	0	5517706	10983842	4992209	5991633
61	SERB - Dr.Suhesh Kumar Singh - ECR/2016/001232	251257	0	408935	660192	537834	122358
62	SERB -Dr.Saikat Chatterjee - YSS/2015/001687	124031	0	205236	329267	168666	160601
63	SERB-Dr.Thirumurugan .A -EMR/2016/002637	475708	0	830893	1306601	154355	1152246
64	UGC-UKEIRI- Dr.Joy Mitra 184-16/2017(IC)	468935	0	12245	481180	277521	203659
65	UGC-UKIERI-D.Joy Mitra -184-26/2014(IC)	0	197743	282434	84691	0	84691
66	WT-DBT-Dr.Satish Khurana -IA/1/15/2/502061	5771825	0	5010457	10782282	5660994	5121288
67	WT-DBT-Dr.Nisha N Kannan - IA/E/15/1/502329	1471636	0	3033497	4505133	3476817	1028316
68	GE India Industrial P Ltd -Dr. Rajeev N Kini	368556	0	614715	983271	504226	479045
69	CSIR-CCMB-Dr.Ravi Maruthacha-lam	1200000	0	12788	1212788	522463	690325
70	CSIR- Dr.Tapas Kumar Manna -37(1433)/10/EMR-II	192905	0	312571	505476	459946	45530
71	DBT-Dr.Reji Varghese -BT/ PR30172/MNT/28/1593/2018	1563632	0	29638	1593270	1358067	235203

72	DBT-Dr.Ullasa Kodandaramaiah - BT/PR27535/2018	625870	0	18189	644059	313682	330377	
73	DST-INSPIRE FACULTY- Dr.K.Srilakshmi	35513	0	1249	36762	14664	22098	
74	DST-NM-Dr.Vinayak Kamble - NM/NT/2018/124	1741683	0	9368	1751051	1790162		39111
75	ICAR-Dr.Ravi Maruthachalam - NASF/GT-7024/2018-19	181701	0	371906	553607	451755	101852	
76	IUSSTF-Dr.M.M.Shaijumon -JC-071/2017	7503	0	270727	278230	224683	53547	
77	KSCSTE(KSYSA) Dr.Rajeev N Kini -431/2018	381275	0	6674	387949	375670	12279	
78	KSCSTE-R.S.Swathi - 430/2018	1688082	0	19306	1707388	1294904	412484	
79	NBHM-PDF-Dr.T.Kathiravan	141422	0	60027	201449	163000	38449	
80	SERB-Dr.Bindusar Sahoo - CRG/2018/002373	981500	0	14341	995841	359734	636107	
81	SERB-DR.Devaraj - MTR/2018/000559	220000	0	3748	223748	219641	4107	
82	SERB-Dr.Geetha T - MTR/2017/000424	204370	0	222859	427229	333145	94084	
83	SERB-Dr.Kana M Sureshan-CRG/2018/000577	1366300	0	10695	1376995	715866	661129	
84	SERB-Dr.Nishant K T-CRG/2018/000916	1220000	0	1634520	2854520	1201249	1653271	
85	SERB-Dr..N.Sadananda Singh - ECR/2016/000979	544340	0	621933	1166273	654189	512084	
86	SERB-Dr.Saikat Chatterjee -MTR/2018/000528	220063	0	2783	222846	219991	2855	
87	SERB-Dr.Sarbeswar Pal-EMR/2015/002172	53214	0	84971	138185	128293	9892	
88	SERB-Prof Srinivasa Murty Srinivasula - /EMR/2016/008048	550441	0	1015514	1565955	1300798	265157	
89	SERB-Dr.Subrata Kundu - ECR/2017/003200	96720	0	517705	614425	537478	76947	
90	SERB-Dr.Sumit Mohanty - / MTR/2017/000458	181928	0	1889	183817	196572		12755
91	SERB-Dr.Madhu Thalakulam - CRG/2018/004213	3778000	0	49096	3827096	3063759	763337	
92	SERB-Dr.Sadananda Singh -EEQ/2018/001090	2125000	0	50636	2175636	1879741	295895	
93	SERB-Prof utpal Manna-MTR/2018/000034	220000	0	3636	223636	113380	110256	
94	SERB-Dr.Vinayak Kamble -EEQ/2018/000769	3086396	0	96457	3182853	1853832	1329022	
95	SERB-WOS- Dr.Smitha Vishnu - LS-457/2017(G)	1055000	0	22056	1077056	1047593	29463	
96	UGC-UKIERI-Dr.Bikas Chandra Das -4(I)/P-3Y-42/C	380996	0	610761	991757	441758	549999	
97	MPG-Dr.Shankaranarayanan	0	0	9257	9257	9257	0	

98	MPG-Dr.Archana Pai	0	0	28357	28357	28357	0
99	EICL-Dr.M.M.Shaiumon	0	0	650981	650981	601117	49864
100	DST-JSPS-Dr.Kumaragurubaran -DST/INT/JSPS/P-288/2019	0	0	275768	275768	186088	89680
101	SERB-Dr.Ajay Venugopal - CRG/2019/005040	0	0	724293	724293	537664	186629
102	DST-JSPS-Dr.Sukhendu Mandal - DST/INT/JSPS/P-285/2019	0	0	309502	309502	79449	230053
103	SERB-Dr.Kalika Prasad-EMR/2017/002503	0	0	1373196	1373196	1040167	333029
104	MHRD-STARS-Dr.Ajay Venugopal-APR2019/CS/250/FS	0	0	681000	681000	227804	453196
105	DBT-Dr.Tapas Kumar Manna -BT/HRD/NWB/38/2019-20(7)	0	0	701956	701956	200000	501956
106	SERB-Dr.Vinesh Vijayan - CRG/2019/004880	0	0	946726	946726	222872	723854
107	SERB-Prof Hema Somanathan - CRG/2019/003805	0	0	967000	967000	0	967000
108	MHRD/STARS-Dr.Vinesh Vijayan - STARS/APR2019/BS/708	0	0	1601000	1601000	607488	993512
109	SERB-Dr.Ramech Chandra Nath - CRG/2019/000960	0	0	1171346	1171346	114736	1056610
110	SPARC-Dr.Nishant K T	0	0	2783967	2783967	1422779	1361188
111	MHRD-Dr.Manoj Namboothiry -STARS/APR2019/PS/308/FS	0	0	1742000	1742000	193144	1548856
112	CSIR-Dr.Shadak Alee - 03(1457)/19/EMR-II	0	0	1782270	1782270	0	1782270
113	MHRD-STARS-Dr.Ravi Maruthachalam - APR2019/BS/818/FS	0	0	1967000	1967000	0	1967000
114	SERB- Dr.Rajeev N Kini - CRG/2019/004865	0	0	2032531	2032531	96970	1935561
115	JC BOSE (NEW) -Prof K George Thomas	0	0	1914604	1914604	818596	1096008
116	SERB-Dr.Gokulnath Sabapathi - CRG/2019/006303	0	0	2640500	2640500	292519	2347981
117	DST-Dr.M.M.Shaijumon - DST/TMD/HFC/2K18/136(C)&(G)	0	0	2915894	2915894	330998	2584896
118	DST-TMD-Dr.Deepshikha Jaiswal Nagar- DST/TMD/HFC/2K18/37	0	0	4575075	4575075	1974652	2600423
119	DST-Dr.R.A.Muthukrishnan- DST/TMD/HFC/2K18/24	0	0	3309115	3309115	534396	2774719
120	SERB-Dr.Joy Mitra-CRG/2019/004965	0	0	3262000	3262000	203046	3058954
121	MHRD-STARS - Dr.Madhu Thalakulam - APR2019/PS/363/FS-	0	0	3280000	3280000	148000	3132000
122	SERB-Prof Mahesh Hariharan-CRG/2019/002119	0	0	3567205	3567205	143953	3423252

123	SERB(NEW)-Dr. Rajeev N Kini - IPA/2020/000021	0	0	3547000	3547000	0	3547000	
124	SERB-Dr.Ravi Pant - CRG/2019/000993	0	0	4561394	4561394	195893	4365501	
125	DBT-Dr.Suhesh Kumar Singh -BT/ PR30005-2018	0	0	8389373	8389373	433544	7955829	
126	DBT - WT-Dr.Sabari Sankar Thir-upathy	0	0	10435126	10435126	1079034	9356092	
127	DBT-Dr.Tapas Kumar Manna - BT/ PR30271-2018	0	0	11612115	11612115	888917	10723198	
128	FIST PROJECT -SCHOOL OF BI-OLOGY	0	0	22743006	22743006	0	22743006	
129	DST-FIST - SCHOOL OF PHYSICS	0	0	24572636	24572636	36	24572600	
130	OTHERS	2267488		933684	3201172	9669	3191503	
	Total	**133480193**	**851814**	**185295602**	**317923980**	**110184018**	**208323455**	**583493**

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 3 (B)-SPONSORED FELLOWSHIPS AND SCHOLARSHIPS

Amount in Rupees

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sl. No	**Name of the Sponsor**	**Opening Balance as on 01.04.2019**		**Transactions during the year**		**Closing Balance as on 31.03.2020**	
		Credit	**Debit**	**Credit**	**Debit**	**Credit**	**Debit**
1	DST - INSPIRE - BSMS/ PHD		91,45,840	3,11,45,718	98,45,618	1,21,54,260	
2	CSIR (Ph D Research Scholars)	5,57,032	-	16,33,301	3,84,677	18,05,656	
3	KVPY (BSMS)	-	14,32,686	14,32,686			
4	UGC (Ph D Research Scholars)	7,23,586				7,23,586	
5	DBT (Ph D Research Scholar)		90,166	8,72,127	7,81,961		
6	ICMR (Ph D Research Scholar)	24,094			24,094		
7	PMRF (Ph D Research Scholars)			12,40,000.00	7,70,000.00	4,70,000.00	
	Total	**13,04,712**	**1,06,68,692**	**3,63,23,832**	**1,18,06,350**	**1,51,53,502**	**-**

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 3(C)-UNUTILIZED GRANTS FROM UGC, GOVERNMENT OF INDIA AND STATE GOVERNMENTS		Amount in Rupees
	2019-20	**2018-19**
A. Plan grants: Government of India (MHRD)		
Balance B/F	1,15,31,16,891	84,34,04,958
Add: Receipts during the year	1,238,000,000	1,57,00,00,000
Total (a)	2,39,11,16,891	2,41,34,04,958
Less Refunds		
Less: Utilized for Revenue Expenditure	56,88,47,409	63,37,82,143
Less: Utilized for Capital Expenditure	23,32,41,302	62,65,05,924
Total (b)	80,20,88,711	1,26,02,88,067
Unutilized carried forward (a-b)	1,58,90,28,180	1,15,31,16,891
B. UGC Grants: Plan		
Balance B/F		
Add: Receipts during the year		
Total (c)	NIL	NIL
Less Refunds		
Less: Utilized for Revenue Expenditure		
Less: Utilized for Capital Expenditure		
Total (d)	NIL	NIL
Unutilized carried forward (c-d)		
C. UGC Grants Non-Plan		
Balance B/F		
Add: Receipts during the year		
Total (e)	NIL	NIL
Less Refunds		
Less: Utilized for Revenue Expenditure		
Less: Utilized for Capital Expenditure		
Total (f)	NIL	NIL
Unutilized carried forward (e-f)		
D. Grants from State Govt.		
Balance B/F		
Add: Receipts during the year		
Total (g)	NIL	NIL
Less Refunds		
Less: Utilized for Revenue Expenditure		
Less: Utilized for Capital Expenditure		
Total (h)	NIL	NIL
Unutilized carried forward (g-h)		
Grand Total (A+B+C+D)	1,58,90,28,180	1,15,31,16,891

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 4 - FIXED ASSETS (PLAN)

	DESCRIPTION	GROSS BLOCK			
		Opening Balance as on 01.04.2019	Additions	Deductions	Closing Balance
	TANGIBLE ASSETS				
1	**LAND:**				
	a) Freehold				
	Land obtained from Govt	1	-	-	1
	Vithura	9,54,506	-	-	9,54,506
2	Site Development	-			-
3	BUILDINGS:	2,41,60,81,105		-	2,41,60,81,105
4	Roads & Bridges	7,33,41,681			7,33,41,681
5	Tubes & Water Supply	11,28,215		-	11,28,215
6	Sewage & Drainage	-			-
7	Electrical Installation and equipment	3,83,83,268	46,31,311	-	4,30,14,579
8	Plant and Machinery	5,39,03,468		-	5,39,03,468
9	Scientific & Laboratory Equipment	2,03,21,25,642	14,35,21,731	-	2,17,56,47,373
10	Office Equipment	68,04,321	11,63,289	-	79,67,610
11	Audio Visual Equipment	44,997	73,465	-	1,18,462
12	Computers & Peripherals	17,31,50,526	18,54,011	-	17,50,04,537
13	Furniture, Fixtures and Fittings	20,46,62,817	2,54,62,096		23,01,24,913
14	VEHICLES	31,52,898	7,34,919	-	38,87,817
15	Library Books & Scientific Journals	2,89,24,759	95,960	30,99,514	2,59,21,205
16	Small Value Assets				
	TOTAL (A)	**5,03,26,58,204**	**17,75,36,782**	**30,99,514**	**5,20,70,95,472**
17	CAPITAL WORK-IN PROGRESS - Construction	2,48,64,77,048	6,50,06,970	4,01,168	2,55,10,82,850
17	CAPITAL WORK-IN PROGRESS - Lab Equipment	11,37,60,978	84,58,955	6,14,89,592	6,07,30,341
	CAPITAL WORK IN PROGRESS (B)				
	TOTAL A+B				

S. No.	INTANGIBLE ASSETS	GROSS BLOCK			
		Opening Balance as on 01.04.2019	Additions	Deductions	Closing Balance
18	Computer Software	1,92,31,607	16,46,100		2,08,77,707
19	E-Journals	38,46,66,865	4,55,82,768		43,02,49,633
20	Patents	1,76,500			1,76,500
	TOTAL -(C)	**40,40,74,972**	**4,72,28,868**	**-**	**45,13,03,840**
GRAND TOTAL (A+B+C)		**8,03,69,71,202**	**29,82,31,575**	**6,49,90,274**	**8,27,02,12,503**

(Amount-Rs.)

	DEPRECIATION				NET BLOCK	
Rate of Depreciation	Opening Balance	Depreciation for the year	Deductions / Adjustment	Total Depreciation	31.03.2020	31.03.2019
0.00%					1	1
0.00%					9,54,506	9,54,506
2.00%	10,45,19,022	4,83,21,622		15,28,40,644	2,26,32,40,461	2,31,15,62,083
2.00%	55,78,677	14,66,834		70,45,511	6,62,96,170	6,77,63,004
2.00%	84,616	22,564	(62,052)	45,128	10,83,087	10,43,599
2.00%	-	-		-	-	-
5.00%	80,32,299	21,50,729		1,01,83,028	3,28,31,551	3,03,50,969
5.00%	1,44,85,205	26,95,173		1,71,80,378	3,67,23,090	3,94,18,263
8.00%	66,65,69,452	17,40,51,790		84,06,21,242	1,33,50,26,131	1,36,55,56,190
7.50%	5,10,324	5,97,571		11,07,895	68,59,715	62,93,997
7.50%	3,375	8,884		12,259	1,06,203	41,622
20.00%	10,41,50,781	1,76,20,738		12,17,71,519	5,32,33,018	6,89,99,745
7.50%	4,65,27,934	1,72,59,369		6,37,87,303	16,63,37,610	15,81,34,883
10.00%	11,94,498	3,18,677		15,13,175	23,74,642	19,58,400
10.00%	1,85,81,222	16,82,929	(3,09,951)	1,99,54,200	59,67,005	1,03,43,537
	97,02,37,405	**26,61,96,880**	**(3,72,003)**	**1,23,60,62,282**	**3,97,10,33,190**	**4,06,24,20,799**
					2,55,10,82,850	2,48,64,77,048
					6,07,30,341	11,37,60,978
					2,61,18,13,191	**2,60,02,38,026**
					6,58,28,46,381	**6,66,26,58,825**

	DEPRECIATION				NET BLOCK	
Rate of Depreciation	Opening Balance	Amortization for the year	Deductions / Adjustment	Total Amortization/Adjustments	31.03.2020	31.03.2019
40.00%	1,87,95,822	10,82,426		1,98,78,248	9,99,459	4,35,785
40.00%	34,45,22,773	4,81,04,266	12,39,805	39,38,66,844	3,63,82,789	4,01,44,092
9 Years	19,611	19,611	-	39,222	1,37,278	1,56,889
	363,338,206	**49,206,303**	**1,239,805**	**413,784,314**	**37,519,526**	**4,07,36,766**
	1,33,35,75,611	**31,54,03,183**	**8,67,802**	**1,64,98,46,596**	**6,62,03,65,907**	**6,70,33,95,591**

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 4 A - FIXED ASSETS (PLAN+NON PLAN)

	DESCRIPTION	GROSS BLOCK			
		Opening Balance as on 01.04.2019	Additions	Deductions	Closing Balance
	TANGIBLE ASSETS				
1	**LAND:**				
	a) Freehold				
	Land obtained from Govt	1	-	-	1
	Vithura	9,54,506	-	-	9,54,506
2	Site Development	-			-
3	BUILDINGS:	2,41,60,81,105		-	2,41,60,81,105
4	Roads & Bridges	7,33,41,681			7,33,41,681
5	Tubes & Water Supply	11,28,215		-	11,28,215
6	Sewage & Drainage	-			-
7	Electrical Installation and equipment	3,83,83,268	46,31,311	-	4,30,14,579
8	Plant and Machinery	5,39,03,468		-	5,39,03,468
9	Scientific & Laboratory Equipment	2,03,21,25,642	14,35,21,731	-	2,17,56,47,373
10	Office Equipment	68,04,321	11,63,289	-	79,67,610
11	Audio Visual Equipment	44,997	73,465	-	1,18,462
12	Computers & Peripherals	17,31,50,526	18,54,011	-	17,50,04,537
13	Furniture, Fixtures and Fittings	20,46,62,817	2,54,62,096		23,01,24,913
14	VEHICLES	31,52,898	7,34,919	-	38,87,817
15	Library Books & Scientific Journals	2,89,24,759	95,960	30,99,514	2,59,21,205
16	Small Value Assets				
	TOTAL (A)	**5,03,26,58,204**	**17,75,36,782**	**30,99,514**	**5,20,70,95,472**
17	CAPITAL WORK-IN PROGRESS - Construction	2,48,64,77,048	6,50,06,970	4,01,168	2,55,10,82,850
17	CAPITAL WORK-IN PROGRESS - Lab Equipment	11,37,60,978	84,58,955	6,14,89,592	6,07,30,341
	CAPITAL WORK IN PROGRESS (B)				
	TOTAL A+B				

S. No.	INTANGIBLE ASSETS	GROSS BLOCK			
		Opening Balance as on 01.04.2018	Additions	Deductions	Closing Balance
18	Computer Software	1,92,31,607	16,46,100		2,08,77,707
19	E-Journals	38,46,66,865	4,55,82,768		43,02,49,633
20	Patents	1,76,500			1,76,500
	TOTAL -(C)	**40,40,74,972**	**4,72,28,868**	**-**	**45,13,03,840**
GRAND TOTAL (A+B+C)		**8,03,69,71,202**	**29,82,31,575**	**6,49,90,274**	**8,27,02,12,503**

(Amount-Rs.)

	DEPRECIATION				NET BLOCK	
Rate of Depreciation	Opening Balance	Depreciation for the year	Deductions / Adjustment	Total Depreciation	31.03.2020	31.03.2019
0.00%					1	1
0.00%					9,54,506	9,54,506
2.00%	10,45,19,022	4,83,21,622		15,28,40,644	2,26,32,40,461	2,31,15,62,083
2.00%	55,78,677	14,66,834		70,45,511	6,62,96,170	6,77,63,004
2.00%	84,616	22,564	(62,052)	45,128	10,83,087	10,43,599
2.00%	-	-		-	-	-
5.00%	80,32,299	21,50,729		1,01,83,028	3,28,31,551	3,03,50,969
5.00%	1,44,85,205	26,95,173		1,71,80,378	3,67,23,090	3,94,18,263
8.00%	66,65,69,452	17,40,51,790		84,06,21,242	1,33,50,26,131	1,36,55,56,190
7.50%	5,10,324	5,97,571		11,07,895	68,59,715	62,93,997
7.50%	3,375	8,884		12,259	1,06,203	41,622
20.00%	10,41,50,781	1,76,20,738		12,17,71,519	5,32,33,018	6,89,99,745
7.50%	4,65,27,934	1,72,59,369		6,37,87,303	16,63,37,610	15,81,34,883
10.00%	11,94,498	3,18,677		15,13,175	23,74,642	19,58,400
10.00%	1,85,81,222	16,82,929	(3,09,951)	1,99,54,200	59,67,005	1,03,43,537
	97,02,37,405	**26,61,96,880**	**(3,72,003)**	**1,23,60,62,282**	**3,97,10,33,190**	**4,06,24,20,799**
					2,55,10,82,850	2,48,64,77,048
					6,07,30,341	11,37,60,978
					2,61,18,13,191	**2,60,02,38,026**
					6,58,28,46,381	**6,66,26,58,825**

	DEPRECIATION				NET BLOCK	
Rate of Depreciation	Opening Balance	Amortization for the year	Deductions / Adjustment	Total Amortization/Adjustments	31.03.2019	31.03.2018
40.00%	1,87,95,822	10,82,426		1,98,78,248	9,99,459	4,35,785
40.00%	34,45,22,773	4,81,04,266	12,39,805	39,38,66,844	3,63,82,789	4,01,44,092
9 Years	19,611	19,611	-	39,222	137,278	1,56,889
	36,33,38,206	**4,92,06,303**	**12,39,805**	**41,37,84,314**	**3,75,19,526**	**4,07,36,766**
	1,33,35,75,611	**31,54,03,183**	**8,67,802**	**1,64,98,46,596**	**6,62,03,65,907**	**6,70,33,95,591**

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 4 B FIXED ASSETS (NON PLAN)

	DESCRIPTION	GROSS BLOCK			
		Opening Balance as on 01.04.2019	Additions	Deductions	Closing Balance
	TANGIBLE ASSETS				
1	LAND:				
	a) Freehold				
	Land obtained from Govt				
	Vithura				
2	Site Development				
3	BUILDINGS:				
4	Roads & Bridges				
5	Tubes & Water Supply				
6	Sewage & Drainage				
7	Electrical Installation and equipment				
8	Plant and Machinery				
9	Scientific & Laboratory Equipment				
10	Office Equipment				
11	Audio Visual Equipment				
12	Computers & Peripherals				
13	Furniture, Fixtures and Fittings				
14	VEHICLES				
15	Library Books & Scientific Journals				
16	Small Value Assets				
	TOTAL (A)	**NIL**	**NIL**	**NIL**	**NIL**
17	CAPITAL WORK-IN PROGRESS (B)				

S. No.	INTANGIBLE ASSETS	GROSS BLOCK			
		Opening Balance as on 01.04.2019	Additions	Deductions	Closing Balance
18	Computer Software				
19	E-Journals				
20	Patents				
	TOTAL -(C)	**-**	**-**	**-**	**-**
	GRAND TOTAL (A+B+C)	**NIL**	**NIL**	**NIL**	**NIL**

(Amount-Rs.)

	DEPRECIATION					NET BLOCK	
	Rate of Depreciation	Opening Balance	Depreciation for the year	Deductions / Adjustment	Total Depreciation	31.03.2020	31.03.2019
	NIL	NIL	NIL	NIL	NIL	NIL	NIL

	DEPRECIATION					NET BLOCK	
	Rate of De-preciation	Opening Balance	Amortization for the year	Deductions / Adjustment	Total Amorti-zation / Adjust-ments	31.03.2020	31.03.2019
		-	-	-	-	-	-
	NIL	NIL	NIL	NIL	NIL	NIL	NIL

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 4 C - INTANGIBLE ASSETS

(Amount-Rs.)

	DESCRIPTION	GROSS BLOCK				DEPRECIATION					NET BLOCK	
		Opening Balance as on 01.04.2019	Addi-tions	De-duc-tions	Closing Balance	Rate of Depre-ciation	Open-ing Bal-ance	Depre-ciation for the year	Deductions/ Adjustment	Total Depre-ciation	31.03.2020	31.03.2019
1	Computer Software											
2	E-Journals											
3	Patents											
	TOTAL -(C)	-	-	-	-		-	-	-	-	-	-
	GRAND TOTAL (A+B+C)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 4C (i)- PATENTS AND COPYRIGHTS

(Amount-Rs.)

Description	Op. Balance	Addition	Gross	Amortization	Net Block 2019-20	Net Block 2018-19
A. Patents Granted						
1. Balance as on 31.03.18 of patents obtained in (Original value- Rs. ...../-						
2. Balance as on 31.03.18 of patents obtained in Original value- Rs. ...../-						
3.. Balance as on 31.03.18 of patents obtained in (Original value- Rs. ...../-						
4. Patents granted during the Current Year						
TOTAL	NIL	NIL	NIL	NIL	NIL	NIL

Description	Op. Balance	Addition	Gross	Patents Granted/ Rejected	Net Block 2019-20	Net Block 2018-19
B. Patents Pending in respect of Patent applied for						
TOTAL	-	-	-	-		-
C. Grand Total (A+B)	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 4 D FIXED ASSETS (OTHERS)

	DESCRIPTION	GROSS BLOCK			
		Opening Balance as on 01.04.2019	Additions	Deductions	Closing Balance
	TANGIBLE ASSETS				
1	LAND:				
	a) Freehold				
	Land obtained from Govt				-
	Vithura				-
2	Site Development				-
3	BUILDINGS:				-
4	Roads & Bridges				-
5	Tubes & Water Supply				-
6	Sewage & Drainage				-
7	Electrical Installation and equipment				-
8	Plant and Machinery				-
9	Scientific & Laboratory Equipment		1,79,10,183		1,79,10,183
10	Office Equipment				-
11	Audio Visual Equipment		59,832		59,832
12	Computers & Peripherals		26,21,110		26,21,110
13	Furniture, Fixtures and Fittings		66,400		66,400
14	VEHICLES				-
15	Library Books & Scientific Journals				-
16	Small Value Assets				
	TOTAL (A)	**-**	**2,06,57,525**	**-**	**2,06,57,525**
17	CAPITAL WORK-IN PROGRESS (B)				

S. No.	INTANGIBLE ASSETS	GROSS BLOCK			
		Opening Balance as on 01.04.2019	Additions	Deductions	Closing Balance
18	Computer Software				
19	E-Journals				
20	Patents				
	TOTAL -(C)	**-**	**-**	**-**	**-**
	GRAND TOTAL (A+B+C)	**-**	**2,06,57,525**	**-**	**2,06,57,525**

(Amount-Rs.)

	DEPRECIATION				NET BLOCK	
Rate of Depreciation	Opening Balance	Depreciation for the year	Deductions/ Adjustment	Total Depreciation	31.03.2020	31.03.2019
0.00%						
0.00%						
2.00%				-	-	
2.00%				-	-	
2.00%				-	-	
2.00%				-	-	
5.00%				-	-	
5.00%				-	-	
8.00%		14,32,815		14,32,815	1,64,77,368	
7.50%				-	-	
7.50%		4,487		4,487	55,345	
20.00%		5,24,222		5,24,222	20,96,888	
7.50%		4,980		4,980	61,420	
t10.00%				-	-	
10.00%				-	-	
	-	**19,66,504**	**-**	**19,66,504**	**1,86,91,021**	**-**

	DEPRECIATION				NET BLOCK	
Rate of De-preciation	Opening Balance	Amortiza-tion for the year	Deductions / Adjust-ment	Total Amor-tization / Adjustments	31.03.2020	31.03.2019
	-	**-**	**-**	**-**	**-**	**-**
-	**-**	**19,66,504**	**-**	**19,66,504**	**1,86,91,021**	**-**

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 5- INVESTMENTS

(Amount-Rs.)

INVESTMENTS FROM EARMARKED/ ENDOWMENT FUNDS	2019-20	2018-19
1. In Central Government Securities		
2. In State Government Securities		
3. Other approved Securities		
4. Shares		
5. Debentures and Bonds		
6. Term Deposits with bank		
7. Others (to be specified)		
TOTAL	**NIL**	**NIL**

SCHEDULE 5(A)- INVESTMENTS FROM EARMARKED/ ENDOWMENT FUNDS (FUND WISE)

(Amount-Rs.)

	2019-20	2018-19
1. Endowment Fund Investment		
TOTAL	**NIL**	**NIL**

SCHEDULE 6- INVESTMENTS OTHERS

(Amount-Rs.)

	2019-20	2018-19
1. In Central Government Securities		
2. In State Government Securities		
3. Other approved Securities		
4. Shares		
5. Debentures and Bonds		
6. Others (to be specified)		
TOTAL	**NIL**	**NIL**

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 7- CURRENT ASSETS

(Amount-Rs.)

	Sub Sch. No.	2019-20	2018-19
1. Stock			
a) Stores and Spares			
b) Loose Tools			
c) Publications			
d) Laboratory Chemicals, consumables and glass wares			
e) Building materials			
f) Electrical materials			
g) Stationery			
h) Water supply material			
2. Sundry Debtors:			
a) Debts Outstanding for a period exceeding six months			
b) Others			
3. Cash balances in hand (including cheques/drafts and imprest)	1	-	-
4. Bank Balances:			
Institute balance			
a) With Scheduled Banks:			
-On Current Accounts	2	46,02,637	47,56,656
-On Term Deposit Accounts (includes margin money)	2	62,26,66,086	56,87,37,129
-On Savings Accounts	2	11,75,61,917	5,59,74,106
b) With non-Scheduled Banks:			
-On Current Accounts			
-On Term Deposit Accounts			
-On Savings Accounts			
Project Balance			
a) With Scheduled Banks:			
-On Current Accounts			
-On Term Deposit Accounts (includes margin money)	2	1,96,09,579	32,50,000
-On Savings Accounts	2	21,83,52,769	9,95,57,522
b) With non-Scheduled Banks:			
-On Current Accounts			
-On Term Deposit Accounts			
-On Savings Accounts			
5. Post Office- Savings Accounts			
TOTAL		**98,27,92,988**	**73,22,75,413**

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

SCHEDULE 8- LOANS, ADVANCES & DEPOSITS

(Amount-Rs.)

	Sub Sch. No.	2019-20	2018-19
1. Advances to employees: (Non interest bearing)			
a) Salary			
b) Festival			
c) Medical Advance			
d) Other (to be specified)			
2. Long Term Advances to employees: (Interest bearing)			
a) Vehicle Loan			-
b) Home Loan			
c) Others (to be specified)			
3. Advances and other amounts recoverable in cash or in kind or for value to be received			
a) On Capital Account			
b) To suppliers			
c) Others	4	2,05,39,61,902	1,62,25,96,771
4. Prepaid Expenses			
a) Insurance			
b) Other Expenses	3	6,85,207	1,76,36,931
5. Deposits			
a) Telephone			
b) Lease Rent			
c) Electricity			
d) AICTE, if applicable			
e) Others (to be specified)			
6. Income Accrued:			
a) On Investments from Earmarked/Endowment Funds			
b) On Investments-Others			
c) On Loans and Advances			
d) Others (includes income due unrealized-Rs.....)	5	2,36,93,845	2,76,40,730
7. Other Current Assets Recievables			
a) Debit balances in sponsered projects	8	5,83,493	
b) Debit balances in fellowship & scholarships			
c) Grants recoverable			
d) Other recievables			
e) TDS	7	4,58,594	3,34,675
8. Claims Receivable	6	**8,61,54,843**	**11,70,51,650**
TOTAL		**2,16,55,37,884**	**1,78,52,60,757**

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/YEAR ENDED 31st MARCH 2020

	2019-20	2018-19
SCHEDULE 9- ACADEMIC RECEIPTS		
FEE FROM STUDENTS		
Acadamic		
a) Tuition fee	40,598,215	30,892,325
b) Admission fee		
c) Enrolment fee		
d) Library fee	686,030	619,875
e) Laboratory fee		
f) Art & Craft fee		
g) Registration fee	559,900	506,250
h) Syllabus fee		
i) Other Receipts	859,255	746,955
j) Alumini Fee	143,450	235,500
TOTAL (A)	42,846,850	33,000,905
Examinations		
a) Admission test fee		
b) Annual examination fee	773,680	732,575
c) Mark sheet, Certificate fee		
d) Entrance Examination fee		
TOTAL (B)	773,680	732,575
Other Fee		
a) Identity Card fee		
b) Fine/ Miscellaneous fee		
c) Medical fee		
d)Transportation fee		
e)Hostel Fee	2,404,850	1,751,850
f)Mess Establishment	777,000	1,212,650
TOTAL (C)	3,181,850	2,964,500
Sale of publications		
a) Sale of admission forms		
b) Sale of syllabus and question paper		
c) Sale of prospectus including admission forms		
TOTAL (D)		
Other Accademic Receipts		
a) Registration fee for workshops programmes		
b) Registration fees (Academic Staff College)		
GRAND TOTAL (A+B+C+D)	**46,802,380**	**36,697,980**

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/YEAR ENDED 31st MARCH 2020

		2019-20	2018-19
SCHEDULE 10- GRANTS/ SUBSIDIES			
(Irrevocable Grants & Subsidies Received)			
Balance B/F		1,15,31,16,892	81,37,69,158
ADD: Receipts During the Year			
Capital Grant		1,23,80,00,000	1,57,00,00,000
General	45,80,00,000		
SC	2,10,00,000		
ST	1,10,00,000		
Revenue Grant			
General	65,90,00,000		
SC	5,85,00,000		
ST	3,05,00,000		
DST - INSPIRE (BSMS)			
CSIR (Ph D Research Scholars)			
KVPY (BSMS)			
UGC (Ph D Research Scholar)			
DBT			
ICMR			
Other Adjustments			2,96,35,801
		2,39,11,16,892	**2,41,34,04,959**
Less: Capital Expenses Incurred during the year		23,32,41,302	62,65,05,924
Less: Closing Unspent balance of grant		1,58,90,28,181	1,15,31,16,892
		56,88,47,409	**63,37,82,143**
TOTAL		**56,88,47,409**	**63,37,82,143**

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/YEAR ENDED 31st MARCH 2020

SCHEDULE 11- INCOME FROM INVESTMENTS

(Amount-Rs.)

	Earmarked or Endownment funds		Other investments	
	2019-20	2018-19	2019-20	2018-19
1) Interest				
a) On Govt. Securities				
b) Other Bonds/Debentures				
2) Interest on term deposits				
3) Income Accrued but not due on term depos-its or interest bearing advances to employees				
4) Interest on Savings Bank Accounts				
5) Others (Specify)				
TOTAL	**NIL**	**NIL**	**NIL**	**NIL**
TRANSFERRED TO EARMARKED/ENDOWMENT FUNDS				
Balance	**NIL**	**NIL**	**NIL**	**NIL**

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/YEAR ENDED 31st MARCH 2020

SCHEDULE 12- INTEREST EARNED

(Amount-Rs.)

Particulars	2019-20	2018-19
1) On Savings Accounts with scheduled banks		30,23,308
2) On Loans		
a. Employees/ Staff		
b. Others		
3) On debtors and others receivables		
TOTAL	**-**	**30,23,308**

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/ YEAR ENDED 31st MARCH 2020

SCHEDULE 13- OTHER INCOME

(Amount-Rs.)

	2019-20	2018-19
A. Income from Land & Building		
a) Hostel room rent	65,39,850	53,80,180
b) License fee	4,98,970	2,79,295
c) Hire charges of Auditorium/ Play ground/ Convention Centre, Etc		
d) Electricity Charges recovered	13,34,340	12,10,482
e) Water Charges recovered		
Total	**83,73,160**	**68,69,957**
B. Sale of Institutes Publications		
Total	**-**	**-**
C. Income from Holding Events		
a) Gross reciepts from annual function/ sports carnival		
Less: Direct expenditure incurredon the annual function/ sports carnival		
b) Gross reciepts from fetes		
Less: Direct expenditure incurred on fetes		
c) Gross reciepts on educational tours		
Less: Direct expenditure incurred on tours		
d) Others (to be specify and separately disclosed)		
Total	**-**	**-**
D. Interest On Term Deposits:		
a) With Scheduled Banks	4,80,50,405	87,10,286
b) With Non-Scheduled Banks		
c) With Institutions		
d) Others		
Total	**4,80,50,405**	**87,10,286**
E. Interest On Savings Accounts:		
a) With Scheduled Banks		
b) With Non-Scheduled Banks		
c) With Institutions		
d) Others		
Total	**-**	**-**
F. On Loans:		
a) Employees/Staff		
b) Others		7,74,299
Total	**-**	**7,74,299**

SCHEDULE 13- OTHER INCOME	(Amount-Rs.)	
	2019-20	2018-19
Total	**-**	**-**
H. Others		
a) Income from consultancy		
b) RTI Fees	140	70
c) Income from royalty		
d) Sale of application form	8,47,500	7,78,000
e) Misc. reciepts (Sale of tender form, waste paper, etc.)	76,51,803	67,37,256
f) Profit on sale/ disposal of Assets		
1. Owned asset		
2. Assets aquired out of grants, or received free of cost		
g) Other Incomes		
Total	**84,99,443**	**75,15,326**
GRAND TOTAL (A+B+C+D+E+F+G+H)	**6,49,23,008**	**2,38,69,868**

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/YEAR ENDED 31st MARCH 2020

SCHEDULE 14 : PRIOR PERIOD INCOME

(Amount-Rs.)

Particulars	2019-20	2018-19
1. Academic Receipts		
2. Income from investments		
3. Interest earned		
4. Other Income		
Total	**NIL**	**NIL**

SCHEDULE 15- STAFF PAYMENT & BENEFITS

(Amount-Rs.)

	2019-20	2018-19
a) Salaries and Wages	23,97,42,535	26,96,20,620
b) Allowances and Bonus	52,99,049	58,93,751
c) Contribution to Provident Fund		
d) Contribution to Other Fund (Leave Salary & NPS Employer Share)	2,35,74,327	1,74,17,954
e) Staff Welfare Expenses	-	-
f) Retirement and Terminal Benefits		
g) LTC facility	25,86,123	43,59,662
h) Medical facility	23,22,260	25,80,523
i) Children Education Allowance	20,54,839	9,34,750
j) Honorarium		
k) Others (Leave Salary)	1,32,61,618	1,52,42,007
TOTAL	**28,88,40,751**	**31,60,49,267**

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/YEAR ENDED 31st MARCH 2020

SCHEDULE 15 A- EMPLOYEES RETIREMENT AND TERMINAL BENEFITS

(Amount-Rs.)

	Pension	Gratuity	Leave Encashment	Total
Opening balance as on				
Additions: Capitalized value of contributions Received from other Organizations				
Total (a)				
Less: Actual Payment during the Year (b)				
Balance available as on 31.03.... C (a-b)				
Provision required on 31.03.... As per Actuarial Valuation (d)				
A. Provision to be made in the curent year (d-c)				
B. Contribution to New Pension Scheme				
C. Medical Reimbursement to Retired Employees				
D. Travel to Home town on Retirement				
E. Deposit Linked Insurance Payment				
TOTAL (A+B+C+D+E)	**NIL**	**NIL**	**NIL**	**NIL**

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/ YEAR ENDED 31st MARCH 2020

SCHEDULE 16- ACADEMIC EXPENSES

(Amount-Rs.)

Particulars	2019-20	2018-19
a) Laboratary Expenses	3,46,67,353	5,44,17,587
b) Field Work/ Participation	1,52,685	2,44,109
c) Expenses on Seminar/ Workshop		
d) Payment to visiting faculty		
e) Examination		
f) Student welfare expense		
g) Admission expenses	-	-
h) Convocation expense	10,95,791	8,40,051
i) Publication		
j) Stipend/ means-cum-merit scholarship	6,62,05,850	5,51,49,052
k) Subscription Expense		
l) Others (Specify)		
TOTAL	**10,21,21,679**	**11,06,50,799**

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/ YEAR ENDED 31st MARCH 2020

SCHEDULE 17- ADMINISTRATIVE AND GENERAL EXPENSES (Amount-Rs.)

Particulars	2019-20	2018-19
A. Infrastructure		
a) Electricity and power	5,27,61,559	5,57,36,834
b) Water charges	17,074	1,93,653
c) Insurance		-
d) Rent, Rates and Taxes	4,12,500	79,28,750
B. Communication		
e) Postage & Telegram	1,74,784	5,62,361
f) Telephone and Internet Charges	44,15,048	37,05,337
C. Others		
g) Printing and Stationary	19,15,976	29,66,783
h) Travelling and Conveyance Expenses	96,22,867	97,77,889
i) Expenses on Seminar/Workshops	21,60,997	69,16,678
j) Hospitality		
k) Auditors Remuneration	3,94,110	1,42,960
l) Professional Charges		
m) Advertisement and Publicity	13,01,566	25,53,971
n) Magazine & Journals		
o) Others (specify)		
Sports / Cultural Festival / Celeberation expense	35,45,183	17,79,520
Consumables	1,06,08,408	1,47,81,890
Contingencies		-
Cable TV Charges	1,38,720	20,954
Newspaper & Periodicals	1,36,835	124,655
Office contingencies	24,16,295	31,39,790
Software License fees	12,90,362	7,99,443
Photography Charges		961
Publication charges	4,80,426	7,67,191
Guest house and other expenses	9,29,371	87,057
Gardening & Landscaping Chages		-
Other Adminstrative / Miscellaneous Expenses	57,46,867	1,58,94,503
Legal and consultancy charges	92,30,776	87,03,951
Anvesha Programme Expenses	3,06,254	1,92,338
Expenses related to COVID 19	1,85,504	-
Medical Centre - Consumables&Medicines	6,94,016	3,36,670
Running of Generator Set	3,84,677	16,34,758
IT recurring expenses for service	48,12,223	94,51,891
TOTAL	**11,40,82,398**	**14,82,00,788**

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/ YEAR ENDED 31st MARCH 2020

SCHEDULE 18- TRANSPORTATION EXPENSES (Amount-Rs.)

	2019-20	2018-19
1. Vehicles (owned by educational institution)		
a) Running expense	4,95,431	3,80,159
b) Repairs & Maintanence	1,32,612	1,10,203
c) Insurance Expenses	1,78,008	10,22,930
2. Vehicles taken on rent		
a) Rent/ Lease expenses	10,232,911	14,191,405
3. Vehicle (Taxi) Hiring expenses		
TOTAL	**1,10,38,962**	**1,57,04,697**

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/YEAR ENDED 31st MARCH 2020

SCHEDULE 19- REPAIRS & MAINTANENCE (Amount-Rs.)

	2019-20	2018-19
a) Building		
b) Furniture & Fixtures		
c) Plant & Machinary	5,16,57,455	4,17,75,921
d) Office Equipments		
e) Computers		
f) Laboratory & Scientific equipment		
g) Audio Visual equipment		
h) Cleaning Material & Services		
i) Book binding charges		
j) Gardening		
k) Estate Maintenance		
f) Others (Specify)		
TOTAL	**5,16,57,455**	**4,17,75,921**

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/ YEAR ENDED 31st MARCH 2020

SCHEDULE 20- FINANCE COSTS (Amount-Rs.)

	2019-20	2018-19
a) Bank Charges	11,06,164	14,00,671
b) Others (specify)		
TOTAL	**11,06,164**	**14,00,671**

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/ YEAR ENDED 31st MARCH 2020

SCHEDULE 21- OTHER EXPENSES (Amount-Rs.)

	2019-20	2018-19
a) Provision for Bad and Doubtful debts/ Advances		
b) Irrecoverable Balances Wrtitten off		
c) Grants/ Subsidies to other institutions/ Organisations		
c) Others (Specify)		
TOTAL	**NIL**	**NIL**

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE PERIOD/YEAR ENDED 31st MARCH 2020

SCHEDULE 22- PRIOR PERIOD EXPENSES (Amount-Rs.)

	2019-20	2018-19
1. Establishment Expenses		
2. Academic Expenses		
3. Administration Expenses		
4. Transportation Expenses		
5. Repair & Maintenance		
6. Other Expenses	8,67,802	16,18,08,148
TOTAL	**NIL**	**NIL**

Schedule 23: Significant Accounting Policies

1. Basis for preparation of Accounts:
The Annual Accounts of the institute are prepared on the basis of revised format and guidelines issued by the Ministry of Human Resource Development, Government of India and approved by the C&AG of India for all Central Educational Institutes w.e.f. FY 2014-15 (Communicated vide Lr.No.29-4/2012-IFD dated 17.04.2015 of MHRD, GOI).

2. Accounting Convention:
The financial statements are prepared on the basis of Historical Cost Convention and ongoing concern concept unless otherwise stated.
The institute follows accrual method of accounting.

3. Revenue Recognition:
The institute is significantly funded by the Ministry of Human Resource Development (MHRD, Government of India. The Government release the Grants-in-Aid under two major heads i.e., Capital and Revenue. Grants-in-Aid from GOI is accounted for in the same financial year for which it is sanctioned by the MHRD.
Government Grants to the extent utilized for meeting revenue expenditure on accrual basis are treated as revenue income of the year and depicted in the Income and Expenditure Account.
Admission fees, Tuition Fees and other fees received from students are accounted on accrual basis.
Interest on Fixed Deposits has been credited in the accounts on accrual basis.
No interest bearing advances for House Building, Purchase of Vehicles etc., has been sanctioned to staff to the said period.

4. Fixed Assets and Depreciation
The fixed assets are valued at cost of acquisition and inclusive of inward freight, duties, taxes, incidental and direct expenses related to acquisition.
No fixed asset has been received directly by way of non-monetary grant during the year under consideration.
The land at Jersey Farm, Vithura Nedumangad Taluk, Thiruvananthapuram District has been given by the Govern-

ment of Kerala at no cost, hence the same has been shown at nominal value of Rs.1/- in Annual Account.
No gifted / donated assets and Books have been received during the year under consideration.
Fixed Assets are valued at cost less accumulated depreciation. No change has been made in the method and depreciation on fixed assets has been provided on Straight Line Method at the following rates:

Tangible Assets:		
1	Land	0.0%
2	Site Development	0.0%
3	Buildings	2.0%
4	Roads and Bridges	2.0%
5	Tube wells and water supply	2.0%
6	Sewerage and Drainage	2.0%
7	Electrical installation and equipment	5.0%
8	Plant and Machinery	5.0%
9	Scientific and Laboratory Equipment	8.0%
10	Office Equipment	7.5%
11	Audio Visual Equipment	7.5%
12	Computer and Peripherals	20.0%
13	Furniture, Fixtures and Fittings	7.5%
14	Vehicles	10.0%
15	Library Books and Scientific Journals	10.0%

Intangible Assets (Amortization)		
1	E-Journals	40%
2	Computer Software	40%
3	Patents and Copyrights	9 Years

Depreciation is provided for the whole year on additions during the year for acquisition period of six months and above and for half year on additions for acquisition period of less than six months.
Where an asset is fully depreciated, it will be shown at a residual value of Rs.1/- in the Balance Sheet and will not be further depreciated.

Assets created out of Earmarked Funds and Funds of Sponsored Projects where the ownership of such assets vests in the Institution will be setup by credit in Capital Fund and merged with the Fixed Assets of the institution. Depreciation will be charged at the rates applicable to the respective assets. Accordingly, assets of Sponsored Projects of 2019-20 shown in Schedule 4-D Fixed Assets (Others). Patents, copyrights and E Journals are grouped under intangible assets.
Electronic Journals (E-Journals) are separated from Library Books in view of the limited benefit that could be derived from the on-line access provided. E-Journals are not in a tangible form, but temporarily capitalized in view of the magnitude of expenditure and the benefit derived in terms of perpetual knowledge acquired by the Academic and Research Staff. Depreciation is provided in respect of E-Journals at a higher rate of 40% as against depreciation of 10% provided in respect of Library Books.
Software and Computer Peripherals are being shown under the Fixed Assets.

Stocks:
Expenditure on purchase of Chemicals, Lab ware, Office Consumables, Publications and other consumable items are accounted as revenue expenditure. Such items issued to Labs are treated as consumed and hence closing stock is taken as NIL.

Retirement Benefits:
All employees of the Institute are covered under the New Pension Scheme. As such no provision has been made for pension, however suitable provision on the basis of actuarial valuation has been made for the Earned Leave Encashment.
No long term or Short Term Investments are made by the institute in Government Securities, Bonds, Debentures and Shares.

Corpus / Earmarked / Designated Endowment Funds:
The funds of the institute are classified into following categories:

1. Corpus / Capital Fund: It refers to fund contributed by Government for establishment and activities of the institute. Corpus / Capital fund is the main fund of the institute and it denotes a permanent fund kept for the existence of

the institute. The additions to this fund are Grants from Government to the extent utilised for Capital Expenditure. Assets purchased out of earmarked funds and sponsored project funds and excess of income over expenditure transferred from Income and Expenditure account.

Government Grants:
Plan grants received from Government are accounted on accrual basis.
To the extent utilised towards capital expenditure, Government Grants are transferred to the Capital Fund.
Unutilised Government Grants are carried forwarded and depicted under Current Liability in the Balance Sheet.

Capital Work-In Progress:
Deposit works are accounted for as Capital Work-in-Progress on the basis of statements received from Works Wing. Running Bills of Contractors are also accounted for as construction work in progress till completion. No depreciation is charged on Capital work in progress. Secured advances and Mobilization advances and Deposit work with CPWD are disclosed separately under the heads Loans and Advances.

Sponsored Projects:
The amount received under Sponsored Projects has been separately shown in Schedule 3 A.
The fellowships and scholarships funded by the UGC, CSIR, DST INSPIRE etc., are also shown separately in Schedule 3B
The Fellowships and Scholarships provided by the institute itself are accounted as Academic expenses.

Income Tax:
The income of the institute is exempt from Income Tax under Section 10 23 (C)(iii ab) of the Income Tax Act 1961. No provision for tax is therefore made in the accounts.

Foreign Currency transactions:
Foreign Currency transactions are accounted for at the rate of exchange prevailing on the dates of such transactions.

Schedule 24: Contingent Liabilities and Notes on Accounts

The financial statement of the institute is prepared in three parts:
i) Receipt and Payment Account
ii) Income and Expenditure Account
iii) The Balance Sheet.
The Receipts and Payments Account consists of the figures of actual receipts and payments of the institute during the financial year 2019-20 as per Cash Book. The total receipts from the different sources as shown in Receipt and Payment Account comes to Rs.263.020 cr. which inter alia includes grant of Rs.123.00 cr. received from Ministry of Human Resource Development and the total receipts towards Fees, interests and other resources of Rs.63.51 cr.
The Income and Expenditure Account is prepared on accrual basis.
In Balance Sheet the acquired fixed assets, current assets are taken as assets while the Corpus Fund, Designated Fund, Endowment Funds, balance of Sponsored Projects and Grants received from Government and Current Liabilities etc., are shown in respective Schedules under Sources of Funds / Liabilities.
Figures in Final Accounts have been rounded off to the nearest rupee.
Schedule 1 to 22 are annexed and they form an integral part of Annual Accounts.
As per MHRD guidelines method of computing of depreciation is Straight Line Method.
The details of balances in Saving Bank, Current Accounts and in Fixed Deposit Accounts are given in Schedule 7 of the Balance Sheet.
The brought forward of opening balance from last financial year segregated in Schedule 3 Current Liabilities as the provisions of leave encashment shown in separate.

During the financial year 2019-20, some small value assets / spare parts procured has been shown as consumable in the accounts being treated as augmentation to the Scientific / Lab equipment.
The unutilized grant shown under Schedule 3(C) Plan Grants from MHRD is Rs.158.90 cr. out of which advance payment made to CPWD as Deposit work for construc-

tion of IISER Permanent Campus vide Balance Sheet Sub Schedule 7.
An appeal was filed against M/s. Consolidated Construction Consortium Ltd. (CCCL) before the Hon'ble High Court of Kerala challenging the award of arbitrator vide O.P(Arb.) No.446/2018. Institute have deposited B.G for 1/4th of the award amount in the court on 1.1.2019 as per the directions of the Sessions Court and the matter is posted for further hearing.

Corpus / Capital Fund
In Balance Sheet of 2018-19, under Corpus / Capital Fund, the unutilized grant of Rs.115.31 cr. included has been rectified and shown separately under Liabilities in the current year as per the comments of Separate Audit Report of 2018-19. Hence the closing balance of 2018-19 shown in current year annual accounts opening balance of 2018-19 under Corpus / Capital Fund will reflect in two heads viz., Corpus / Capital Fund and Unspent balance of Grant – MHRD. [Rs.7351244980 + Rs.1153116891= Rs.8504361871]. Accordingly, the balance as at the beginning of the year 01.04.2019 at Schedule 1 also depicted as Rs.7351244980/-

Fixed Assets:
During the current financial year 2019-20 changes under the Schedule 4 of Fixed Assets the closing balance of 2018-19 under Buildings segregated to Buildings and Roads & Bridges. Hence the closing balance shown under Buildings in 2018-19 reflects in two heads as opening balance of 2019-20 [Buildings - Rs.2416081105/- + Roads & Bridges – Rs.73341681/- = Rs.2489422786]

Depreciation:
As per the annual accounts of 2018-19, under the head Tubes & Water Supply, depreciation calculated at 7.5% whereas depreciation as per MHRD guidelines it is 2%, hence the excess depreciation charged in previous year is reversed in 2019-20 annual accounts.
The depreciation arrived for the assets shown under Schedule 4-D in respect of assets of Sponsored Projects amounting to Rs.19,66,504/- shown in Income and Expenditure Account as Depreciation of assets acquired out of Sponsored Project Grant.
The effect of change in depreciation workings under the head Tubes & Water Supply and Library Books & Scientific Journals amounting to Rs.8,67,802/- is accounted as prior period expense in the current year.

Sponsored Project Accounts:
The institute has received grants from DST, DBT, Wellcome Trust DBT Alliance Fellowships, DAE, ISRO, CSIR, UGC etc., in Research and Development (R&D) Projects. A separate bank account is maintained for Sponsored R & D Projects. The transactions of Sponsored Projects and Project wise closing balances are being shown in Schedule 3(A) of the Balance Sheet. As per the funding agencies guidelines project wise bank account(s) are being maintained with IDBI Bank and Canara Bank separately.
The treatment of Project Grant and its Utilisation is on Cash Basis.

Capital Works-in-Progress:
The construction work of institute's permanent campus situated at Jersey Farm, Vithura is under progress and expenditure related to the same is shown under Schedule 4 (Fixed Assets) of the Balance Sheet.
The expenditure on capital work-in-progress as at 31.03.2020 was of Rs.261,18,13,191/-. Out of which construction is Rs.255,10,82,850/- and uninstalled equipment procured during the period is Rs.6,07,30,341/-.

The NPS subscription recovered from employees and employer's contribution are remitted to NPS Trust Account regularly. NPS Accounts are maintained by NSDL. Hence separate schedule has not been prepared.
GPF is not applicable to the institute employees. Hence GPF accounts schedule has not been prepared.
Other Additions
As per the institute's policy, the overhead generated from the Externally Funded Projects have been segregated into four parts vis-a-vis, (i) 45% - income from overheads to institute, (ii) 5% - Staff Welfare Fund, (iii) 25% - School Departmental Fund and (iv) 25% - Project Investigator Fund. The said figures (ii) to (iv) have been depicted as other additions in Schedule 1 of Annual Accounts.

RECEIPTS AND PAYMENTS FOR THE PERIOD / YEAR ENDED 31.03.2020

RECEIPTS	2019-20	2018-19
I. Opening Balance		
a) Cash in hand		
b) Bank Balances		
i) In current accounts		
a) Canara Bank A/c	31,257	34,002
b) IDBI Bank A/c	2,29,556	2,14,556
c) SBI Bank A/c	44,95,844	18,00,104
d) Canara Bank	35,07,94,919	42,52,61,706
e) SBI	27,39,16,316	30,60,45,714
f) Canara Bank Project A/c	80,36,152	1,17,74,065
g) IDBI Bank Project A/c	9,15,21,369	17,75,81,379
II. Grants Received		
a) From Government of India	1,23,00,00,000	1,82,35,00,000
b) From State Government		
c) From other sources		
III. Acadamic Receipts	4,88,41,035	3,85,09,261
IV. Receipts against Earmaked/ Endowment Fund		
V. Receipts against Sponsored Projects (including interest)	18,57,56,652	10,18,42,813
VI. Receipts against Sponsored Fellowships and Scholarships	3,60,90,019	
VII. Income on Investments from		
a) Earmarked/Endow. Funds		
b) Own Funds ()th. Investment)		

(Amount Rs.)

PAYMENTS	2019-20	2018-19
I. Expenses		
a) Establishment Expenses	29,28,83,231	30,55,91,188
b) Acadamic Expenses	7,91,90,092	11,31,99,839
c) Administrative Expenses	10,43,26,588	14,67,89,850
d) Transportation Expenses	1,82,67,824	1,68,57,880
e) Repair & Maintanence Expenses	5,11,69,036	4,02,03,640
f) Prior period Expenses		
II. Payments made against earmarked endowment funds		
III. Payment against Sponsored Projects		
IV. Payment against sponsored fellowships	1,02,12,342	
V. Investments and deposits made		
a) Out of Earmarked/Endowment funds		
b) Out of Own Funds (Investments-Others)		
VI. Term Deposits with Scheduled Banks		
VII. Expenditure on Fixed Assets & Capital Work in Progress, Purchase of Fixed Assets and Expenditure	27,92,55,771	40,88,72,997
VIII. Other payment including Statutory payment	7,84,18,925	7,67,00,669
IX. Refunds of Grants	2,01,14,146	
X. Deposits & Advances	50,46,29,892	1,19,05,45,852
XI. Other payments	11,24,656	5,39,617
Other payments-External projects	20,79,20,423	17,51,59,012
VIII. Closing Balances		
a) Cash in hand		
b) Bank Balances		
i) In current accounts		
a) Canara Bank A/c	28,405	31,257
b) IDBI Bank A/c	2,51,103	2,29,556

RECEIPTS	2019-20	2018-19
VIII. Interest Received		
a) On Bank deposits	5,19,88,279	1,96,46,698
b) Loans. Advances etc.		
c) Savings Bank Account	23,98,811	30,23,308
IX. Investment encashed		
X. Term Deposits with Schedule bank encashed	63,07,421	
XI. Other Income (Incuding prior period income)	1,45,94,260	1,98,09,600
XII. Deposits & Advances	32,27,00,679	27,38,65,033
XIII. Miscellaneous receipts including Statutory receipts	26,03,345	
XIV. Any other receipts		5,77,719
Total	2,63,03,05,914	3,20,34,85,957

c) SBI Bank A/c	43,23,129	44,95,844

PAYMENTS	2019-20	2018-19
ii) In deposit /savings accounts		
a) Canara Bank	40,17,59,154	35,07,94,919
b) SBI	33,70,43,849	27,39,16,316
c) Canara Bank Project A/c	14,58,02,073	80,36,152
d) IDBI Bank Project A/c	9,21,60,275	9,15,21,369
e) IDBI Bank	14,25,000	
Total	2,63,03,05,914	3,20,34,85,957

SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31st MARCH 2020

(Amount in Rs.)

SUB SCH No.	PARTICULARS	2019-20	2018-19
	CURRENT LIABILITIES AND PROVISIONS		
1	**Sundry Creditors for Goods & Services:**		
	Asst.Executive Engineer, KWA, Pongumoodu	0	77733
	Meeguards Info Services	0	284472
	Sunish Radhakrishnan	0	141541
	AshinRaj	0	4550
	Dr.Nisha N Kanna	0	-672
	Dr.P.Chiranjeevi	0	-1552
	Dr.Ullasa Kodandaramaiah	0	-212
	Dr.Vinayak Kamble	0	-672
	Fi-Tec Power Solutions Ltd	0	-91
	Sudeep S	0	-280
		0	504817
2	**Sundry Creditors for expenses:**		
	Advertisement Charges Payable	17545	5765
	Audit fees payable	101480	143960
	Consumables Payable	3079604	870095
	CIF Testing Charges	1182358	0
	Computer & Peripheral Expense Payable	0	31613
	Electricity Charges Payable	5441072	4876411
	E Journal Subsciption payable	4821610	1467668
	Equipment Expense payable	3775948	3319777
	Fellowship Payable	6215640	5462334
	Fuel Expense Payale	0	43044
	Furniture & Fixtures Payable	0	1195445
	Insurance charges Payable	0	2832
	IT Consumables Payable	0	118581
	Library Books & Scientific Journals Payable	0	3156696
	Manpower Security Charges payable	2990796	3003640
	Meeting & Seminar Payable	0	6570
	Manpower Charges payable	2788307	165250
	Loan From IISER TVM Cooperative Society	0	22672
	IISER TVM Employees Co-operative Society	286579	4000
	Membership For Employees Cooperative Society	0	7000
	Medical Reimbursement Payable	238180	64056

SUB SCH No.	PARTICULARS	2019-20	2018-19
	Newspaper payable	10185	9595
	NPS Employee contribution payable	1378593	1376849
	NPS Employer contribution payable	1930032	1376849
	Payable to M/s Balmer Lawrie & Co Ltd.,	33975	0
	Payable to BRICS Mathematics Programme	60000	0
	Printing and Stationery payable	295514	140525
	Rent Payable	0	82500
	Salaries & Allowances Payable	12854701	32945005
	Telephone / Internet Charges Payable	437609	31177
	Travel Expense Payable	563542	8128
	Vehicle Hire Charges Payable	0	1191920
	Payable to SOB Frontier Symposium	4750	0
	Payable to SOC Frontier Symposium	25000	0
	Other miscellaneous payable	0	479509
	Transportaion charges Payable	877964	55486
	Sports / Cultural Meet Expenses Payable	0	18000
	Office/Contingency expenses Payable	74077	139065
	R&M AMC for Equipment & Machineries payable	0	903881
	Research & Teaching expenses payable	0	1143775
	Postage Courier Charges Payable	7928	125983
	Repairs and Maintenance Payable	3883404	678629
		53376393	64674285
3	**EMD & Caution Deposit**		
	EMD	9037242	6978292
	Caution Deposit- Institute	1490700	1376700
	Caution Deposit- Hostel	2973983	2745983
	Caution Deposit- Library	1458000	1344000
	Caution Deposit-Mess	3822000	3407500
	Security Deposits	30305755	30556346
		49087680	46408821
4	**Statutory Liabilities- Others**		
	TDS & Cess (Contract, Salary, Professional, Rent, Advances)	2934581	1966889
	VAT	1485	1485
	LWF	77182	369006
	Professional Tax	1250	1250
	TDS-CGST	253415	387441

SUB SCH No.	PARTICULARS	2019-20	2018-19
	TDS-SGST	253415	387442
	TDS - IGST	107920	224880
	NPS recovery from employees	178140	0
	GST	0	67500
	Kerala Flood Cess	80	0
		3807468	3405893
5	**Other Current Liabilities**		
	Advances from M/s CCC Ltd	336728015	336728015
	Advance Construction- M/s CCC Ltd	7155311	
	Advance from MHRD for Gian Programme	0	77108
	Loan from Project	0	30000000
	Payable to JAC	0	4615368
	Phd Students	0	45000
	IISER NISER Meeting outstanding	0	406783
	Monthly Deposit Scheme (Society)	0	219697
	Payable to Project Canara Bank	67500	5143785
	Payable to Institute	3909	0
	Payable to Institute by IDBI A/c's	170781	610358
	Payable to IDBI by Institute	0	76322
	CPF/GPF/Others Payable to other institutions	18450	0
	IIITK Fee Payable	432368	0
	Other Charges Payable	252494	0
	Payable to ICNT Programme	0	140550
	Payable to DST (Reshma Raveendran)	3000	3500
	Payable to STEP Programme KSCSTE	-66538	262500
	Payable to J & K Scholarship	0	1700
	Payable to MTTS Conference	0	750000
	Payable to Sateesh Raghavan	0	2060
	Payable to We Build	60292	60292
	Performance Guarantee	3253921	4868438
	Withheld from CCC Ltd.	23774101	23774101
	Withheld from We Build Private Limited	400000	400000
	The Registrar, IIT Kanpur	269316	0
	Receivables from District Tibal Welfare Department	10900	10900
	Medical Insurance Premium of Students	894139	426921
	Group Term Life Insurance (GTLI)	-331092	-36601
	Loan from Institute - Dr.Sukhendu Mandal Project	0	300000

SUB SCH No.	PARTICULARS	2019-20	2018-19
	Loan from Institute - Ramanujan Project	0	140000
	DST FIST Review Meeting	360141	
	Loan to SERB - Dr.Sukhendu Mandal	300000	
	Loan to DBT Project- Prof Srinivasa Murty Srinivasula	400000	
	Loan to Ramanujan Project - Dr.Rajendrar Goretti	175000	
	Payable to MHRD	8245461	
		382577469	409026797
6	**PROVISIONS**		
	Leave Salary Payable	81776332	69284878
		81776332	69284878
		570625342	593305491
7	**FELLOWSHIP/SCHOLARSHIP FROM OTHER SOURCE**		
	ICMR FELLOWSHIP	0	24094
	DST SHE Inspire BSMS / PH D	12154260	-9145840
	KVPY BSMS	0	-1432686
	CSIR Ph D	1805656	557032
	UGC - Ph D	723586	723586
	DBT Ph D	0	-90166
	PMRF - Ms Anjali Warrier	60000	0
	PMRF - Mr.Vivek	410000	0
		15153502	-9363980
		585778844	583941511

SUB SCH No.	PARTICULARS	2019-20	2018-19
	CURRENT ASSETS, LOANS AND ADVANCES		
1	**Cash Balance**		
	Institute Balance	-	-
	Project Balance	-	-
		-	-
2	**Bank Balances**		
	Institute Balance		
	Canara Bank - Current A/c	28,405	31,257
	SBI - Fee Collect -	1,12,991	31,35,361
	IDBI Bank Ltd., (Current A/c)	2,51,103	2,29,556
	SBI Current A/c- Vithura	23,90,717	66,150
	SBI - WCT	18,19,421	12,94,333
	Term Deposits with Canara Bank	35,07,11,158	32,40,59,144
	Term Deposits with Canara Bank - LC	2,00,98,093	1,60,72,000
	Term Deposits with SBI	15,79,06,952	14,49,91,835
	Fixed Deposits with SBI- Vithura SB A/c	9,25,24,883	8,36,14,150
	Deposit with IDBI	1,425,000	-
	Canara Bank - SB A/c	3,09,49,903	1,06,63,775
	SBI Vitura SB A/c	3,24,90,448	11,69,174
	SBI -Vithura SB A/c	5,41,21,566	4,41,41,157
	Project Balance - IGF	1,85,00,000	-
	Project Balance -IDBI Term Deposit	384,579	32,50,000
	Project Balance -Canara Bank Term Deposit	725,000	-
	Project Balance -Canara Bank SB A/c	12,65,77,073	80,36,152
	Project Balance -IDBI Bank Various A/c's	9,17,75,696	9,15,21,369
		98,27,92,988	73,22,75,413
3	**Prepayments**		
	Vehicle Insurance	25,622	94,737
	Transit Insurance	87,899	-
	Office/Contingency Expense	12,362	810
	Software License Fees	5,47,900	6,90,779
	E-Journal	11,424	-
	Library Journal	-	1,65,75,297
	GTLI	-	2,75,308
		6,85,207	1,76,36,930
4	**Deposits and Advances**		

SUB SCH No.	PARTICULARS	2019-20	2018-19
	Rent	1,09,000	1,09,000
	KSEB - Sreekaryam	33,600	33,600
	Gas Connection Deposit	47,377	47,377
	Foreign Consumables Supplies Advance	-	2,001
	KSEB Deposit	77,40,700	61,48,568
	Techies Park	32,872	32,872
	Advance to Project	5,75,000	-
	Advance to CPWD	1,95,37,92,663	1,52,45,92,663
	Advance for Plant and Mechinery	22,71,451	22,71,451
	Advances for Mobilisation	6,40,93,878	6,40,93,878
	Advance - Capital	2,48,82,011	2,48,82,011
	Advance- Recurring	3,83,350	3,83,350
		2,05,39,61,902	1,62,25,96,771
5	**Interest Accrued**		
	Interest from Flexi /Fixed Deposit with Canara Bank	1,09,88,222	1,63,66,455
	Interest from Term Deposit with Canara Bank for LC	7,21,229	11,28,837
	Interest from Fixed Deposit with IDBI	21,547	-
	Interest from Term Deposit with SBI	1,19,62,847	1,01,45,438
		2,36,93,845	2,76,40,730
6	**Claims Receivable**		
	Temporary Advance		
	Dr Sathesh Khurana	15,000	15,000
	Krishnakumar A	2,00,000	-
	Dr.Sunish Radhakrishnan	-	(10,000)
	Dr.Sukhendu Mandal	25,000	-
	Arafath E M	99,400	-
	Dr.Suhesh Kumar Singh	8	-
	Dr.Ramanathan Natesh	7,307	-
	Sangeeth M	10,000	-
	Ashinraj D	40,000	-
	Dr.Nishant K T	25,000	-
	Vijesh K	10,000	-
	Dr.Deepshika Jaiswal Nagar	25,000	-
	Rajesh A P	50,000	-
	Dr.Bikas Chandra Das	-	15,000
	Dr.Madhu Thalakulam	-	25,000
	Subin S	-	25,000

SUB SCH No.	PARTICULARS	2019-20	2018-19
	Amritha Sivan	-	25,000
	Kumar	-	23,000
	M/s Zeba Lab Systems Pvt Ltd	20,1961	20,1961
		7,08,676	3,19,961
	Cumulative Professional Development Advance		
	Dr Madhu Thalakulam	75,000	0
	Dr.Saikat Chatterjee	0	1,50,000
	Dr.Deepshika Jaiswal Nagar	0	80,000
		75,000	2,30,000
	TA / LTC Advance		
	Sarathkumar R	88,000	-
	Soham Bhattacharya	-	75,000
	Rishika Rai	-	75,000
	Vignesh	-	75,000
	Arthi R	-	75,000
	Dr.Sukhendu Mandal	-	1,00,000
	Dr.Suhesh Kumar Singh	-	1,35,000
	Ankush Kumar Garg	-	75,000
	Niyas Rehman	-	75,000
		88,000	6,85,000
	Consumables Advance (M/s B J DS)	4,85,000	
	Secured Advance		
	Secured Advances for construction	32,35,433	32,35,433
	Secured Advances - RDS	-	24,38,308
	M/s CCC Ltd	5,11,77,978	5,11,77,978
	Miscellaneous Deposits Advances - M/s RDS	1,83,10,284	1,63,69,133
	Admission Fee for Officers, Faculty & Staff	3,400	3,400
	Advance payment made to KSEB	-	1,524
	Receivable from DAE-NBHM	4,162	-
	Receivable from IST 2019 - SOM	1,521	-
	Receivable from BMC IN	-	73,196
	Recivable from Balani Infotech Pvt Ltd	-	2,633
	Receivable from BSMS Students	-	8,677
	Receivable from JAC 2020	24,70,508	-
	Receivable from JAC 2019	-	1,08,840
	Receivable from Dr.Utpal Manna	-	180

SUB SCH No.	PARTICULARS	2019-20	2018-19
	Receivable From Caligo Technologies	-	4,400
	Receivable from Mahendranath	-	10,000
	Receivable from M.S.Steels	-	1,450
	Recievable from Prof M.V.George Memorial Lecture Fund	(14,25,000)	-
	Recievable from IIIT Kottayam	-	61,02,062
	Recievable from JEST	-	1,66,900
	Recievable from Priji E Moses	-	828
	Receivable From Scientists and Officers	1,812	-
	Receivable from APC 2014	-	79,091
	Receivable from Amal Medhi	-	2,529
	Receivable from Mahesh Hariharan	-	500
	Recievable from Nafeesa K	-	100
	Recievable from UK Agencies	-	41,194
	Receivable from Institute (IDBI)	-	76,322
	Receivable from Institute	67,500	51,43,785
	Receivable from Project	3,909	-
	Receivable from IDBI Project A/c by Institute	1,70,781	6,10,358
	Receivable from Customs	-	21,743
	Receivable from SERB Project of Dr.Sukhendu Mandal	3,00,000	3,00,000
	Receivable from Ramanujan Project(Ramesh Rasappan)	-	1,40,000
	Receivable from ppf to DST MES project -Shaijumon	-	75,000
	Receivable from Science Writing Workshop-Dr.Natesh	-	25,460
	Receivable from Shree Balaji Scientific Co	-	11,288
	Receivable from SPL Engineers	-	6,527
	Receivable from Rajdhani Engg Co.,	-	1,073
	Receivable from Loom	-	10,620
	Receivables from Ideal Systems	7,489	7,489
	Receivable from CSIR Contingency	2,000	-
	Receivable from CSIR Fellowship	45,000	
	Receivable from Sangeeth M	-	265
	Receivable from KSCSTE	28,375	(5,38,090)
	Receivable from Newton Scholarship	-	2,00,000
	Loan to institute	-	3,00,00,000
	Loan From FIST Project of SOP	18,00,000	
	Loan From SERB Project of Prof Hema - SIDA	1,50,000	
	Receivable from Dr.Sadananda Singh	127	
	Receivable from Dr.Reji Varghese	1,262	

SUB SCH No.	PARTICULARS	2019-20	2018-19
	Receivable from PPF	75,000	
	Receivable from Tanmay Sarkar	30,000	
	Receivable from UBA	400	
	Receivables from KSCSTE -Crystal Programme SOC	1,41,040	
	Receivables from Teachers Training Programme	1,45,602	
	Receivables from Science Workshop 2019	-	(103,507)
	Receivables from IISER-CEM3DIP	(4,75,859)	
	Receivable from RSC	1,86,383	
	Receivable from RSC- ICUS	2,89,060	
	Receivable from Dr.Sukhendu Mandal	50,000	-
	Receivable from MHRD (Grants in aid)	80,00,000	
		8,47,98,167	11,58,16,689
		8,61,54,843	11,70,51,650
7	**Other Current Asset**		
	TDS 2018-19	3,34,675	334,675
	TDS 2019-20	123,919	
		4,58,594	334,675
	Debit Balances of Project		
8	**DST Inspire Dr.Gokulnath**	**1,07,172**	
	DBT - Prof Murty	3,71,532	
	ISRO - Dr.Deepshikha Jaiswal Nagar	27,700	
	KSCSTE - Dr.Reji Varghese	25,222	
	DST - NM - Dr.Vinayak Kamble	39,112	
	SERB - Dr.Sumit Mohanty	12,755	
		5,83,493	

SEPARATE AUDIT REPORT OF THE COMPTROLLER & AUDITOR

GENERAL OF INDIA ON THE ACCOUNTS OF THE INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH (IISER) THIRUVANANTHAPURAM FOR THE YEAR ENDED 31 MARCH 2020

We have audited the attached Balance Sheet of the Indian Institute of Science, Education and Research, Thiruvananthapuram (Institute) as af 31 March 2020, the Income & Expenditure Account and Receipts & Payments Account for the year ended on that date under Section 19(2) of the Comptroller and Auditor General's (Duties, Powers and Conditions of Service) Act, 1971 read with section 22(2) of the NITSER Act 2007 . These financial statements are the responsibility of the institute's management. Our responsibility is to express an opinion on these financial statements based on our audit.

2. This Separate Audit Report contains the comments of the Comptroller & Auditor General of India (CAG) on the accounting treatment only with regard to classification, conformity with the best accounting practices. accounting standards and disclosure norms, etc. Audit observations on financial transactions with regard to compliance with the Law. Rules & Regulations (Propriety and Regulatory) and efficiency -cum - performance aspects, etc.. if any are reported through Inspection Reports /CAG's Audit Reports separately.

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

4. Based on the audit, we report that:

i. We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary lor the purpose ff our audit;

ii. The balance Sheet, Income & Expenditure Account and Receipt & Payment Account dealt with by this report have been drawn up in the format approved by the Ministry of Education (erstwhile Ministry of Human Resource Development), Government of India;

iii. In our opinion, proper books of accounts and other relevant records have been maintained by the Indian institute of Science, Education and Research Thiruvananthapuram as required under Regulation 15.1 forming part of Memorandum of Association of the Institute in so far as it appears from our examination of such books; and

iv. We further report that :

A. Income & Expenditure Statement

A.1 Income

Grants and Subsidies of Rs. 56.88 crore (Schedule 10)

As per MHRD Instructions lor preparation oi Income and Expenditure Account (Schedule 10, item No.6). Depreciation and Provision for retirement benefits are not recouped from the grant given by Government.

The above head is overstated Rs. 1.25 crore due to booking of provisions for retirement benefits as receivable out of grant. This has also resulted in understatement of Current Liabilities & Provisions by the same amount.

B. Grant-in Aid

IISER, Thiruvananthapuram received a Grant-in-aid of Rs. 123.80 crore from Ministry of Education, Government of India during 2019-20. Out of the total grant of Rs. 239.11 crore (including Rs. 115.31 crore being the unspent grant carried forward from previous year) the institute utilized Rs. 80.21 crore during the year, leaving a balance of Rs. 158.90 crore as on 31.3.2020.

C. Management Letter

The deficiencies which have not been included in the Audit Report have been brought to the notice of Indian Institute of Science, Education and Research, Thiruvananthapuram, Kerala through a Management Letter issued separately for remedial/corrective action.

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

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

In so far as it relates io the Balance Sheet, of the state of affairs of the Indian Institute of Science, Education and Research, Thiruvananthapuram as at 31 March 2020; and
In so far as it relates to Income & Expenditure Account of the deficit for the year ended on that date.

For and behalf of the C& AG of India

Sd/-
Principal Director of Audit (C), Chennai
Place: Chennai
Date: 3 February 2021

ANNEXURE 1

1. Adequacy of Internal Audit System:
There is no separate Internal Audit Wing in the Institute. The Internal Audit of the Institute is conducted by Chartered Accountants on quarterly basis and covered the year 2019-20. The Institute has prepared an Accounting Manual.

2. Adequacy of Internal Control System:
In the absence of internal audit wing and non-conduct of physical verification of fixed assets during 2019-20, the internal control system is found to be inadequate.

3. System of Physical Verification of Assets:
Physical verification of fixed assets for the year 201 8- 1 9 only was completed.

4. System of Physical Verification of Inventory:
Physical verification of inventory was conducted during 2019-20

5. Regularity in Payment of Statutory Dues:
The Institute is regular in payment of statutory dues.

Sd/-
Deputy Director (DT) II

Credits for Images:

Lakshmi PN
Dr. Vinayak Kamble
Ashish Ranjan
K Hayagreev V Sharma
Girish M
Sagnik Saha
Ankush Kumar Garg
IICM Media Team
SAC Clubs
Aiswarya PS
Mithun Xavier
Anup K
Rinsa SR
Charutha VS
Tarunkishwor Yumnam
Govindarajan P
Pavithra M

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