

# वार्षिक रिपोर्ट ANNUAL REPORT 2016 - 17



नैनो एवं मृदु पदार्थ विज्ञान केंद्र

विज्ञान एवं प्रौद्योगिकी विभाग, भारत सरकार के अधीन एक स्वायत्त संस्था

**CENTRE FOR NANO AND  
SOFT MATTER SCIENCES**

Autonomous Institute under the Dept. of Science and Technology, Govt. of India



... in pursuit of  
Global excellence in  
Science and  
to nurture Indigenous  
Technology for the  
betterment of  
Our Country.

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# FOREWORD

Centre for Nano and Soft Matter Sciences (CeNS) in the present form, has entered into its fourth year. The in-house inventions in Nanotechnology interlaced with soft matter principles are aiming translation towards flexible, ergonomic futuristic technology. Nanotechnology being the focus, the diversity in research borne out of interdisciplinary will be all but natural; Nano can connect and percolate seamlessly into the diverse areas of science and technology. In short, CeNS exercises an open-minded approach to R&D in Nanotechnology with high emphasis on IP generation and technology realisation. The Centre has embarked on collaborative activity with well-known industries. It will be growing to newer heights in the coming years serving the society at large.

Outreach programmes of the Centre launched two years ago, विज्ञान विद्यार्थि विचारविनिमय(V4) for popularization of science among school children, and Research Outreach Initiative (ROI), an internship programme for the benefit of students in their post graduate degree in science or in engineering, are being continued with all vigour. A “Learn it Experimentally (LitE)” Gallery, which houses several hands-on science experiments designed for school and college going students has added another dimension to Centre’s outreach activity. Increasingly higher number of students are being enrolled for research programmes leading to PhD, in the area of nanoscience and technology. During the year 2016-17, several lab facilities related to fabrication and device characterization have been commissioned. Prototype Gallery, which displays prototypes based on in-house inventions, and a Gas Sensor Testing Laboratory have been set up during the year under report. These facilities are attracting a large number of academic and industry visitors to the campus. Extramural and industrial projects and also mission mode projects were undertaken during the year. Several workshops held jointly with neighbouring institutions and national and international organisations have enhanced research interactions and networking.

The Centre is expanding its activities at the new campus located at Shivanapura. It is being constantly mentored by eminent scientists, administrators as well as policy makers, in particular by the Nano Mission of the Government of India.

DIRECTOR



# 1. INTRODUCTION

Centre for Nano and Soft Matter Sciences (CeNS), an autonomous research institute under the Department of Science and Technology (DST), Government of India, is a registered scientific society in Karnataka. DST provides core support to the Centre in the form of a grant-in-aid for conducting basic and applied research in Nano and Soft matter sciences. CeNS is currently located at Jalahalli, Bengaluru.

The Centre is engaged in materials research at all relevant length scales. Specifically, the activities are focussed on a variety of metal and semiconductor nanostructures, liquid crystals, gels, membranes and hybrid materials. It has close interactions with many Institutions and Industries, in India and abroad.

The Centre then known as Centre for Liquid Crystal Research, was established in 1991 by an eminent liquid crystal scientist, Prof. S. Chandrasekhar, FRS. In 1995, it became an autonomous institute under the Department of Electronics, Government of India and in 2003, was brought under DST. Subsequently in the year 2010, the name was changed to Centre for Soft Matter Research. Recently in 2014, the Centre has further widened the scope of research activities to embrace nanoscience and technology and is now known as Centre for Nano and Soft Matter Sciences (CeNS). It is being mentored by the Nano-Mission of the Government of India.

The Centre has commenced construction of its new campus on the land of about 14 acres allotted by the Government of Karnataka at Shivanapura, Bangalore North Taluk. The construction activity has been undertaken in phases, with a Fast-track Laboratory Building, comprising a few laboratories and administrative office, being set up in the first phase. The fast track laboratory building is likely to be complete by the end of January 2018. The Centre also proposes to set up incubation laboratories, where startups may use technology on results of research for making prototypes of new innovative products.

With the extended responsibility, the Centre has renewed its vision to work in pursuit of Global excellence in Science and to nurture Indigenous Technology for the betterment of Our Country.

## 2. GOVERNING COUNCIL

### **Chairman**

#### **Bharat Ratna Professor C. N. R. Rao, F.R.S.**

National Research Professor and  
Honorary President & Linus Pauling Research Professor,  
Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bengaluru - 560 064

### **Members**

#### **Professor Ashutosh Sharma**

Secretary to the Government of India, Department of Science and Technology  
Technology Bhavan, New Mehrauli Road, New Delhi - 110 016

#### **Shri J.B. Mohapatra**

Joint Secretary & Financial Adviser, Department of Science and Technology  
Technology Bhavan, New Mehrauli Road, New Delhi - 110 016

#### **Professor R. Narasimha, F.R.S.**

DST Year-of-Science Professor,  
Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, Bengaluru - 560 064

#### **Professor N. Kumar**

Emeritus Professor  
Raman Research Institute, Sadashivnagar, Bengaluru - 560 080

#### **Professor A. K. Sood, F.R.S.**

Professor  
Department of Physics, Indian Institute of Science, Bengaluru - 560 012

#### **Dr. A. T. Kalghatgi**

Director (R & D)  
Bharat Electronics Limited, Outer Ring Road, Nagawara, Bengaluru - 560 045

### **Member Secretary**

#### **Professor G.U. Kulkarni**

Director,  
Centre for Nano & Soft Matter Sciences, Jalahalli, Bengaluru - 560 013

(One vacancy has arisen on account of Prof. Ashutosh Sharma's assumption of charge as Secretary, DST)

### 3. RESEARCH ADVISORY BOARD

1. <b>Professor D.D. Sarma</b> , Indian Institute of Science	Chairman
2. <b>Professor V. Ramgopal Rao</b> , Director, Indian Institute of Technology - Delhi	Member
3. <b>Professor M.K. Sanyal</b> , Saha Institute of Nuclear Physics	Member
4. <b>Professor George K. Thomas</b> , IISER – Thiruvananthapuram	Member
5. <b>Professor Ashok K. Ganguli</b> , Director, Institute of Nano Science & Technology	Member
6. <b>Shri Chandrasekhar B. Nair</b> , Head and Founder Director, Bigtec Labs	Member
7. <b>Professor G.U. Kulkarni</b> , <b>Director</b> , Centre for Nano and Soft Matter Sciences	Convener





## 4. SCIENTISTS AND ADMIN STAFF

No.	Name	Designation
1.	Prof. G. U. Kulkarni	Director
2.	Prof. K. A. Suresh	Honorary Professor
3.	Dr. S. Krishna Prasad	Scientist G
4.	Dr. Geetha G. Nair	Scientist E
5.	Dr. D. S. Shankar Rao	Scientist E
6.	Dr. Veena Prasad	Scientist E
7.	Dr. C. V. Yelamaggad	Scientist E
8.	Dr. P. Viswanath	Scientist D
9.	Dr. S. Angappane	Scientist D
10.	Dr. Neena Susan John	Scientist D
11.	Dr. Pralay K. Santra	Scientist D (on contract)
12.	Dr. H.S.S.R. Matte	Scientist C (on contract)
13.	Dr. K.S. Subrahmanyam	Scientist C (under project)
14.	Dr. Uma S. Hiremath	WoS-A Scientist (under project)

No.	Name	Designation
1.	Mr. Subhod M. Gulvady	Administrative Officer
2.	Mr. Vivek Dubey	Accounts Officer
3.	Ms. P. Nethravathi	Office Superintendent
4.	Dr. Sanjay K. Varshney	Technical Assistant
5.	Mr. Sandhya D. Hombal	Technical Assistant
6.	Mr. M. Jayaram	Assistant
7.	Ms. Nayana .J.	Library Assistant
8.	Mr. Samuel V. Hebich	Support Staff
9.	Mr. Jayaprakash V.K.	Support Staff

### Consultants (on contract)

No.	Name	Designation
1.	Mr. R. S. Gururaj	Consultant - Administration
2.	Mr. K. S. Chandrashekhar	Consultant Engineer
3.	Dr. Rama Krishnamurthy	Consultant - IP Matters
4.	Mr. Narayana M.G.	Consultant - Administration
5.	Dr. M.L.V. Archana	Authorised Medical Officer
6.	Mr. Ravishankar Solanki	Consultant - Computer Networking
7.	Mr. Deepak S	Admin. Asst. (Public Relations)

## 5. RESEARCH AND DEVELOPMENT ACTIVITIES

### 5.1 Transparent & flexible electronics

Visibly transparent yet electrically conducting materials are rare. Conventionally used tin doped indium oxide is quite expensive. Transparent conductors made from our invention, invisible metal nanomesh, provide affordable solutions besides adding many novel features. Using nanomesh electrodes, many optoelectronics and optoelectrical devices have been fabricated including touchscreens, EMI shields and smart windows.

**Investigators:** K. D. M. Rao and G. U. Kulkarni

**Collaborators:** Ritu Gupta, Indian Institute of Technology Jodhpur, Jodhpur; S. Kiruthika, Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru

### 5.2 Gold nanorods soften the Frank elasticity of a nematic

The liquid crystal–nanoparticle (LC-NP) dispersions provide non-synthetic routes to tune the existing properties of LC or give rise to new ones not achievable by pure organic medium of LC alone. Splay and bend Frank elastic constants are measured in a composite comprising a nematic LC doped with a small concentration of sterically stabilized gold nanorods (AuNR). Despite the similarity in the form anisotropy the addition of nanorods influences the elastic properties significantly: both the splay and bend elastic constants are nearly halved. More importantly, a substantial diminution in the temperature dependence of these parameters, almost to the point of becoming thermally invariant is observed.

**Investigators:** P. Lakshmi Madhuri, S. Krishna Prasad,

**Collaborators:** Pravin Shinde and B.L.V. Prasad, CSIR-National Chemical Laboratory, Dr. Homi Bhabha Road, Pune

### 5.3 Twisted graphene stacks

The extraordinary properties of graphene are truly observable when it is suspended, being free from any

substrate influence. In this work, a new type of multilayer graphene system has been made wherein each layer is turbostratically decoupled, resembling the suspended graphene, while maintaining high degree of 2D crystallinity.

**Investigators:** G. U. Kulkarni, U. Mogera and R. Pujar

**Collaborators:** R. Dhanya, and C. Narayana, Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru

### 5.4 Unusual forms of gold

Inducing lattice strain in crystals may cause structural transformation and the same has been achieved in the case of gold, by stabilizing nanocorrugated morphologies. This ‘microrice gold’ is more nobler than the conventional gold; it stands aquaregia and mercury treatments and exhibits interesting catalytic properties!



**Investigators:** G. U. Kulkarni

**Collaborators:** G. Mettela, N. Mammen and S. Narasimhan, Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru; J. Joardar, International Advanced Research Centre for Powder Metallurgy & New Materials, Hyderabad

### 5.5 Supramolecular devices

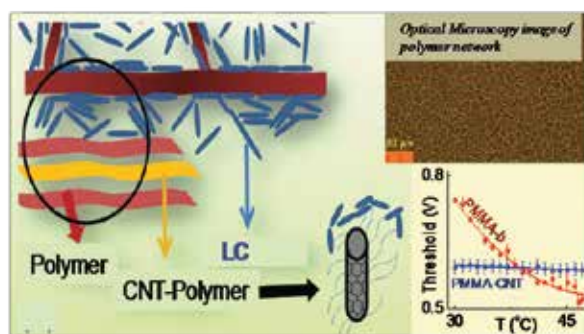
Supramolecules particularly in the form of nanofibres offer advantages in electrical transport as they are essentially 1D systems. Using nanofibres built via self-assembly of donor and acceptor molecules, high mobility FET, supercapacitors and ultrafast humidity sensors have been fabricated. The latter have been applied to measure humidity in human breath dynamically.

**Investigators:** G. U. Kulkarni and U. Mogera

**Collaborators:** M. Gedda and S. J. George, Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru

### 5.6 CNT reinforcement improves device performance of polymer stabilized LCD

A novel variation of polymer stabilized liquid crystal (PSLC) device fabricated by reinforcing the polymer (PMMA) matrix with polymer-capped single-walled carbon nanotubes (CNTs) is developed. The most important outcome of this strengthening of the polymer strands is that the threshold voltage associated with the electro-optic switching becomes essentially temperature independent in marked contrast to the significant thermal variation seen in the absence of the nanotubes. The reinforcement reduces the magnitude of the threshold voltage and accelerates the switching dynamics. The features are attractive from the device operation point of view, especially the circuit design of the required drivers.



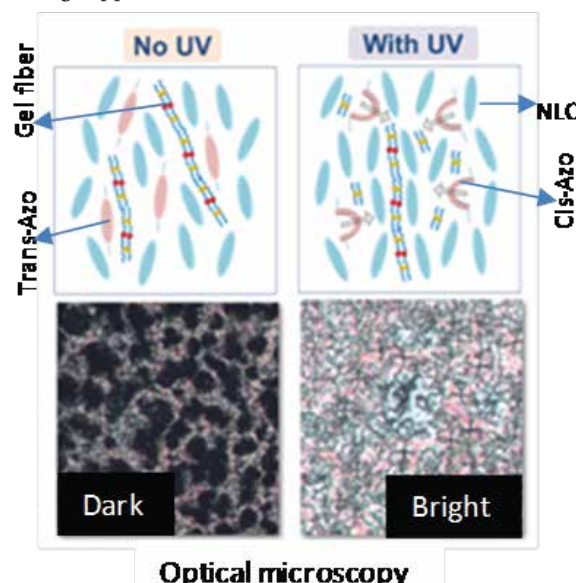
**Investigators:** S. Krishna Prasad and Marlin Baral

**Collaborators:** Adhigan Murali and Sellamuthu N. Jaisankar, Polymer Science & Technology Division, CSIR-Central Leather Research Institute (CLRI), Adyar, Chennai

### 5.7 A process to achieve permanent optical memory states in a nematic liquid crystal

The work describes the effect of photo-isomerisation on the physical gelation in a nematic liquid crystal. The material used is a homogeneous mixture prepared by the addition of a low molecular weight organogelator to a photo-active (azobenzene based) nematic liquid crystal. The UV-induced photo-isomerization of azobenzene molecules (from trans- to cis-) substantially lowers the temperature corresponding to nematic sol to nematic gel phase transition giving rise to an isotropic gel to nematic gel transition. This results a randomly

aligned “bright” nematic gel state which otherwise shows a “dark” homeotropically aligned gel state under “no-UV” conditions. The attractive part of the study is that, the “bright” and the “dark” states obtained with and without light respectively could not be erased until the gel network melts. This phenomenon makes the system viable to be used in permanent optical data storage applications.



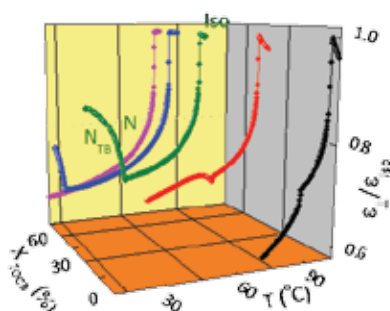
**Investigators:** S. Vimala and Geetha G. Nair

**Collaborators:** S. Sathya, S. Krishna Prasad and C. V. Yelamaggad

### 5.8 Twist bend nematic phase-measurements at atmospheric pressure

Unlike the typical nematic (N) phase, the twist bend nematic ( $N_{TB}$ ) phase possesses non uniform director  $\mathbf{n}$  distribution composed of twist bend deformation. The permittivity and Frank elastic constant measurements are done on a system prepared using a  $N_{TB}$  dimeric material mixed with a rod-like monomeric NLC (RLN).  $N_{TB}$  phase is stable for mixtures even when the concentration of RLN ( $X_{RLN}$ ) is as high as ~64 mol%. The permittivity measured perpendicular to  $\mathbf{n}$  ( $\epsilon_{\perp}$ ) shows a decrease for  $X_{RLN} \leq 25$  whereas a reversal in the trend is seen for  $49.6 \leq X_{RLN} \leq 64.1$  across  $N$ - $N_{TB}$  transition. The elastic constant behavior (splay < bend) seen for pure RLN, crosses over to splay > bend (typical for bent-core NLC) behavior for mixtures with very high concentration (75%) of RLN. This is surprising because the bent shape of the dimer is conformationally driven and not due to covalent linkages. Also the





convex-shaped thermal profile of bend elastic constant is not seen for the  $N_{TB}$  dimer but for the mixtures with RLN. The results are explained based on a molecular packing model.

**Investigators:** Srividhya Parthasarathi, D.S. Shankar Rao, Nani Babu Palakurthy, C.V. Yelamaggad and S. Krishna Prasad.

### 5.9 Effect of pressure on dielectric and frank elastic constants behavior of a material exhibiting the twist bend nematic phase

First investigations on the effect of applied pressure on a dimer material exhibiting the  $N-N_{TB}$  transition is described. At atmospheric and relatively low pressures,  $\epsilon_{\perp}$  decreases on entering the  $N_{TB}$  phase, but a trend reversal is seen above a certain pressure. A salient feature of the study is that with increase in pressure from atmospheric to 1.5kbar the bend elastic constant is enhanced by a factor of 5, whereas the splay constant exhibits a much smaller change of only 70%. These features can be understood in terms of the relative population of two conformers present in the dimer, i.e., the more energetic 'horseshoe', and the lower energy 'extended' forms. The 'extended' conformer is favoured at lower temperatures, or at higher pressures. This is validated by XRD experiments performed at atmospheric pressure.

**Investigators:** Srividhya Parthasarathi, D.S. Shankar Rao, Nani Babu Palakurthy, C.V. Yelamaggad and S. Krishna Prasad.

### 5.10 Structural characterization of self-assembling and luminescent chiral oxadiazole

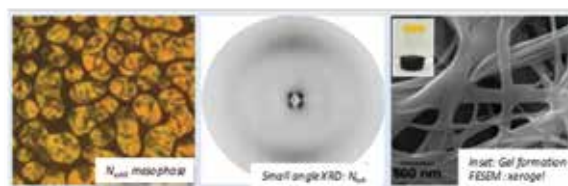
XRD studies of self-assembling and luminescent chiral oxadiazole are reported. The high temperature columnar phase showed multiple peaks at low angles

with spacings ratio of  $1: \sqrt{3}: \sqrt{4}$ , characteristic of a hexagonal lattice. The comparatively large value for the lattice parameter  $b$  and off-meridional reflection indicate that the mesophase at low temperature is oblique columnar. The material forms an organogel due to supramolecular aggregation. The XRD results indicate the presence of macromolecularly ordered columns in the xerogel.

**Investigators:** D.S. Shankar Rao and S. Krishna Prasad.

### 5.11 Nematic liquid crystals composed of smectic nano clusters (Cybotactic nematics)

In cybotactic nematic phases the smectic layer can be either normal ( $N_{cybA}$ ) or tilted ( $N_{cybC}$ ) with respect to the nematic director  $n$ . Intensive experimental studies have proved that cybotactic clusters in such nematics have dimensions in the nanometric scale. Several new dimers by connecting two rod-like non-mesogenic laterally substituted azo moieties via alkylene spacer are designed and synthesised. Polarising optical microscopic and X-ray studies revealed that the nematic phases exhibited by these dimers, are composed of skewed smectic nano clusters ( $N_{cybC}$ ) irrespective of whether a smectic phase exist below the nematic or not. Some of the dimers form organogels with organic solvents. They undergo thermo-reversible as well as photo-reversible sol – gel transitions, a property that can be exploited for practical applications. They also exhibit photoswitching in the solution and nematic phase.



**Investigators:** Monika M. and Veena Prasad

**Collaborators:** Arun Roy, Raman Research Institute, Bengaluru

### 5.12 Photo-responsive and electrically switchable bent-core liquid crystals:

New bent-core compounds were designed and synthesized with a goal to obtain ambient/near ambient temperature liquid crystals. Two types of compounds; one without any lateral substitution and the other with a lateral substitution ( $-F$  /  $-Cl$  /  $-CH_3$ ) on one of the arms were synthesized. In addition to a  $B_1$  mesophase,

these compounds exhibit photo-responsive and electrically switchable  $B_2$  mesophases. It was observed that the lateral substitutions not only induce but also stabilize the  $B_2$  mesophases in these compounds. The laterally substituted compounds showed  $B_2$  mesophase existing well below the room temperature with a very wide thermal range of about 130°C.

**Investigators:** Rekha S. Hegde and Veena Prasad

### 5.13 Luminescent, redox-active discotics for electronic devices

Three series of novel photoluminescent discotic liquid crystals comprising tris(N-salicylideneaniline) (TSANs) and trans-stilbene fluorophores have been realized. These compounds, existing in  $C_{3h}$  and  $C_s$  keto-enamine tautomeric forms, self-assemble to form the columnar (Col) phase. They emit light in solid, mesomorphic and solution states. The Col phase freezes in to glassy state where luminescence, defect free alignment and restriction on the motion of ionic impurities are ensured. Notably, they show well-defined irreversible oxidation and reduction waves; the values of HOMO and LUMO have been determined to be in the range of -6.21 to -6.39 eV and -3.8 to -4.12 eV respectively. The electrochemical band gaps (2.27-2.62 eV) observed are comparable to the values of the optical band gaps (2.32-2.35 eV). The values are lower than some standard materials used for device fabrication which makes these discotics promising candidates for the use in photovoltaic cells.

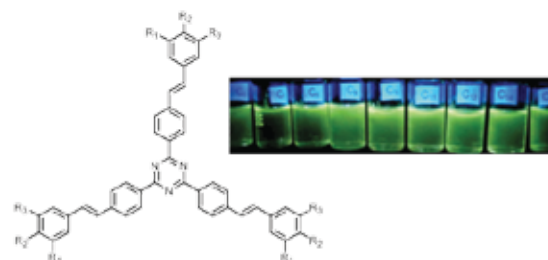
**Investigators:** B. N. Veerabhadraswamy, Uma S. Hiremath, D. S. Shankar Rao, S. Krishna Prasad and C. V. Yelamagad.

**Collaborator:** A. S. Achalkumar, Indian Institute of Technology Guwahati, Guwahati

### 5.14 Electrochemically-active, photoluminescent discotics derived from s-triazine

A series of photoluminescent discotic liquid crystals derived from s-triazine and styrylbenzene  $\pi$ -conjugates have been synthesized. The number and length of peripheral alkoxy tails have been varied to recognize the correlation among molecular structure and self-assembly / photophysical behaviour. The mesogens display hexagonal columnar ( $Col_h$ ) phase over a wide thermal range. Photoluminescence spectra obtained in

solid, solution and thin-film, fluid / frozen columnar states confirm the intrinsic light-emission property. The AFM images of the thin-films suggest a homogeneous surface having granular morphology featuring fibrillar components. The CV measurements data show LUMO energy of - 4.0 eV; ideal for organic semiconductors to be used in device application.



Molecular structure of s-triazine-based discotics

**Investigators:** B. N. Veerabhadraswamy, Hashambi K. Dambal, D. S. Shankar Rao and C. V. Yelamagad

### 5.15 Non-symmetric, optically active liquid crystal dimers and binary Mixtures

Optically active, non-symmetric dimers, in which cynobiphenyl and salicylaldimine mesogens are interlinked by a flexible spacer, have been synthesized and characterized. While the terminal chiral tail has been held constant, the number of methylene units in the spacer has been varied from 3 to 10 affording eight pairs of (R & S) enantiomers. Notably, one of the dimers and certain mixtures of dimers exhibit a biaxial smectic A ( $SmA_b$ ) phase possessing  $D_{2h}$  symmetry and nematic-type biaxiality appearing between a uniaxial SmA and a re-entrant uniaxial SmA phases.

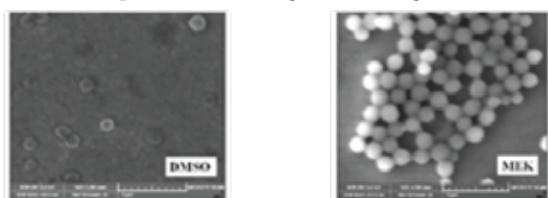
**Investigators:** P. Nani Babu, Geetha G. Nair, D. S. Shankar Rao and C. V. Yelamagad

**Collaborator:** V. Padmini Tamilenth, Madurai Kamaraj University, Tamilnadu

### 5.16 Impact of good and swelling solvents on ultrathin film of ferroelectric polymer at air-water and air-solid interfaces

Impact of good (Dimethylsulfoxide (DMSO), Dimethylformamide (DMF)) and swelling solvents (Acetone, Methyl ethyl ketone (MEK) and Tetrahydrofuran (THF)) on ultrathin film of ferroelectric polymer, Poly(vinylidene fluoride), PVDF at air-water (A-W) and air-solid (A-S) interfaces are studied. Swelling solvents when used as spreading agents at A-W interface leads to partial collapse of PVDF

where a shift in lift-off area towards lower area per monomer is seen. Further, surface potential isotherm measurements shows that the potential is negative (positive) for good (swelling) solvents. Brewster angle microscopy studies on PVDF film at A–W interface support the conclusion that the film is heterogeneous and of much higher thickness for the case of swelling solvents. At A–S interface, the structural studies on PVDF multilayers (20 layers) using grazing incidence XRD show evidence for predominantly polar beta phase for the case of good solvents. This is also confirmed by FTIR studies wherein a larger fraction of polar beta phase is found for films obtained using good solvents. In contrast to good solvents, morphological features obtained using FESEM show clustering of spherical crystallites for swelling solvents. These films were found to be hydrophobic exhibiting contact angle above  $100^\circ$ .



FESEM images of ultrathin multilayers of PVDF obtained using good (DMSO) and swelling (MEK) solvents at A–S interface.

**Investigators:** Chandan Kumar and P. Viswanath

### 5.17 Magnetic nanoparticles for magnetic memory applications

The studies focus on NiO nanoparticles, which show room temperature ferromagnetism. NiO nanoparticles of uniform size of about 50 nm was synthesized using sol-gel method involving  $\text{Ni}(\text{OAc})_3 \cdot 4\text{H}_2\text{O}$  (0.1 mol) in 2-methoxyethanol (1 mol) and PVAc. The nanoparticles show exchange bias of  $\sim 30$  Oe and the compacts show magnetoimpedance of about 10% for the low applied field of 0.1 kG at room temperature at 2000 Hz. In order to acquire measureable DC resistance, Ni/NiO nanocomposite was synthesized by the reaction involving  $\text{Ni}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$ , PVA and graphite. Magnetic measurements show exchange bias of  $\sim 10$  Oe. The cold pressed powder shows magnetoresistance of about 20 % at 5 kOe.

**Investigators:** Subir Roy, Nagaiah Kambhala, Ramesh Reddy Indukuru and S. Angappane

### 5.18 Fabrication of Perovskite solar cells

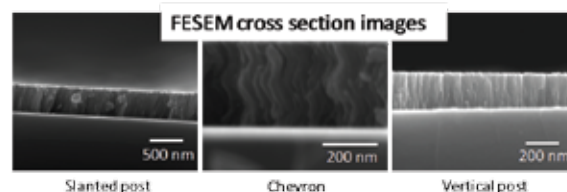
It is intended to fabricate perovskite solar cells with CuI

and ZnO as the respective inorganic hole and electron transport layers. A device was fabricated in FTO/n-ZnO/ $\text{CH}_3\text{NH}_3\text{PbI}_3$ /p-CuI configuration after characterizing the individual layers. Photoluminescence (PL) quenching effect was observed when the perovskite layer contacts with ZnO layer, which demonstrates that ZnO can be used as ETL for high performance perovskite solar cells. UV-visible spectra show the enhanced absorbance of perovskite with its hole and electron transport layer between 400–800 nm in comparison with perovskite material alone. From this it is inferred that ZnO and CuI can be utilized as superior ETL and HTL respectively. About 0.7 % efficiency was achieved.

**Investigators:** M. Pruthvi, Subir Roy and S. Angappane

### 5.19 Textured oxide surface for light trapping

It is proposed to deposit textured films of various oxides, such as,  $\text{TiO}_x$ , ZnO,  $\text{SnO}_x$  by glancing angle deposition using sputtering and employ it for light trapping applications. The copper nanostructures were formed by GLAD using magnetron sputtering. The angle of deposition ( $\alpha$ ) was  $80^\circ$  for each while rotational motion was absent in slanted post, discrete in chevron and continuous in vertical post. Further work is on to utilize the nanostructured films for fabrication of solar cells.



**Investigators:** Gaurav Shukla and S. Angappane

### 5.20 Films of graphene based iron oxide nanostructures for supercapacitor applications

Reduced graphene oxide (rGO, graphene derivative with a few oxygen functional groups) with iron oxide nanoparticles ( $\text{Fe}_2\text{O}_3$ ) are prepared as free-standing films at the interface of water and toluene. The films are transferred on to pencil graphite rod electrodes by a simple lifting process and thinner films exhibit good adhesion without the use of any binders. Iron oxide is an environment friendly material and hence, the

interest. The capacitance of the films is measured in a three electrode-electrochemical cell using cyclic voltammetry and charge-discharge measurements. Carbon materials including rGO exhibit capacitance due to electrical double layer formation while reversible metal ion reduction-oxidation reactions in metal oxides such as  $\text{Fe}_2\text{O}_3$  result in energy storage, termed as pseudocapacitance. Electrochemical capacitance studies of rGO- $\text{Fe}_2\text{O}_3$  nanocomposite films as electrode materials reveal a specific capacitance of 64.5 F/g at 2 mV/s, which is 6.6 times more than that of constituents, rGO or  $\text{Fe}_2\text{O}_3$ . In addition to the capacitance contribution, the high surface area of rGO and  $\text{Fe}_2\text{O}_3$  nanostructures, good conductivity and stability of rGO also aids in the better performance of the nanocomposite by promoting ion diffusion and transport. Energy density of 6.7 Wh/kg and power density, 600 W/kg at 1 A/g are calculated for rGO- $\text{Fe}_2\text{O}_3$  nanoparticle films. Capacitance retention of 75% for the nanocomposite is measured.

**Investigators:** Neena S John, K. Bramhaiah, Dr. Indu Pandey

**Collaborator:** V. N. Singh, National Physical Laboratory, Delhi; TEM studies

### 5.21 Films of graphene based osmium nanoparticles for sensing of rhodamine B dye

Hybrid film of reduced graphene oxide-osmium nanoparticles (rGO-Os) synthesized at a liquid/liquid interface is explored for its electrocatalytic activity towards the oxidation of rhodamine B (RhB), a popular colourant found in textile industry effluents and a non-permitted food colour. The free-standing nature of the films enables them to be lifted directly on to electrodes without the aid of any binders. The films consist of aggregates of ultra-small Os NPs interspersed with rGO layers. The hybrid films coated on pencil graphite rods are demonstrated as efficient sensing materials for RhB. Os nanoparticles without rGO support are prone to self-oxidation and are not desirable as active materials for sensing. The hybrid film electrodes exhibit a linear response range from 4–1300 ppb of RhB (8.3 nM–2.71  $\mu\text{M}$ ) with an experimental detection limit of 4 ppb. The modified electrode presents good stability over more than six months, reproducibility and anti-interference capability. The developed sensor gives 83.1–106.4% RhB recovery in

real samples such as chilli powder, tomato ketchup and highlighter ink.

**Investigators:** Neena S John, K. Bramhaiah and Dr. Indu Pandey

**Collaborator:** V.N Singh, NPL, Delhi; TEM studies

### 5.22 Enhanced Raman spectroscopy and catalytic activity of graphene based osmium nanoparticles

Self-assembly of noble metal nanoparticles along with rGO is the best route to achieve improved properties by synergic effect between the metal nanoparticles and rGO. Liquid/liquid interface method that provides a simple and good way to generate Os metal nanostructures on rGO layers in the form of thin films is demonstrated. The capability of the rGO-Os hybrid film has been analyzed for catalysis and surface enhanced Raman spectroscopy (SERS) applications. The catalytic activity was tested for the reduction of p-nitroaniline into p-phenyldiamine with an excess amount of  $\text{NaBH}_4$ . The catalytic activity factors of these hybrid films are  $2.3 \text{ s}^{-1} \text{ g}^{-1}$  (Os nanoparticles) and  $4.4 \text{ s}^{-1} \text{ g}^{-1}$  (rGO-Os), which are comparable with other noble metal nanoparticles such as Au, Ag, but lower than Pd-based catalysts. SERS activity of the fluorescent dyes, rhodamine 6G and methylene blue, adsorbed on rGO-Os and Os has also been investigated. The enhancement factors (calculated with respect to dye on glass) for the rGO-Os is  $1.0 \times 10^5$  and for Os nanoparticles is  $2.7 \times 10^3$  in the case of rhodamine 6G molecules and reveal the superior performance of Os combined with rGO. The dye concentration up to 10  $\mu\text{M}$  could be detected.

**Investigators:** Neena S John and K. Bramhaiah,

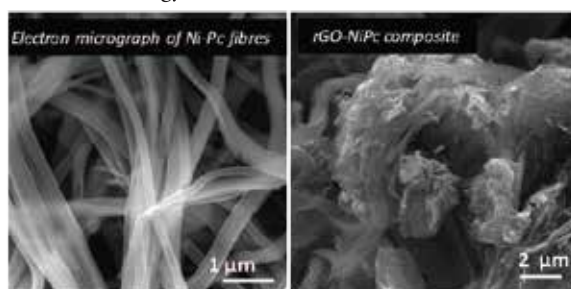
**Collaborator:** C. Kavitha, BMSIT, VTU, Bengaluru

### 5.23 Synthesis of metallophthalocyanine nanofibres and their composites with graphene

The nanostructures of Metallophthalocyanines (MPcs) have gained attention due to their improved performances and high surface area. NiPc and CuPc nanostructures are synthesized through simple chemical routes; the hybrid structure is also achieved by combining it with rGO and to further study their properties. Nanofibres of NiPc are synthesized by dispersing phthalonitrile and nickel chloride hydrate in ethylene glycol and heating to 100°C for 6 h in the



presence of ammonium molybdate as the catalyst. By spreading the dispersion on toluene surface, films of nanofibres can be obtained. The composite with graphene is obtained by dispersing the nanofibres in dimethylformamide containing graphene oxide and is subjected to solvothermal treatment at 100°C. Combining rGO with metallophthalocyanine can improve the properties towards supercapacitor performance and electrocatalytic activity for high activation energy reactions.



**Investigators:** Neena S John and K. Priya Madhuri

#### 5.24 Understanding electronic and internal structure of highly luminescent quantum dots and thermoelectric materials

Heavy metal ion lead (Pb) in drinkable water is poisonous, and it causes severe short and long term effects. Visible photoluminescence (PL) sensor to detect Pb<sup>2+</sup> ions up to ppb level has been developed. The sensor comprised a composite of Mn-doped ZnS and reduced graphene oxide (rGO) and upon detection of lead, the PL intensity of the composite goes down significantly such that it can be noticed with naked eye. Development of a visible photoluminescence based gas sensor is underway.

**Investigators:** Pralay K. Santra, Anamul Haque and Abhishek Shibu

#### 5.25 Ring-fusion as a perylenediimide dimer design concept for high-performance non-fullerene organic photovoltaic acceptors

Silicon solar cells are expensive and rigid. The aim of the work is to provide cheap and flexible plastic (organic) solar cells (OSC). Molecular design of non fullerene acceptors is key for efficient OSC. We show that ring fusion increases the electronic coupling between PDI acceptor molecules and the twisted dimers shows decreased geminate recombination and less crystallinity

compared to planar one with 4% efficiency .

**Investigators:** H. S. S. Ramakrishna Matte

**Collaborators:** Patrick E. Hartnett, , Nicholas D. Eastham, Nicholas E. Jackson, Yilei Wu,<sup>a</sup> Lin X. Chen, Mark A. Ratner, Robert P. H. Chang, Mark C. Hersam, Michael R., Northwestern University, USA

#### 5.26 Effects of crystalline Perylenediimide acceptor morphology on optoelectronic properties and device performance

To understand the role of crystal structure in OSC performance 3,7-DMO is crystallized in either herringbone or slip-stacked geometries. The herringbone acceptors (3%) suffer from increased geminate recombination than slip-stacked(4%) acceptors results in less efficiency.

**Investigators:** H. S. S. Ramakrishna Matte

**Collaborators:** Patrick E. Hartnett, Eric A. Margulies, Mark C. Hersam, Tobin J. Marks and Michael R. Wasielewski, Northwestern University, USA

#### 5.27 switching of molecular packing in cholesteryl laurate and self-assembly of cholesteryl esters at interfaces

Self-assembly and molecular packing in cholesteryl esters, relevant to biological processes, are studied at the air-water (A-W) and air-solid (A-S) interfaces. The molecular packing of cholesteryl esters at interfaces can be related to the Craven's model of packing, given for bulk. Interestingly, in the case of cholesteryl laurate (ChL), the fluidic bilayer (m-ii packing) phase which is unstable, immediately switches to a crystalline bilayer phase contrary to Craven's model. Texture studies at interfaces using Brewster angle microscope, imaging ellipsometer and AFM show that cholesterol, cholesteryl acetate, cholesteryl nonanoate, ChL and cholesteryl myristate exhibit homogeneous films with large size domains whereas cholesteryl palmitate and cholesteryl stearate exhibit less homogeneous films with smaller size domains. It is suggested that, in general, the assembly of the molecules in the films at A-W and A-S interfaces can be related to the structure of the molecule. The films exhibit similar texture at the A-W and A-S interfaces indicating a controlled transfer onto solid substrate that is useful for device applications.

**Investigators:** Kattera A. Suresh and Arup Sarkar

## 6. PUBLICATIONS

<b>Total no. of publications</b>	<b>49</b>
<b>1. In Refereed Journals</b>	<b>45</b>
<b>2. In Conference Proceedings</b>	<b>3</b>
<b>3. In Books</b>	<b>1</b>
<b>Average Impact Factor</b>	<b>4.66</b>

No.	Journal	Publications
1.	ACS Appl. Mater. Interfaces	4
2.	ACS Energy Lett.	1
3.	Adv. Elec. Mater.	1
4.	Adv. Mater.	1
5.	Chem. Asian J.	1
6.	Chem. Eur.J.	1
7.	Chem. Mater.	2
8.	Chem. Nano. Mat.	1
9.	Chem. Phys. Lett.	1
10.	Chem. Sci.	1
11.	ChemPhysChem	1
12.	Composites Part B: Engineering	1
13.	Curr. Sci.	1
14.	Dyes and Pigments	1
15.	Eur. J. Inorg Chem.	1
16.	Euro. Poly. J.	1
17.	J. Appl. Phys.	1
18.	J. Chem. Phys.	1
19.	J. Mater. Chem. C	2
20.	J. Nanosci. Nanotechnol.	1
21.	J. Phys. Chem. B	4
22.	J. Phys. Chem. C	2
23.	J. Phys. Chem. Lett.	1
24.	J. Phys. D: Appl. Phys.	1
25.	J. Raman Spectrosc.	1
26.	Liq. Cryst.	2
27.	Mol. Cryst. Liq. Cryst.	2
28.	Nano Research	1
29.	Phys. Rev.E	1
30.	RSC Adv.	2
31.	Sci. Rep.	1
32.	Soft Matter	1
33.	Sol. Energ Mat. Sol. C	1

Details shown in Annexure A



## 7. PATENTS

**Total no. of patents 9**

No.	Title	Inventors	Patent Application No.
1.	A process for producing graphene based transparent conductive electrode and the product thereof	S.K. Choudhary, Sumitesh Das G.U. Kulkarni and Rajashekhar N. Pujar	Indian Patent Application No.: IN201721021005
2.	A process for producing graphene and application thereof	S.K. Choudhary, Sumitesh Das, G.U. Kulkarni and Rajashekhar N. Pujar	Indian Patent Application No.: IN20162104172 Filing PCT application is under process.
3.	Solar cell and method therefore	G.U.Kulkarni, Nikita Gupta, K.D.M. Rao	Indian Patent Application No.: 201741003497
4.	A synergistic mixture of water and isopropyl alcohol and application thereof	G. U. Kulkarni, K. D. M. Rao and R. N. Pujar	Indian Patent Application No.: 201641012112 PCT Application no: PCT/IB2017/051934
5.	A strain sensor and method thereof	G. U. Kulkarni, K. D. M. Rao and R. K. Srivastava	Indian Patent Application No.: 201641013578 PCT Application no: PCT/IB2017/052183
6.	Photoactive gel exhibiting optical memory states	Vimala S., Geetha G. Nair, S. Krishna Prasad, Sathya S., C. V. Yelamaggad	Indian Patent Application No.: 201641033449
7.	Polymer stabilized liquid crystal device, composition and method thereof	S. Krishna Prasad, Marlin Baral and S.N. Jaisankar	Indian Patent Application No.: 201741002313
8.	Supramolecular nanofiber as electrolyte	G.U.Kulkarni, Subi J. George, Murali Gedda and Umesh Mogera	Indian Patent Application No.: 5285/CHE/2015
9.	Turbostratic graphene dispersions, coatings and process therefore	G.U.Kulkarni, Nikita Gupta and Umesh Mogera	Indian Patent Application No.: 201741004449

## 8. ENTREPRENEURSHIP ACTIVITIES

- Technology transfer agreement with Lab Engineers (India) - To manufacture and commercialize Projection Lithography system, G. U. Kulkarni and S. Angappane
- With Hind High Vacuum Co. Pvt. Ltd.: R&D project to prototype manufacturing of oxide coated metal mesh based transparent conducting plates, G. U. Kulkarni
- “Advanced Workshop on IP management”, Geetha G. Nair, 12-14 January 2017, NASC Complex, ICAR, New Delhi
- Dr. John Richmond, Tata Steel Limited, visited CeNS in connection with TSAMRC project activity on 8 February 2017.
- Dr. Santhosh Ansumali, JNCASR, visited CeNS in connection with Incubation Activity on 13 April 2017
- **Participation in IISF- 2016 at NPL, Delhi:** CeNS participated in the recently held IISF 2016 at NPL, Delhi from December 7-11, 2016, which saw India's biggest science fest with participation from academia, industry and schools. Several programmes were arranged such as popular science talks on socially relevant themes and patenting, industry-academia interaction, international and national science films and competition for school students. CeNS showcased their research through posters and demonstrative models in the Mega Science Expo exhibited in a stall under DST pavilion. A large number of visitors which included school students and other researchers appreciated our prototypes, the Triboelectric generator and the Transparent heater.



CeNS participation in IISF 2016, New Delhi 7-11 December 2016

### • **Prototype Gallery**

A new gallery housing prototypes developed by CeNS facility and students based on their research activities was inaugurated by Mr. Anand Sen, President, Total Quality Management and Steel Business, Tata Steel Limited, on 3 October 2016. The objective of having such a space is to set meaningful dialogue



Research Advisory Board Members visiting the Prototype Gallery at CeNS



A prototype device exhibited at the gallery

Some of the prototypes displayed in the gallery are listed below :

- ✧ Graphene coated quartz plates
- ✧ Corrosion Protective Coating for Copper
- ✧ Fast Responding Anisotropic Organogels
- ✧ Fog-on Demand: Electrically Switchable Transparency
- ✧ Triboelectric Nano Generator
- ✧ Ultrafast supramolecular humidity sensor
- ✧ Self-heated Cover slip
- ✧ Flexi Touch Display
- ✧ Defrosting Panel
- ✧ Defogging Panels



- ☒ Light Modulating Smart Window
- ☒ Invisible Switches
- ☒ Instant hot packs
- ☒ Invisible EMI shield
- ☒ Luminescence based Lead Sensor

- **Swachh Bharath:** MoU signed with Hindustan Petroleum Corporation Limited: to find value addition to industrial carbon waste.

## 9. TEACHING

No.	Course Title /New Modules	Credits
1.	<b>Basics of Nano and Soft Matter</b> Concepts and Definitions: nanoscale processes, nanosystems, important nanomaterials, historical account; Quantum confinement and Surface effects in nanosystems, Size-dependent properties-optical, electronic, magnetic and reactivity- I &II; Electronic structure of semiconductor, Photovoltaics – working principle, Synthesis of quantum dots and their characterization, Carbon Nanomaterials: Fullerenes, Nanotubes and Graphene; Analogues and Hybrids; Thermal analysis; Rheology of gels and Liquid Crystals	2:1
2.	<b>Scientific Communication</b> Manuscript preparation; Means of communicating scientific data	1:0
3.	<b>Instrumental Methods &amp; Analysis</b> X-ray and nuclear methods; Electron microscopy and probe microscopy; Rheology	1:1
4.	<b>Intellectual Property</b>	1:0
5.	<b>Safety and Waste Management</b>	1:1

## 10. EXTRAMURAL RESEARCH PROJECTS

### COMPLETED

No.	Course Title /New Modules	Duration	Amount ₹ in lakhs
1.	Electro-optic and rheological investigations on liquid crystal gels	2013-2016	55.00
2.	Optically active supramolecular liquid crystals, photochromic trimers and functional trimer-like mesogens: Synthesis and characterization	2014-2017	23.75

### ONGOING

No.	Course Title /New Modules	Duration	Amount ₹ in lakhs
1.	IGSTC project on Nanostructured hybrid transparent network electrodes for large area visibly transparent solar cells (METNETWORK)	2016-2017	185.80
2.	IUSSTF project on Nanomaterials for Clean Energy and Environmental Sensors	2016-2018	21.76
3.	Thematic projects in frontiers of nano S&T (TPF-Nano) on “Chemical Physics of Functional Nanostructures and Interfaces”	2016-2019	1115.23
4.	Synthesis of chiral liquid crystals and their composites with nanoparticles: Development of functional mesophases for applied science	2017-2020	22.8

No.	Course Title /New Modules	Duration	Amount ₹ in lakhs
5.	Tata Steel Advanced Materials Research Centre (TSAMRC)	2016-2021	870.00
6.	CeNS-Centre for High Technology (CHT) Project	2017-2020	100.00
7.	Transparent conducting glasses made of metal nanomesh coated with metal oxide overlayer and scaling their production to m2 area SR/NM/NT-03/2016	Approved	
8.	Molecular design directed synthesis and characterization of inexpensive, functional organic materials exhibiting technologically relevant liquid crystal phases	Approved	58.00
9.	Magnetic nanoparticles for memory applications	Approved	35.38

## 11. NEW RESEARCH FACILITIES

- 3D Printer
- Solar Simulator
- Environmental Test Chamber precision Oven
- Contact angle meter, DM-501 with tilting stage.
- Glancing Angle Deposition (GLAD) system with sputtering gun.
- Upgradation of existing Confocal Raman microscope facility with attachment of additional lasers of wavelength 633 nm and 785 nm and a variable temperature stage (-196° C to 600°C).
- Upgradation of Scanning Electron Microscope chamber with a Plasma Decontaminator attachment.
- Central glove box integrated with thermal evaporator facility
- ITO/AZO Sputtering System



Gas Sensor Lab



Table Top Sputtering System

## 12. OUTREACH PROGRAMME

### 12.1 V4: विज्ञान विद्यार्थी विचारविनिमय

With a view to stimulate and nurture scientific curiosity in the young minds, CeNS embarked on a science initiation programme aimed at students on 1st August 2015. Under this programme, in the last academic year, the Centre reached out to high school, pre-university and university students to participate in innovative science learning activities which included lab tours,

scientific talks and experimental demonstrations on its campus. Apart from this CeNS faculty visited other academic institutes/schools/colleges and conducted workshops /deliver lectures for the student community. Since its inception in August 2015, more than 5000 students from over 90 schools/colleges have been benefitted.

Details shown in Annexure B

### 12.2 Research Outreach Initiative (ROI)

The Research Outreach Initiative Studentship (ROIS) is a programme aimed at providing research experience to highly motivated students pursuing post-graduate studies in Physical/Chemical Sciences or a relevant branch of Engineering/Technology. The goal of the programme is to identify brilliant students having a

potential to pursue research as a career. Since inception in December 2015, twenty two ROI students successfully completed various projects. During the past one year from August 2016 fifteen students successfully completed various projects under Nano and Soft Matter Sciences.

The list is given in Annexure C

## 13. Ph.D. & TECHNICAL TRAINING

**Number of Ph.D produced: 6;      Awarded: 4;      Submitted: 2**

Sl. No.	Name of the Student	Ph.D	Date
1	Rajalakshmi R.	Awarded	November 2016
2	Gayathri H. N.	Awarded	February 2017
3	Nagaiah Kambhala	Awarded	May 2017
4	Shilpa Harish	Awarded	May 2017
5	Pappu Lakshmi Madhuri	Submitted	6 Sep 2016
6	Bramhaiah Kommula	Submitted	30 June 2017

### Ph.D. students (pursuing): 27

#### Senior Research Fellow

Ms. S. Vimala  
 Mr. K. Bramhaiah  
 Ms. M. Monika  
 Ms. P. Srividya  
 Mr. B. N. Veerabhadraswamy  
 Mr. Chandan Kumar  
 Mr. Arup Sarkar  
 Ms. Priya Madhuri  
 Mr. Rajashekhar N. Pujar (Industrial Project)  
 Mr. Sachin Ashok Bhat

#### Junior Research Fellow

Mr. Madhu Babu Kanakala  
 Mr. Suman Kundu  
 Ms. Rekha S. Hegde  
 Mr. Vaisakh V.M.  
 Ms. Marlin Baral  
 Mr. Indrajit Mondal  
 Mr. Sunil Walia  
 Ms. Brindhu Malani S.  
 Ms. Ramya Prabhu  
 Mr. Alex C.  
 Ms. Varshini G.V.  
 Ms. Pragnya Satapathy  
 Mr. Gaurav Shukla  
 Mr. Subir Roy  
 Mr. Prashanth Nayak  
 Ms. Sruthi Rose Tom  
 Mr. Anamul Haque

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**Research Associates: 12**

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Dr. Ashutosh Kumar Singh

Dr. L. R. Shobin

Dr. Indu Pandey

Dr. Suchand Sangeeth

Dr. S.R. Srither

Dr. Dharm Dev

Dr. Vivek Ramakrishnan

Dr. Kavitha T.

Dr. Jitendra Kumar

Dr. Sujeet Dutta

Dr. Remya K. Govind

Dr. Umesh Mogera (Project)

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**R&D Assistance: 11**

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Mr. Arun .D.

Ms. Prasanna M.

Mr. Madhanmohanraju

Ms. Pallavi V.

Ms. Amrutha Thomas

Ms. Amala M.Vijay

Mr. Dharmendra Kumar Singh

Mr. Ravishankar Sugumar

Mr. Abhishek Shibu (Project)

Mr. Kaushalendra K. Singh (Project)

Ms. S. Kiruthika (Project)

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## 14. EVENTS AT CeNS

### 14.1 International Yoga Day

The 2nd International Yoga Day was celebrated in our Centre on 21 June 2016. Dr. Lathashekhar, a renowned Yoga practitioner and founder of Amrita Yoga Kendra, Bengaluru was invited as the Guest and for delivering a lecture-demonstration on the benefits of Yoga, at the Centre. Dr. Lathashekhar gave an inspiring presentation, detailing the benefits of practicing Yoga and also demonstrated various Mudras and Asanas, which are effective in avoiding work related stress, fatigue, back pain and other such problems. The members of the Centre also took part in the interactive session after the lecture. This was followed by an enthralling show of Yoga postures and acrobatic formations, performed by young students of Amrita Yoga Kendra. The programme has strongly motivated the staff as well as students to take up Yoga and aim for a healthy lifestyle.

### 14.2 Foundation Stone of New Campus

CeNS is setting up a new campus on about 14 acres of land, allotted by the Government of Karnataka, for the exclusive purpose of promoting Nano-Science and Technology and to create a Centre of Excellence.

The foundation stone for the new campus was laid by Bharat Ratna Professor C.N. R. Rao, FRS, Chairman, Governing Council, CeNS on 1 August 2016. In his

address, Prof. Rao emphasized the importance of Nanoscience and Technology and its applicability in a wide range of areas, from drug delivery, engineering, agriculture and so on. He advised the Centre to take-up important projects and complete them on fast track mode so that innovations would help in the development in all spheres of life.



The foundation stone for the new campus at Shivanapura was laid by Bharat Ratna Professor C.N. R. Rao, FRS, Chairman, Governing Council, CeNS.

Professor G.U. Kulkarni, Director, CeNS, in his welcome speech, mentioned that the aim of the Centre will be to highlight the applications of Nanoscience and Technology and to translate the results of research into technology to ensure that the innovations are applicable in the lives of common men particularly in Indian context. The facilities in the new campus will be

designed to include regular interaction programmes with the students from schools and colleges, exhibitions and demonstrations of research work for developing a scientific temper among young students. The campus will also house specialized laboratories and incubation centres for carrying out research and technology projects in collaboration with other scientific institutions as well as industry.

### 14.3 Fresher's Day

During the current academic year nine students joined the Ph.D. programme. Freshers' Day was held on 5 August 2016 to welcome the new students.

### 14.4 Prof. S. Chandrasekhar Memorial Lecture

The 13th Professor S. Chandrasekhar Memorial Lecture was delivered on 11 August 2016 by Prof. Krishna N. Ganesh, Director, Indian Institute of Science Education and Research, Pune. The talk titled "Supramolecular mimics of DNA base pairs: Potpourri of H-bonds" was attended by Members of the Governing Council and the Research Advisory Board of CeNS, Late Prof. S. Chandrasekhar's family members, faculty, research scholars and other invited guests.

### 14.5 Launch of Tata Steel Advanced Materials Research Centre



TSAMRC launch at CeNS campus on 3 October 2016

Tata Steel signed a Memorandum of Understanding with CeNS on 3 October, 2016 to set up the Tata Steel Advanced Materials Research Center (TSAMRC) at CeNS premises. This initiative is in the light of Tata

Steel being entrusted with the responsibility of developing a long-term strategic roadmap in the area of advanced materials. Mr. Anand Sen, President, Total Quality Management and Steel Business, Tata Steel Limited, inaugurated the occasion.

### 14.6 Dr. Abdul Kalam's Birthday

A special lecture on the occasion of Dr. Abdul Kalam's Birthday was organized by the Centre on 18 October 2016. Padma Shri Dr. Prahlada Ramarao, Former Distinguished Scientist and Chief Controller, DRDO and Former Vice Chancellor, DIAT, Pune, gave a lecture titled 'My Years with Kalam'.

### 14.7 Vigilance Awareness Week

The Centre observed the Vigilance Awareness Week during 31 October to 5 November 2016. The faculty and administrative staff took a pledge on vigilance while they were told about the importance of maintaining the same.

### 14.8 Kannada Rajyotsava

Kannada Rajyotsava was celebrated at the Centre on 4th November 2016. A variety of programmes, including singing of Kannada songs, poetry recital, skit, quiz, etc. marked the event. Mrs. Indira Kulkarni, an enthusiastic Kannada educationist, was the Chief Guest. In her address, Mrs. Kulkarni touched upon various aspects of the majestic language and also highlighted the contributions by non-Kannadigas, including Britishers like Sir Mark Cubbon, a renowned Commissioner of the erstwhile Mysore state. The Director distributed the prizes to the winners of the Essay and Quiz Competitions held as part of the celebration.

### 14.9 Ornamental Garden Award

Outstanding award for Best Ornamental Garden Award has been received by the Centre from Mysore Horticultural Society, Lalbagh, Bengaluru on January 2017.

### 14.10 National Science Day

The National Science Day, celebrated to commemorate the discovery of Raman Effect had the theme "Science and Technology for specially abled persons". Several programmes were organized which included visits to



schools based in Bengaluru which specifically cater to specially abled students. During the celebration these spread over a week in February, CeNS researchers interacted with the students as well as the teaching staff to learn about the functioning of these schools and to explore ways where the Centre can contribute in providing additional academic interaction. As a corollary, a visit to the Centre by children of four different special schools, Spastics Society of Karnataka, Asha Kiran, Deepika Special School and ASHA was arranged on 22 February 2017. A specifically designed science demonstration tour was the highlight.



The main event culminating these activities was held on 28 February, in which students of B.E.L. high school as well as all the staff & student members participated. The programme was presided over by Prof. G.U. Kulkarni, the Director of the Centre, and included a lecture on “Science of Colour” by Dr. P. Viswanath, CeNS faculty, a science-based skit by CeNS researchers and a compiled video show on specially abled achievers.



National Science Day at CeNS, 22 February 2017

A Science Quiz show was also held for the members of the Centre. The LiTE Gallery, a hall hosting exhibits and hands-on experiments designed for school and college

going students, was inaugurated which will be, henceforth, an important component of Centre's flourishing science outreach programme. The entire activity was coordinated by a senior faculty, Dr. S. Krishna Prasad. The Centre sincerely thanks Ms. Jayashree Ramesh, Director, ASHA for the copious help in organizing the events with the special schools.

#### 14.11 LiTE Gallery

The LiTE Gallery which houses several hands-on science experiments designed for school and college going students was inaugurated on 28 February 2017. This is an important component of Centre's flourishing science outreach programme.



The Lite Gallery inauguration

#### 14.12 An interaction meeting on 'Nanomaterials for Clean Energy and Environmental Sensors', IUSSTF

An interaction meeting on 'Nanomaterials for Clean Energy and Environmental Sensors', under an Indo-US R & D networked Joint Centre awarded by Indo-US Science & Technology Forum (IUSSTF) took place on

11 & 13, March 2017. The meeting began with the inspiring opening remarks by Bharat Ratna Professor C. N. R. Rao. Scientists and students from the participating institutes, viz., CeNS, IISc and JNCASR from India and Purdue University, North-western University, University of Notre Dame and the University of Akron from the US presented their work



Bharat Ratna Prof. C. N. R. Rao delivering inaugural lecture at the IUSSTF Workshop, 11-13 March 2017.

at the meeting. The scientific content of the presentations covered a wide variety of topics such as perovskites, helical nanomaterials, block copolymers/nanoparticles assemblies, advanced electron microscopy, nanostructured GaN, quantum dots, thermal interfaces, transparent conducting



Participants at the IUSSTF interaction meeting

electrodes, liquid crystal-nanoparticle hybrids, nanofabrication under the theme of clean energy and environmental sensors. In all there were 17 invited talks

and 25 poster presentations. The sessions took place in three places, viz., CeNS, JNCASR and CeNSE-IISc with a view to include a wider student audience of the respective institutes. The meeting was convened by Prof. G.U. Kulkarni (Director, CeNS) and co-convened by Dr. Geetha G. Nair, CeNS.

#### 14.13 Interaction session with Prof. Prashant Kamat, Editor-in-Chief, ACS Energy Letters

On Sunday, 12 March 2017, an interaction session between Prof. Prashant Kamat, Editor-in-Chief, ACS Energy Letters, and young researchers of CeNS, JNCASR and CeNSE-IISc was held at the CeNS. Prof. Kamat, a Zahm Professor of Science at the University of Notre Dame, USA, spoke to the researchers about the art of publishing scientific research. The interaction was filled with very useful tips from Prof. Kamat about different aspects of writing a good manuscript and to publish in reputed journals. The highlight of the programme was an hour long question and answer session found extremely fruitful by the research student community. After the session, 'Holi' the festival of colors, was played both by the students and professors alike with lot of fervour and gaiety.



Prof. Prashant Kamat, Editor-in-Chief, ACS Energy Letters interacting with research students from CeNS, IISc and JNCASR at CeNS, 12 March 2017

## 15. HONOURS AND AWARDS

### FACULTY

#### G. U. Kulkarni

- Fellow of International Senior Fellowship of University of Bayreuth 2016
- Adjunct Member of the faculty for Science and Technology, Gulbarga University, Gulbarga

### **S. Krishna Prasad**

- Associate Editor for Bulletin of Materials Science, Indian Academy of Sciences, Bengaluru

### **Neena S. John**

- Member of the Royal society of Chemistry in August 2016.
- Springer award for best paper at 'International Conference for NextGen Technologies: Silicon to Software', VIT University, Chennai, March 2017

### **K.A. Suresh**

- Keynote speaker 23rd National Conference on Liquid Crystals, IIT Dhanbad, Dhanbad, 7-9 December 2016
- Chief Guest, Inauguration function of DST-INSPIRE Internship, Science Camp, University College, Mangaluru, at Pilikula Regional Science Centre, Mangaluru, 24-28 November 2016.

## **RESEARCH FELLOWS**

- Sunil Walia won prize for the poster titled "Transparent Pd Wire Network based Areal Hydrogen Sensor with Inherent Joule Heater" at the CeNS-Manipal Joint Workshop, held at Manipal University, Manipal, 16-17 August 2016.
- Sunil Walia won prize for the poster titled "Transparent Pd Wire Network based Areal Hydrogen Sensor with Inherent Joule Heater" at the IUSSTF Workshop, held at CeNS and JNCASR, 11 & 13 March 2017.
- Bharath B got Best Poster award for the poster titled "Solution Based Fabrication of a Fast Response, Broad-Band, Large Area Photodetector" at the Japan Society for the Promotion of Science.
- Vimala S., SRF got IUCr Young Scientist Award by International Union of Crystallography, September 2016.
- Monika M., SRF has got Best Paper presentation at International Conference on Advanced Materials (SCICON-2016), 12-16 December, 2016, Coimbatore.
- Sachin Ashok Bhat, SRF, got Best poster award for his poster titled "Nanoparticles Coated with Dimer-Like Mesogenic Ligands: Synthesis and Characterization of Liquid-Crystalline Nanoparticle (LC-NP) Composite" at National Conference on Liquid Crystals, December 07-09, 2016
- Nagaiah Kambhala, RA (Provisional), selected under National Post-Doctoral Fellowship, SERB, DST, New Delhi

# 16. RESERVATION

The Centre follows the national policies on Reservation and Official Language as per the rules and orders issued by the Government of India from time to time.

The Centre has one SC/ST employee working under Group C.

# 17. OFFICIAL LANGUAGE

## **Hindi Day**

On the occasion of Hindi Diwas, Hindi Week has been organized by the Centre during 12-17 September 2016. Various activities like essay writing on importance of scientific research in Nation's progress, talk on Hindi Diwas, drama based on Munshi Prem Chand story, debate on scientific approach to life to eliminate superstition in society, were organized.

Also to popularize usage of Hindi at CeNS, a scientific word is displayed everyday on the Notice Board under आज का शब्द



## 18. AUDITED STATEMENT OF ACCOUNTS

**B.R.V. Goud & Co.**  
Chartered Accountants



### AUDITOR'S REPORT

#### TO THE MEMBERS OF THE GOVERNING BODY OF CENTRE FOR NANO AND SOFT MATTER SCIENCES, BENGALURU

#### Report on the Financial Statements

We have audited the financial statements of "Centre for Nano and Soft Matter Sciences" Prof. U.R Rao Road, Jalahalli, Bengaluru 560 013, which comprise the Balance Sheet as at 31st March 2017 and the Statement of Income & Expenditure Account for the year then ended and the Receipts and Payments for the year then ended and a summary of significant accounting policies and other explanatory information.

#### Management's Responsibility for the Financial Statements

Management is responsible for the preparation of the financial statements. This responsibility includes the design, implementation and maintenance of internal control relevant to the preparation of the financial statements that are free from material misstatement, whether due to fraud or error.

#### Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with the Standards on Auditing issued by the Institute of Chartered Accountants of India. Those Standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances. An audit also includes evaluating the appropriateness of the accounting policies used and the reasonableness of the accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

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

No 37/1, 1st Floor, M.N.K. Rao Road  
Basavanagudi, Bangalore - 560 004  
Phone: 080 - 26566448, 26577448

TeleFax: 080 - 26566337  
E-mail: [audit@brvgoud.co.in](mailto:audit@brvgoud.co.in)  
Website: [www.brvgoud.co.in](http://www.brvgoud.co.in)

**Opinion**

In our opinion and to the best of our information and according to the explanations given to us, the said accounts give the information required & give a true and fair view in conformity with the accounting principles in India.

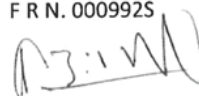
- 1) In the case of the Balance Sheet, of the state of affairs of **Centre for Nano and Soft Matter Sciences**, as at 31<sup>st</sup> March 2017.
- 2) In the case of Income & Expenditure Account, of the Excess of Income over expenditure for the year ended on that date.

**We further report that:**

- a) The Balance Sheet & Income & Expenditure Account dealt with by this report, are in agreement with the books of Accounts.
- b) In our opinion, proper books of accounts as required have been kept by the Centre, so far as appears from our examination of those books.
- c) The Balance Sheet and Income and Expenditure account dealt with by this report are prepared in accordance with the Accounting Standards issued by the Institute of Chartered Accountants of India subject to the following observations:
  - i) Non-Provisions of accrued liability in respect of Gratuity and leave encashment which is not in conformity with the Accounting Standard - 15 (Accounting for retirement benefits) issued by the Institute of Chartered Accountants of India.
  - ii) All capital expenditure incurred during the year for purchase of Fixed Assets is charged to Income and Expenditure account, under the head "Expenditure on Grants/Subsidy" and the corresponding credit is added to Capital Fund account. This is not in conformity with the Accounting Standard – 10 issued by the Institute of Chartered Accountants of India. It has been explained that this format has been consistently followed by the Centre.



For B R V GOUD & CO.,  
Chartered Accountants  
F R N. 0009925



(A B SHIVA SUBRAMANYAM)  
PARTNER  
M. No. 201108

Place: Bangalore  
Date: 12.07.2017


**CENTRE FOR NANO AND SOFT MATTER SCIENCES  
JALAHALLI, BANGALORE - 560 013**



**BALANCE SHEET AS AT 31ST MARCH, 2017**

		(Amount in Rs.)	
I.	CORPUS / CAPITAL FUND AND LIABILITIES	SCH	31.03.2017      31.03.2016
	CORPUS / CAPITAL FUND	1	2507,67,194      1841,15,942
	RESERVES AND SURPLUS	2	-      -
	EARMARKED PROJECTS FUNDS	3	510,22,130      116,79,029
	SECURED LOANS AND BORROWINGS	4	-      -
	UNSECURED LOANS AND BORROWINGS	5	-      -
	DEFERRED CREDIT LIABILITIES	6	-      -
	CURRENT LIABILITIES AND PROVISIONS	7	105,68,012      270,12,065
	<b>TOTAL</b>		<b>3123,57,336      2228,07,036</b>
II.	APPLICATION OF FUNDS/ASSETS		
	FIXED ASSETS	8	1400,81,780      1395,59,788
	INVESTMENTS - FROM EARMARKED/ENDOWMENT FUNDS	9	-      -
	INVESTMENTS - OTHERS	10	-      -
	CURRENT ASSETS, LOANS, ADVANCES ETC.,	11	1722,75,556      832,47,248
	<b>TOTAL</b>		<b>3123,57,336      2228,07,036</b>
	<b>SIGNIFICANT ACCOUNTING POLICIES AND NOTES ON ACCOUNTS</b>	24	

As per our report of even date,  
for B.R.V. GOUD & CO.  
Chartered Accountants

  
(PROF. G.U. KULKARNI)  
DIRECTOR

  
(VIVEK DUBEY)  
ACCOUNTS OFFICER

   
(A B SHIVA SUBRAMANYAM)  
PARTNER  
M. No. 201108

PLACE :BANGALORE  
DATE: 12 JULY 2017


**CENTRE FOR NANO AND SOFT MATTER SCIENCES  
JALAHALLI, BANGALORE - 560 013**

**INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2017**


(Amount in Rs.)

<b>A - INCOME</b>	<b>SCH</b>	<b>2016-17</b>	<b>2015-16</b>
Income from Sales / Services	12	-	-
Grants / Subsidies:	13	14,61,00,000	8,00,00,000
Fees / Subscriptions	14	-	-
Income from Investments (income on investments from earmarked / endowment Funds)	15	-	-
Income from Royalty, Publications etc.,	16	-	-
Interest earned	17	83,16,528	65,44,096
Other Income	18	10,86,642	4,54,073
Increase / (decrease) in stock of finished goods and work-in-progress	19	-	-
<b>TOTAL (A)</b>		<b>15,55,03,170</b>	<b>8,69,98,169</b>
<b>B - EXPENDITURE</b>			
Establishment Expenses	20	4,02,11,407	2,93,41,388
Other Administrative Expenses etc.,	21	2,75,53,162	2,61,49,639
Expenditures on Grants, Subsidies etc.,	22	2,23,51,306	4,54,24,060
Interest	23	-	-
<b>TOTAL (B)</b>		<b>9,01,15,875</b>	<b>10,09,15,087</b>
<b>C. BALANCE BEING SURPLUS / (DEFICIT) (A-B)</b>		<b>6,53,87,295</b>	<b>(1,39,16,918)</b>
<b>D. Less: Prior Period Adjustment</b>		-	-
<b>E. SURPLUS / (DEFICIT) CARRIED TO CORPUS / CAPITAL FUND (C+D)</b>		<b>6,53,87,295</b>	<b>(1,39,16,918)</b>
<b>SIGNIFICANT ACCOUNTING POLICIES AND NOTES ON ACCOUNTS</b>	<b>24</b>		

  
(PROF. G.U. KULKARNI)  
DIRECTOR

  
(VIVEK DUBEY)  
ACCOUNTS OFFICER



As per our report of even date,  
for B.R.V. GOUD & CO.  
Chartered Accountants,  
  
(A B SHIVA SUBRAMANYAM)  
PARTNER  
M. NO. 201108

PLACE: BANGALORE  
DATE : 12.07.2017


CENTRE FOR NANO AND SOFT MATTER SCIENCES  
JALAHALLI, BANGALORE - 560 013

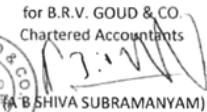
RECEIPTS AND PAYMENTS FOR THE YEAR ENDED 31ST MARCH, 2017

		(Amount in Rs.)			
RECEIPTS	For the year 2016-17	For the year 2015-16	PAYMENTS	For the year 2016-17	For the year 2015-16
<b>I Opening Balances</b>			<b>I. Establishment Expenses</b>	367,50,838	258,49,990
1) Cash in Hand	6,825	-			
2) Bank Balances			<b>II Administrative Expenses</b>	285,06,261	262,30,914
a) State Bank of India A/c No.274	265,27,202	162,86,328	<b>III Fixed Assets (Additions)</b>	138,22,202	230,68,549
b) State Bank of India A/c No.219	50,00,000	-			
c) State Bank of Mysore A/c No.430	5,17,184	40,70,886	<b>IV A) Remittances/Refunds etc.,</b>		
d) State Bank of India A/c No.408	3,825	-	a) Earnest Money Deposit & Security Deposit & S Creditors	248,18,231	8,54,283
e) Closed Bank Accounts	-	98,031			
<b>II Grants-in-aid from DST, Govt of India</b>	922,76,000	800,00,000	<b>B) Remittances/Refunds etc.,</b>		
<b>III Interest Received</b>			a) C.P.F. Employees Contribution	7,08,462	6,79,035
a) On Savings Bank Accounts	26,24,388	21,37,967	b) C.P.F. CeNS Contribution	4,26,950	3,64,144
b) On Fixed/Term Deposits	26,35,485	46,17,843	c) Income Tax Deducted at source from staff, contractor & rent and Professional Tax	37,69,938	25,98,488
<b>IV Other Income</b>			d) Advance to suppliers/others etc.,	31,81,089	47,92,395
a) Stale cheque	-	2,000	e) Staff Advances	17,83,013	3,67,170
b) Sample Charges	2,52,500	-	f) New Pension Scheme Tier 1	6,72,736	13,89,452
c) Miscellaneous Receipts	3,03,824	3,22,259	g) NPS CENS Contribution		
<b>V Other Recoveries etc.,</b>			h) TDS by Bank and others	85,120	-
A) Earnest Money Deposit & Security Deposit & S. Creditors	26,72,718	17,46,795	i) Provisions for last year paid	25,70,593	16,08,321
			j) Misc. Income	-	20,834
<b>B)</b>			<b>VI Investments</b>		
i) CPF Employees Contribution	11,35,412	6,79,035	Fixed/Term Deposits made	429,22,912	135,41,861
ii) Income Tax Deducted at source from staff, contractor & rent and Professional Tax	37,33,200	26,49,538	Security Deposit with HMT	3,74,040	-
iii) Advance to suppliers/others etc.,	7,74,776	30,45,710	<b>VII Earmarked Project Expenses</b>	81,17,707	36,06,374
iv) Staff Advance Recovery	18,44,034	8,31,119			
v) New Pension Scheme Tier -1	6,87,832	6,44,157	<b>VIII Closing Balance</b>		
<b>C)</b>			1) Cash in Hand	-	6,825
i) Establishment Receipts	4,25,346	2,97,434	2) Bank Balances		
ii) Other Administrative Receipts	7,27,024	96,715	a) State Bank of India A/c No.274	150,57,184	265,27,202
<b>VI Deposit with Bank</b>			b) State Bank of India A/c No.219	419,36,037	50,00,000
a) Fixed/Term deposits matured	403,10,951	140,26,029	c) State Bank of India A/c No.430	16,66,801	5,17,184
<b>VII Grants/Financial Assistances received for Earmarked Projects</b>	447,11,588	54,75,000	d) State Bank of India A/c No.408	-	3,825
<b>TOTAL</b>	<b>2271,70,114</b>	<b>1370,26,846</b>	<b>TOTAL</b>	<b>2271,70,114</b>	<b>1370,26,846</b>

  
(PROF. G.U. KULKARNI)  
DIRECTOR

PLACE : BANGALORE  
DATE : 12 JULY 2017

  
(VIVEK DUBEY)  
ACCOUNTS OFFICER

As per our report of even date,  
for B.R.V. GOUD & CO.  
Chartered Accountants  
  
(B. SHIVA SUBRAMANYAM)  
PARTNER  
M. No. 201108





**CENTRE FOR NANO AND SOFT MATTER SCIENCES  
JALAHALLI, BANGALORE - 560 013**

**SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2017**

	(Amount in Rs.)	
	As at 31.03.2017	As at 31.03.2016
<b><u>SCHEDULE 1 - CORPUS / CAPITAL FUND:</u></b>		
As Per Previous Balance Sheet	18,41,15,942	17,05,78,419
<b><u>ADD:</u></b> Addition of Fixed Assets during the year	4,47,06,817	4,54,24,060
Less: Accounted in previous year	2,23,55,511	2,23,51,306
	20,64,67,248	21,60,02,479
<b><u>ADD/(LESS):</u></b> Excess of Income / (Expenditure) for the year	6,53,87,295	(1,39,16,918)
<b><u>LESS:</u></b> Depreciation for the year	2,10,87,349	1,79,69,619
<b>TOTAL</b>	<b>25,07,67,194</b>	<b>18,41,15,942</b>
<b><u>SCHEDULE 2 - RESERVES AND SURPLUS:</u></b>	<b>TOTAL</b>	-
<b><u>SCHEDULE 3 - EARMARKED / PROJECT FUNDS:</u></b> (See Annexure A for details)	<b>TOTAL</b>	<b>5,10,22,130</b>
<b><u>SCHEDULE 4 - SECURED LOANS AND BORROWINGS:</u></b>	<b>TOTAL</b>	-
<b><u>SCHEDULE 5 - UNSECURED LOANS AND BORROWINGS:</u></b>	<b>TOTAL</b>	-
<b><u>SCHEDULE 6 - DEFERRED CREDIT LIABILITIES:</u></b>	<b>TOTAL</b>	-
<b><u>SCHEDULE 7-CURRENT LIABILITIES &amp; PROVISIONS:</u></b>		
<b>A) CURRENT LIABILITIES:</b>		
1) Statutory Liabilities	6,05,662	1,13,074
2) Other Liabilities	33,30,878	2,42,65,778
3) Stale Cheque	62,620	62,620
<b>TOTAL (A)</b>	<b>39,99,160</b>	<b>2,44,41,472</b>
<b>B) PROVISIONS:</b>		
Salaries and Servies and Supplies	65,68,852	25,70,593
<b>TOTAL (B)</b>	<b>65,68,852</b>	<b>25,70,593</b>
<b>TOTAL (A+B)</b>	<b>1,05,68,012</b>	<b>2,70,12,065</b>
<b><u>SCHEDULE 8 - FIXED ASSETS</u></b>	<b>TOTAL</b>	<b>14,00,81,780</b>
<b><u>SCHEDULE 9- INVESTMENTS FROM EARMARKED / ENDOWMENT FUNDS:</u></b>	-	-
<b><u>SCHEDULE 10 - INVESTMENTS - OTHERS:</u></b>	-	-
<b><u>SCHEDULE 11 - CURRENT ASSETS,LOANS, ADVANCES:</u></b>		
<b>A) CURRENT ASSETS:</b>		
1) Inventories	-	-
2) Sundry Debtors:	-	-
3) Cash Balances in Hand	-	6,825
4) Bank Balances:- Nationalised Banks		
a. Term Deposit Receipts (includes margin money)	5,68,39,732	4,91,84,028
b. Current Account : SBM Vyalikaval	-	-
c. <u>Savings Accounts:</u>		
Bank of India (Malleswaram)	-	-
Union Bank of India (Malleswaram)	-	-
Indian Bank (BEL Road)	-	-
SBI SB A/c No.274	1,50,57,184	2,65,27,202
SBI SB Project A/c 219	4,19,36,037	50,00,000
SBM SB A/c 24430	16,66,801	5,17,184
<b>TOTAL (A)</b>	<b>11,54,99,754</b>	<b>8,12,35,239</b>

**B) LOANS,ADVANCES AND OTHER ASSETS:**

1) Loans	-	-
2) Advances and Other amounts recoverable in Cash or in kind or for value to be received:	32,621	15,26,393
a) K P T C L Deposit (SERC/CLCR)	3,62,590	3,62,590
b) Deposit with BSNL	87,000	87,000
3) Deposits HMT Ltd. and Mohan Gas	3,82,690	8,650
4) Grant in Aid Receivable	538,24,000	-
5) Accrued Interest & Prepaid Exp.(Insurance)	19,20,606	-
4) TDS By Bank/ BESCOM & Others	1,66,295	23,551
<b>TOTAL (B)</b>	<b>567,75,802</b>	<b>20,08,184</b>

<b>TOTAL (A+B)</b>	<b>1722,75,556</b>	<b>832,43,423</b>
<b>TOTAL</b>	-	-

**SCHEDULE 12 - INCOME FROM SALES / SERVICES:****SCHEDULE 13 - GRANTS / SUBSIDIES:**

Grant in Aid -Salaries	428,51,000	356,72,000
Grant in Aid -Salaries (SC )	19,22,000	16,00,000
Grant in Aid -General	324,97,000	187,28,000
Grant in Aid- Creation of Capital Assets	288,30,000	240,00,000
Grant in Aid- Creation of Assets (Development of Campus)	400,00,000	-
Dept of Science & Techonolgy Government of India	<b>1461,00,000</b>	<b>800,00,000</b>
<b>TOTAL</b>	<b>1461,00,000</b>	<b>800,00,000</b>

**SCHEDULE 14 - FEES / SUBSCRIPTIONS:**

<b>TOTAL</b>	-	-
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**SCHEDULE 15 - INCOME FROM INVESTMENTS:**

<b>TOTAL</b>	-	-
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**SCHEDULE 16 - INCOME FROM ROYALTY,  
PUBLICATIONS ETC.:**

<b>TOTAL</b>	-	-
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**SCHEDULE 17 - INTEREST EARNED/Accrued:**

1) On Term Deposits - Nationalised Banks	61,18,121	45,41,861
2) On Savings Accounts - Nationalised Bank	21,98,407	20,02,235
<b>TOTAL</b>	<b>83,16,528</b>	<b>65,44,096</b>

**SCHEDULE 18 - OTHER INCOME:**

Sample charges	2,52,500	-
Miscellaneous Income	8,34,142	3,01,425
Project Overhead Recovered	-	1,52,648
Canteen Receipts	-	-
<b>TOTAL</b>	<b>10,86,642</b>	<b>4,54,073</b>

**SCHEDULE 19 - INCREASE (DECREASE) IN STOCK  
OF FINISHED GOODS & WORK IN PROGRESS:**

-	-
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**SCHEDULE 20 - ESTABLISHMENT EXPENSES:**

1) Salaries, Allowance and Wages to Staff	313,10,956	225,38,080
2) Medical Expenses Reimbursed	1,20,073	74,905
3) Bonus	-	34,627
4) Fellowship & Book Grant	82,82,732	61,85,741
5) Salary -SC	4,97,646	5,08,035
<b>TOTAL</b>	<b>402,11,407</b>	<b>293,41,388</b>

**SCHEDULE 21 - OTHER ADMINISTRATIVE EXPENSES, ETC:**

Auditors Remuneration	57,500	28,750
Chemicals, Glasswares & Consumables etc.,	17,57,211	19,71,536
Duties & Taxes	45,738	43,861
Electricity & Water Charges	33,15,650	21,91,389
Fees & Professional charges	6,86,054	5,03,352
Foreign Travel	-	-
Fuel Charges for Genset	1,59,000	1,86,833
Hospitality Charges	6,63,881	4,31,968
House Keeping Charges	15,32,528	17,51,199
Journals & Periodicals /Books	4,40,189	1,00,580
Reimbursement of Fees to Student	2,53,075	-
Conveyance/ Transportation Charges	19,24,222	13,81,948
Man Power Supply Expenses	21,51,707	13,12,412
Other Miscellaneous Charges / Bank Charges	135,752	66,040
Advertisement and Publicity Charges	1,59,567	1,70,666
Printing & Stationery	9,95,333	8,61,725
Registration & Renewals	1,52,100	2,00,290
Rent & Insurance	38,05,514	12,73,671
Repairs & Maintenance	41,41,951	1,02,80,516
Security Charges	18,82,221	16,51,562
Seminar and Conferences	3,22,692	2,86,974
Telephone Charges	8,08,656	5,65,572
Travel Expenses	17,72,921	7,05,907
Testing (N.M.R.) & Sample analysis charges	1,11,550	1,51,600
IP Related Expenses	2,78,150	60,038
<b>TOTAL</b>	<b>2,75,53,162</b>	<b>2,61,78,389</b>


**SCHEDULE 22 - EXPENDITURE ON GRANTS, SUBSIDIES ETC:**

(Fixed assets)( net )

**2,23,51,306 4,54,24,060****SCHEDULE 23 - INTEREST:**

As per our report of even date,  
for B.R.V. GOUD & CO.  
Chartered Accountants

  
(PROF. G.U.KULKARNI)  
DIRECTOR

  
(VIVEK DUBEY)  
ACCOUNTS OFFICER

  
(A B SHIVA SUBRAMANYAM)  
PARTNER  
M. NO. 201108

PLACE :BANGALORE  
DATE : 12.07.2017



**CENTRE FOR NANO AND SOFT MATTER SCIENCES**  
JALAHALLI, BANGALORE - 560 013

<b>SCHEDULE 3 - EARMARKED / PROJECTS</b>		<b>Government and Governmental bodies Sponsor Projects</b>											<b>(Amount in Rs.)</b>	
<b>Annexure - A to Schedule 3</b>														
		<b>Balance Under Closed Project</b>	<b>SERB (NSJ)</b>	<b>INDO Bulgarian (SKP)</b>	<b>SERB (GGN)</b>	<b>SERB (SA)</b>	<b>SERB (SKP)</b>	<b>SERB (CVY)</b>	<b>WOS - A - 2(USH)</b>	<b>DST/TPF/ GUK / 05/16-19</b>	<b>IGSTC/GUK K / 02/16-18</b>	<b>IUSSTF/GU Fellowship</b>	<b>Project Administration</b>	<b>Total Under Government Project</b>
<b>FUNDS</b>														
a)	Opening Balance of the Funds	27,54,175	6,83,172	86,776	28,17,638	6,85,591	14,75,143	(6,88,633)	18,900	-	-	-	5,00,000	83,32,762
b)	Additions to the Funds:													
i)	Grants	-	-	-	92,889	-	-	-	8,00,000	178,57,000	71,10,000	9,79,371	12,80,000	285,29,260
ii)	Income from investment made	-	-	2,035	-	-	-	-	-	1,60,443	59,111	8,444	-	2,30,033
<b>TOTAL (a+b)</b>		<b>27,54,175</b>	<b>6,83,172</b>	<b>88,811</b>	<b>29,10,527</b>	<b>6,85,591</b>	<b>14,75,143</b>	<b>(6,88,633)</b>	<b>8,18,900</b>	<b>180,17,443</b>	<b>71,69,111</b>	<b>9,87,815</b>	<b>17,80,000</b>	<b>370,92,055</b>
c)	Utilisation/Expenditure towards objectives of Funds:													
i)	Capital Expenditure													
	Fixed Assets	-	-	-	-	-	-	-	-	-	-	-	-	-
	Others	-	-	-	-	-	-	-	-	-	-	-	-	-
ii)	Revenue Expenditure													
	Salaries, Wages and Allowances etc.,	-	-	-	44,400	-	-	1,63,020	5,90,806	-	3,21,079	-	2,63,145	13,82,450
	Consumables/ travel	11,449	-	-	25,390	-	-	1,88,230	2,94,103	1,98,344	-	1,31,924	-	8,49,440
	Depreciation	2,39,079	92,792	-	3,96,111	1,03,439	2,62,554	-	-	-	-	-	-	10,93,975
	Overheads	1,00,000	1,00,000	-	2,00,000	17,175	1,00,000	50,000	5,00,000	2,00,000	-	-	-	11,67,175
	Grant Refunded	-	-	88,811	-	-	-	-	-	-	-	-	-	88,811
<b>TOTAL (c)</b>		<b>2,39,079</b>	<b>2,04,241</b>	<b>88,811</b>	<b>6,65,901</b>	<b>1,03,439</b>	<b>2,79,729</b>	<b>4,51,250</b>	<b>9,34,909</b>	<b>6,98,344</b>	<b>5,21,079</b>	<b>1,31,924</b>	<b>2,63,145</b>	<b>45,81,851</b>
<b>c)</b>		<b>25,15,096</b>	<b>4,78,931</b>	-	<b>22,44,626</b>	<b>5,82,152</b>	<b>11,95,414</b>	<b>(11,39,883)</b>	<b>(1,16,009)</b>	<b>173,19,099</b>	<b>66,48,032</b>	<b>8,55,891</b>	<b>1,46,855</b>	<b>325,10,204</b>

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Annexure - A to Schedule 3		Industries Sponsor Project/ Joint Venture with Industries						(Amount in Rs.)
FUNDS		TSAMRC	Tata Steel	HPCL/IIT/NSJ/ 01/17-18	Total of industry projects	Total of Govt. Projects	Total Projects including Government and Industries	Previous YEAR
a) Opening Balance of the Funds		-	33,46,267	-	33,46,267	83,32,762	116,79,029	105,85,244
b) Additions to the Funds:		168,10,000	-	9,40,000	177,50,000	285,29,260	462,79,260	5,00,000
i) Grants								54,75,000
ii) Income from investment made		1,09,777	46,444	8,444	1,64,665	2,30,033	3,94,698	1,35,732
<b>TOTAL (a+b)</b>		<b>169,19,777</b>	<b>33,92,711</b>	<b>9,48,444</b>	<b>212,60,932</b>	<b>370,92,055</b>	<b>583,52,987</b>	<b>166,95,976</b>
c) Utilisation/Expenditure towards objectives of Funds:								
Rental and Maintenance Charges		2,68,600	-	-	2,68,600	-	2,68,600	-
Project Cost		8,89,992	-	-	8,89,992	-	8,89,992	-
Other Expenditure as per project			15,28,294	-	15,28,294	-	15,28,294	-
Salaries, Wages and Allowances etc.,		-		-	-	13,82,450	13,82,450	23,08,903
Consumables/ travel		-	-	-	-	8,49,440	8,49,440	8,11,671
Depreciation		62,120	-	-	62,120	10,93,975	11,56,095	12,43,725
Overheads		-	-	-	-	11,67,175	11,67,175	6,52,648
Grant Refunded		-	-	-	-	88,811	88,811	-
<b>TOTAL (c)</b>		<b>12,20,712</b>	<b>15,28,294</b>	<b>-</b>	<b>27,49,006</b>	<b>45,81,851</b>	<b>73,30,857</b>	<b>50,16,947</b>
<b>NET BALANCE AT THE YEAR END (a+b-c)</b>		<b>156,99,065</b>	<b>18,64,417</b>	<b>9,48,444</b>	<b>185,11,926</b>	<b>325,10,204</b>	<b>510,22,130</b>	<b>116,79,029</b>

CENTRE FOR NANO AND SOFT MATTER SCIENCES JALAHALLI, BANGALORE - 560 013									
SCHEDULES FORMING PART OF BALANCE SHEET AS AT 31ST MARCH, 2017									
(Amount in Rs.)									
SCHEDULE - 8 : FIXED ASSETS									
DESCRIPTION	W.D.V. as on 01.04.2016	Additions during the year		Total as on 31.03.2017	Rate of Dep.	Depreciation Full Rate	Dep. For Addition o <180 Days	Total Depreciation for the year	W.D.V. as on 31.03.2017
<b>A. CENS :</b>									
<b>CIVIL WORKS</b>									
Aluminium Partitions	18,70,616	-	-	18,70,616	10	1,87,062	-	1,87,062	16,83,554
Brick Base(Partitions)	89,403	-	-	89,403	10	8,940	-	8,940	80,463
Construction of Cycle Stand	35,275	-	-	35,275	10	3,528	-	3,528	31,747
Construction of Shed	36,352	-	-	36,352	10	3,635	-	3,635	32,717
Vinyl Flooring	1,73,969	-	-	1,73,969	10	17,397	-	17,397	1,56,572
Other Miscellaneous Works	11,53,206	1,42,215	14,01,684	26,97,105	10	1,29,542	70,084	1,99,626	24,97,479
Infrastructure - New Campus (WIP)	-	27,37,430	41,09,999	68,47,429	-	-	-	-	68,47,429
<b>BUILDING (Main &amp; Annexe)</b>	49,76,675	-	-	49,76,675	10	4,97,668	-	4,97,668	44,79,007
<b>ELECTRICAL INSTALLATIONS</b>									
Air Conditioner	7,04,944	99,850	3,08,775	4,08,625	15	1,20,719	23,158	1,43,877	9,69,692
Computers	7,81,268	3,70,379	6,42,969	10,13,348	60	6,90,988	1,92,891	8,83,879	9,10,737
Fume Cupboard	1,19,459	-	-	1,19,459	10	11,946	-	11,946	1,07,513
Electrical Installation	5,74,510	1,68,609	-	1,68,609	10	74,312	-	74,312	6,80,807
Generator Set	3,72,794	-	-	3,72,794	15	55,919	-	55,919	3,16,875
<b>FURNITURE &amp; FIXTURES</b>									
Carpentary Works	4,02,691	-	-	4,02,691	10	40,269	-	40,269	3,62,422
Furniture & Fixtures	25,16,714	1,53,360	13,39,470	14,92,830	10	2,67,007	66,974	3,33,981	36,75,563
<b>GENERAL EQUIPMENTS</b>									
Canteen Vessels and Equipments	16,167	1,27,297	1,43,464	1,43,464	15	2,425	9,547	11,972	1,31,492
Equipment	56,03,687	4,85,833	12,99,397	17,85,230	15	9,13,428	97,455	10,10,883	63,78,034
Workshop & Other Equipments	1,79,799	-	-	1,79,799	15	26,970	-	26,970	1,52,829
<b>SCIENTIFIC EQUIPMENTS</b>	903,19,747	223,96,919	89,06,464	313,03,383	15	169,07,500	6,67,985	175,75,485	1040,47,645
<b>Total - (A)</b>	<b>1099,11,109</b>	<b>265,70,762</b>	<b>181,36,055</b>	<b>447,06,817</b>	<b>1546,17,926</b>	<b>199,59,255</b>	<b>11,28,094</b>	<b>210,87,349</b>	<b>1335,30,577</b>

As per our report of even date,  
for B.R.V. GOUD & CO.  
Chartered Accountants,



ACCOUNTS OFFICER

(PROF. G.U. KULKARNI)  
DIRECTOR


PLACE: BANGALORE  
DATE: 12 JULY 2017

M. No. 201108


DESCRIPTION	(Amount in Rs.)					
	W.D.V. as on 01.04.2016	>180 days	<180 Days	Total additions	Total as on 31.03.2017 Dep.	Rate of Dep.
<b>B. Projects</b>						
I. Assets Under Closed Projects	15,93,862	-	-	-	15,93,862	15
II. SERB (SKP) Equipment	17,50,363	-	-	-	17,50,363	15
II. SERB (NSJ) PROJECT: Equipment	6,18,615	-	-	-	6,18,615	15
III. SERB (GGN) PROJECT: Equipment	26,40,737	-	-	-	26,40,737	15
IV. SERB (SA) PROJECT: Equipment	6,89,591	-	-	-	6,89,591	15
V. TSAMRC Equipment	4,14,130	-	-	-	4,14,130	15
<b>Total (B)</b>	<b>77,07,298</b>	-	-	-	<b>77,07,298</b>	
<b>Grand Total (A+B)</b>	<b>1176,18,407</b>	<b>265,70,762</b>	<b>181,36,055</b>	<b>447,06,817</b>	<b>1623,25,224</b>	
					<b>211,15,350</b>	
					<b>11,28,094</b>	
					<b>222,43,444</b>	
					<b>1400,81,780</b>	

PLACE: BANGALORE  
DATE: 12 JULY 2017

  
(PROF. G.U. KULKARNI)  
DIRECTOR

  
(VIVEK DUBEY)  
ACCOUNTS OFFICER

As per our report of even date,  
for B.R.V. GOUD & CO.  
Chartered Accountants

  
B.R.V. GOUD & CO.  
CHARTERED  
ACCOUNTANTS  
BANGALORE  
B.S. SHIVA SUBRAMANYAN  
PARTNER  
M. No. 201108

## CENTRE FOR NANO AND SOFT MATTER SCIENCES, JALAHALLI, BANGALORE

SCHEDULES FORMING PART OF THE ACCOUNTS FOR THE YEAR ENDED 31<sup>ST</sup> MARCH 2017

## SCHEDULE 24: SIGNIFICANT ACCOUNTING POLICIES AND NOTES ON ACCOUNTS

**OVERVIEW:**

Centre for Nano and Soft Matter Sciences is registered as a society under the Karnataka Societies Registration Act, 1960 and also registered under Section 12A of the Income Tax Act, 1961. It is an autonomous institution recognised and substantially funded by the Department of Science and Technology, Government of India.

The main objects of the Centre, inter-alia, are to conduct basic and applied research in Nano and Soft Matter Sciences and specifically focused on a variety of metal and semi-conductor nanostructures, liquid crystals, gels, membranes and hybrid materials.

**A. SIGNIFICANT ACCOUNTING POLICIES:**

1. **Accounting Conventions:** The financial statements are drawn up in accordance with historical accounting conventions and on the going concern concept. As per decision of the Governing Council, the method of Accounting is changed from Cash to Accrual system from 01<sup>st</sup> April, 2016.

The guidelines as per the Uniform Format of Accounts for Central Autonomous Institutions, as applicable and to the extent practicable, are followed in the presentation of the financial statements of the Centre.

2. **Investments:** Investments are stated at cost and Interest from Investments are accounted on accrual basis.
3. **Fixed Assets:** Fixed assets are stated at written down value. Fixed assets are accounted at cost of acquisition, inclusive of inward freight, duties, taxes and incidental expenses related to acquisition.
4. **Depreciation:** Depreciation on Fixed assets has been provided on Written Down Value Method at rates as per Income Tax Rules, 1962.
5. **Government Grants / Other Grants:** The Grants received are recognized in the accounts on accrual basis. The total amount of grant received from DST during the year has been credited to the Income & Expenditure account of the Centre. The conditions stipulated for utilization of Grants-in-aid have been strictly adhered to by the Centre.



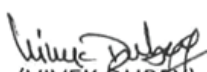
6. **Capital Expenditure:** All Capital Expenditure incurred during the year for purchase of Fixed Assets is charged to Income & Expenditure Account, under the head "Expenditure on Grants/Subsidy". The same is again reflected in Schedule 1 by credit to Capital Fund account. This system is being followed by the centre in the respective years of acquisition of fixed assets acquired and has been treated as Expenditure on Grants in the Income & Expenditure Account, as a matter of accounting policy.
7. **Retirement Benefits:**  
No provision has been made in respect of the Leave Encashment and Gratuity liability in the accounts as required by AS 15. However, the same is accounted on cash basis as and when the liability is discharged.
8. **Allocation / Transfer to Earmarked Project Funds:** The Centre has a policy to transfer interest earned on investments relating to project funds, to earmarked project funds, to recognise the interest attributable to those funds. To meet exigencies in project related expenditure, a fund called Project Administration is maintained under project accounts and allocation of funds to any project is made out of the said fund.

#### **B. NOTES ON ACCOUNTS:**

1. **Contingent Liabilities:** Letters of Credits outstanding as on 31.03.2017 are ₹ 50,43,532/- and ₹ Nil was outstanding at the end of previous year.
2. Claims against the Centre not acknowledged as debts Rs. Nil (Previous year Rs. Nil).
3. Grants amounting to ₹ 4,00,00,000 and ₹ 1,38,24,000 sanctioned for the financial year 2016-17 are received in the month of April 2017. These grants are recorded in the Income and Expenditure account.
4. Foreign currency transactions are translated at the rates prevailing on the date of transaction. During financial year 2016-17 ₹ 1,63,69,988/- paid as foreign currency for purchase of scientific equipment and other expenditure as compared to financial year 2015-16 of ₹ 2,62,80,571/-.
5. Balance shown under Saving Bank Accounts Include amounts held by Bank under "Auto Sweep Accounts".
6. Figures are rounded off to the nearest rupee and figures of previous year have been regrouped and reclassified to conform to that of the current year.
7. An amount of ₹ 12,80,000/- has been transferred to Project Administration fund to meet exigencies of expenditures relating to on-going projects.

8. Depreciation on fixed assets acquired out of Grant-in-aid amounting to ₹2,10,87,349/- is debited to the Capital Fund. Depreciation on fixed assets acquired out of Project funds amounting to ₹ 11,56,095/- is debited to respective earmarked project fund account.
9. An amount of ₹ 2,23,55,511/- which was shown as additions to fixed assets under the head "Fixed Assets under acquisition" in the financial year 2015-16 has been transferred to the respective heads of Fixed Assets during the year 2016-17 and the corresponding credit amount has been reduced in the Capital Fund account.
10. **Income Tax:** The Centre is registered under Section 12A of the Income Tax Act, 1961 and is eligible for exemption from tax and hence no provision has been made towards Income Tax.
11. Schedules 1 to 24 are annexed to and form an integral part of the Balance Sheet as at 31<sup>st</sup> March 2017 and the Income and Expenditure Account for the year ended on that date.

  
(PROF. G.U. KULKARNI)  
DIRECTOR

  
(VIVEK DUBEY)  
ACCOUNTS OFFICER

As per our report of even date  
For B.R.V. Goud & Co.  
Chartered Accountants  
  
(A.B. SHIVA SUBRAMANYAM)  
PARTNER

PLACE : BANGALORE  
DATE : 12.07.2017

# 19. MISCELLANEOUS

## 19.1. IN-HOUSE COLLOQUIA / SEMINARS

### FACULTY

Title of Colloquia/Seminar	Speaker	Date
Passive Light Harvesting Window using texture film	S. Angappane	Held on 20.02.2017
Self cleaning glass based on photovoltaics	Neena S. John	
Metamaterial airconditioner	Geetha G. Nair	
Super-hydrophobic transparent substrates	P. Viswanath	
Flexible, semi/full transparent organic solar cells	H.S.S.R. Matte	
Non-invasive point-of-care devices	G.U. Kulkarni	
Windshield/ Head-up Transparent Displays	S. K. Prasad	
TENG to harvest energy from rain drops on the windshield	D. S. Shankar Rao	30.05.2017
Interference Coating on Glasses	Pralay K Santra	
Hot packs and fruit juices as sensors for metals	C. V. Yelamaggad	
Nano nose: Concept to Applications (Mission mode - programme)	G. U. Kulkarni	

### RESEARCH FELLOWS

#### General

Title of Colloquia/Seminar	Speaker	Date
Improving the electrical conductivity the grown rGO film	Rajashekhar Pujar	09.01.2017
Transparent Conducting Glasses made of Metal Nanomesh Coated with Metal Oxide Overlayer	Ashutosh K. Singh (at CeNS in the interaction meeting of CeNS-HHV)	24.08.2016
New Fabrication Strategies for Smart Window Prototype Devices Using Invisible Metal Mesh Electrodes	S. Kiruthika (at JNCASR)	12.04.2017
Workshop on projection lithography	Bharath B	02.04.2016 & 18.05.2016
Tailoring surface forces: Anchoring transitions in a soft elastic medium	Srividhya Parthasarathi (Seminar)	22.01.2016

#### Thematic

Title of Colloquia/Seminar	Speaker	Date
Recent progress in Electronic skin	Srividhya Parthasarathi	20.05.2016
The Detection of Organic Explosives	Veerabhadraswamy, B. N.	29.04.2016
Rechargeable Lithium-Ion Batteries	Monika M.	01.07.2016
War against cancer: Role of nano and soft matter sciences	Arup Sarkar	26.08.2016
Energy Harvesting Devices	Chandan Kumar	21.10.2016

**Journal Article based Seminar**

Title of Colloquia/Seminar	Speaker	Date
Metal Organic Frameworks (MOFs): Advanced Materials for Thermoelectric Devices	Sachin Ashok Bhat	26.03.2017
H-bonded donor-acceptor units: towards high mobility ambipolar organic semiconductors	Madhu Babu Kanakala	12.05.2017

**Thesis Colloquia**

Title of Colloquia/Seminar	Speaker	Date
Experimental studies on anisotropic soft matter at atmospheric and elevated pressures	Srividhya Parthasarathi	20.03.2017
Electrical and Viscoelastic Studies on Liquid Crystal Gels and Composites	S. Vimala	28.03.2017
Effect of restricted geometries on the physical properties of liquid crystals	Pappu Lakshmi Madhuri	15.07.2016
Synthesis and Properties of Graphene-based Hybrid Materials Employing Chemical Routes	Bramhaiah K	19.10.2016

**19.2. COLLOQUIA / SEMINARS BY VISITORS**

Title of Colloquia/Seminar	Speaker	Date
Subpicosecond Exciton and Bi-exciton Dynamics in Quantum Dot Materials: Implication in Solar Cell	Prof. H. N. Ghosh, INST, Mohali	08.03.2017
Frontier molecular orbitals of CO <sub>2</sub> on ZnO surfaces: Time-resolved photoelectron spectroscopy	Dr. Sesha Vempati, Institute of Max Planck Society, Germany	23.02.2017
Recycle or Perish - Emerging Challenges in MSW Management	Dr. H. N. Chanakya, Center for Sustainable Technologies, IISc	17.02.2017
Continuous and large scale gas phase synthesis of size selected metal, alloy and core-shell nanoparticles	Prof. B.R. Mehta, IIT Delhi, New Delhi	10.02.2017
High Performance Thermoelectric based on SnTe <sup>2</sup>	Dr. Kanishka Biswas, 'Speaker of the month' JNCASR, Bengaluru	13.01.2017
De Novo Approaches to Organic Materials Based on Sterically-Engineered Molecular Systems	Prof. J.N. Moorthy, IIT Kanpur, Kanpur	05.01.2017
Design of nano-catalysts for various applications	Prof. A. K. Tyagi, BARC	02.12.2016
Self-Assembled Photoresponsive Materials	Prof. Suresh Das, State Council for Science Technology and Environment, Trivandrum	22.12.2016
A 50mV Nano - electromechanical(NEM) Switch	Dr.Bivas Saha, University of California, USA	07.07.2017

Title of Colloquia/Seminar	Speaker	Date
Effect of Electric Fields on Desiccation Crack Patterns	Prof. Sujata Tarafdar, Jadavpur University	14.09.2016
The Role of Oxides in Materials Chemistry: Select Examples	Prof. Srinivasan Natarajan, IISc, Bengaluru	08.07.2016
Plasmonic interactions via small gaps and in three dimensions	Prof. Ambarish Ghosh, IISc, Bengaluru	24.03.2017
Tuning tribological and mechanical properties of surfaces by gradient and graded fabrication	Prof. Shivaprakash Ramakrishna, ETH - Swiss Federal Institute of Technology, Switzerland	13.02.2017
Design and development of an embedded system for measuring agriculture based parameters using cloud computing technologies	Ms Divya Vani, Sri Krishnadevaraya University, Ananthapuram	31.01.2017
Chemistry Underlying Functional Materials	Prof. R. Vijayaraghavan, VIT University	21.11.2016
Metal-Nucleotides with Different Modes of Coordination	Prof. Nethaji, Chief Research Scientist, IPC, IISc, Bengaluru	15.09.2016
Switchable Plasmonic Nanostructures	Dr. S. R. C. Vivek Chand, Founder CEO, Sensal Technologies	07.10.2016
COMSOL Multiphysics® & Application Builder Interaction between moisture and graphene: permeation encapsulation FOR the graphene and FROM the graphene	Dr. Abhay A. Sagade, University of Cambridge, UK	31.08.2016
Designing Defects in ZnO: A few curiosities	Dr. Joy Mitra, IISER - Thiruvananthapuram, Kerala	19.08.2016
Self - Assembly of Small Building Blocks: From Molecules to Functional Materials	Dr. Bhimalendu Adhikari, Chiba University, Japan	23.05.2016
Development of smart molecular systems and their applications in molecular recognition, self-assembly and optical upconversion	Dr. Prasenjit Mahato, Kyushu University, Japan	14.06.2016
Fluorescence quenching studies of some important NACs employing conducting polymers as fluorophores	Dr. A. Venkataraman, Gulbarga University, Kalaburgi	14.06.2016
Trends in Advanced Manufacturing and University – Industry Collaboration	Prof. Peter Hodgson, Deakin University, Australia	15.06.2016
Theoretical approaches to understand various bio-inspired soft condensed matter systems	Dr. Debarati Chatterjee, Visiting Scientist, IISc, Bengaluru	06.04.2016
Advanced measurement techniques with the CSI Nano Observer scanning probe microscope	Dr. Kunal Bose, Senior Applications Specialist & General Manager, APAC, CS Instruments, France	07.04.2016
Thermal probe SPM based high speed 3D Nano lithography & Different Hyphenated Characterization tools for Nanotechnology based on SPM	Dr. Samik Pal, General Manager, Labindia Instruments Pvt Ltd, Bengaluru	15.04.2016
Semiconductor oxides and 2-D Materials Based Electronic Devices in Flexible and Printed Format	Dr. Bhupendra K Sharma, IISc, Bengaluru	27.04.2016



## 19.3 FACULTY VISITS INDIA/ABROAD

**G.U. Kulkarni**

Place and period of visit	Purpose of visit	Title of talk
Shanghai Normal University, China 15-17 May 2017	Invited talk at ACS Applied Materials & Interfaces Resource	Supramolecular Sensors, Transistors and Supercapacitors Chemistry Workshop 2017
Tata Chemicals Innovation Centre, Pune 23 January 2017	Symposium on "Recent Trends in Emerging Materials and Specialty Chemicals"	A transparent, wearable strain sensor
Embassy of India, Tokyo 15 December 2016	Special plenary talk at 7th ISAJ Symposium 2016, India-Japan Symposium on Science and Technology for Sustainability	Highly Decoupled Twisted Graphene Multilayers
JNCASR, Bengaluru 03 - 08 December, 2016	JNCASR-Cambridge Univ-SSL Winter school - 2016 on Frontiers of Materials Science	Nobler than the Noblest: non-FCC Gold Crystallites
University of Bayreuth, Bayreuth 26th – 28th October 2016	IGSTC 2+2 Kick-off meeting and UBT Fellowship Award and Fellowship lecture	Highly Decoupled Graphene Multilayers <i>and</i> Seminar in PNS, Nobler than the Noblest: non-FCC Gold crystallites
Mauritius 06 -07 April 2016	Workshop on nanotechnology, Mauritius Research Council	New Generation 2D Nanomaterials
Bengaluru 03-05 March 2016	Bengaluru Nano 2016	Tutorial on Nano Fabrication Technologies
IISER Pune 29 Feb - 02 Mar 2016	International Conference on Nanoscience and Technology (ICONSAT 2016)	Nobler than the noblest: non-FCC gold crystallites <i>and</i> Make your own touchscreen for school students
Weizmann Institute of Science, Israel 22-23 Feb 2016	Israel-India workshop on Nanoscience & Nanotechnology	Transparent and Flexible Large Area Devices

**S. Krishna Prasad**

Place and period of visit	Purpose of visit	Title of talk
Bengaluru 9-10 June 2016	Conference on Polymer Composites, Syntheses and Characterization	Liquid Crystals in Polymers and Polymers in Liquid crystals
Manipal August 16, 2016	CeNS-MU interaction Meeting	Liquid Crystals/Plastic Crystals in Nanoenvironment
Manipal August 17, 2016	CeNS-Manipal University Joint Workshop on "Nano and Soft Materials"	Nanos rule Softies
Dhanabad Dec 6-10, 2016	Invited talk at NCLC 2016	Liquid crystal-nanoparticle hybrids: realization of restricted geometries and enhanced properties

**Geetha G Nair**

Place and period of visit	Purpose of visit	Title of talk
Manipal, 16-17 August 2016	CeNS-MU Interaction Meeting	Liquid Crystal Physical Gels
Jaipur December 12-16, 2016	International Conference on Soft Materials, 2016	A charge transfer complex mediated nematic gel with high anisotropic electrical conductivity

**D. S. Shankar Rao**

Place and period of visit	Purpose of visit	Title of talk
Department of Applied Physics, ISM/IIT Dhanbad December 07 - 09, 2016	Invited talk, 23rd National Conference on Liquid Crystals (NCLC-2016)	Twist-Bend Nematic phase -Behaviour of Permittivity and Elastic Constants at atmospheric and at high pressure
Dept. of Atomic and Molecular Physics, Manipal University, Manipal August 16-17, 2016	Workshop on Nano and Softmatter Sciences	The twist-bend nematic phase

**Veena Prasad**

Place and period of visit	Purpose of visit	Title of talk
Atlanta, USA 12-14 September 2016	Invited talk, 6th International Conference and Exhibition on Materials Science and Engineering	Azo substituted achiral bent-core liquid crystals: photo-induced studies in B7 and B2 mesophases
Jaipur 12-16, December 2016	International Conference on Soft Materials, 2016	Azo functionalized achiral bent-core liquid crystalline compounds: effect of presence of –N=N- linkage at different locations in the molecular architecture

**C. V. Yelamaggad**

Place and period of visit	Purpose of visit	Title of talk
Mumbai 31-03-2017	Invited talk, Department of Chemistry, Indian Institute of Technology	Swimming Gold Nanoparticles: A New Class of Functional Organic-Inorganic Hybrids
Mumbai 31-03-2017	Invited talk, BARC	Functional Fluid Gold Nanoparticles Exhibiting Double Refraction
IIT, New Delhi March 15 & 16, 2017	Invited talk, Nano India 2017 meet	Interlinked Nanoparticle-Liquid Crystal Composites: Expedited Synthesis and Their Self-Assembly in to Functional Fluid Structures
Ramnagar 28-02-2017	Talk given on the eve of Science Day Celebration, Government First Grade College	Liquid Crystals: "Science and Technology"
Department of Chemistry, Sri J. N. (PG) College, Lucknow February 23-24, 2017	Invited talk at National Conference on Recent Advances and Innovations in Chemical and Material Science (RAICMS-2017)	Discotic Liquid Crystals for Organic Solar Cells
P. C. Jabin Science College, Vidyanagar, Hubli, January 20, 2017	Invited talk at the UGC Sponsored One Day State Level Seminar on Advances in Materials Sciences	Environmental Chemistry Problems
P. C. Jabin Science College, Vidyanagar, Hubli, January 20, 2017	Invited talk at the UGC Sponsored One Day State Level Seminar on Advances in Materials Sciences	Liquid crystals and Nanoworld: Science and Technology without Boundaries
Bengaluru 10-01-2017	Invited talk, Department of Chemistry, B. N. M. Institute of Technology	Liquid crystals and Nanoworld: Science and Technology without Boundaries

Place and period of visit	Purpose of visit	Title of talk
Bengaluru 10-01-2017	Invited talk, Department of Chemistry, B. N. M. Institute of Technology	NIR-Emissive Materials for Organic Solar Cells
Department of Physics, M. S. Ramaiah Institute of Technology (MSRIT), M. S. Ramaiah Nagar, Bengaluru 09-01-2017	Invited talk at the Faculty Development Program On the topic entitled "New Horizon in Soft Condensed Matter Physics for Interdisciplinary Research"	NIR-Emissive Materials for Organic Solar Cells
Indian Institute of Technology (Indian School of Mines), Dhanbad Dec.7-9, 2016	Invited talk at the 23 National Conference on Liquid Crystals (NCLC-2016)	C3-Symmetric, ( $n,\pi$ -Cojugated)-Discotics: C3 -Tris(keto-hydrazone)s - The Tautomeric Forms of Tris(azo-enol)s
Guwahati 11-11-2016	Invited talk, Department of Chemistry, Indian Institute of Technology	Functional Homomeric Dipeptides Derived from Natural Amino Acids: Synthesis and Characterization
Department of Atomic and Molecular Physics, MIT, Manipal University, Manipal August, 17 2016	Invited talk at a Joint Workshop on Nano and Soft Materials, Centre for Applied Nanosciences	Functional organic materials for applied science: Synthesis, characterization and structure-property correlations of discotics derived from tris(N-salicylideneaniline)s
Department of P.G. Studies and Research in Physics, Kuvempu University, Shivamogga March 18th & 19th, 2016	Invited talk at the Two-Days National Seminar on Recent Developments in Nano Materials & Their Applications	Liquid crystals and Nanoworld: Science & Technology without Boundaries

**P. Viswanath**

Place and period of visit	Purpose of visit	Title of talk
Manipal University 16-17, August 2016	Talk at CeNS-Manipal Interaction meeting and workshop	Thin film polymorphs of Poly(vinylidene fluoride) at air-water and air-solid interfaces
IIT (ISM) Dhanbad 7-9, December 2016	Talk at 23rd National Conference on Liquid Crystals	Dilatational rheology studies on thin film of ferroelectric copolymer at air-water interface
IIIT, Hyderabad 12-14 December 2016	Invited speaker at CompFlu@Hyd	Spreading and retraction of a lens-shaped nematic domain at the air-water interface
CeNS, Bengaluru 11 & 13 March 2017	Indo-US interaction meeting	Annealing Effects on Morphology and Structural Transformation in Langmuir- Blodgett Films of Nickel Octabutoxy Phthalocyanine

**S. Angappane**

Place and period of visit	Purpose of visit	Title of talk
Central University Karnataka Gulburga 21/4/2016	Invited talk, Workshop on nanoscience and nanotechnology	Nanomaterials: Structural and Magnetic Properties
Department of Physics, Allagappa University, Karaikudi 28/3/2017	Invited talk in National conference on Futuristic Materials (NCFM-2017)	Correlated-Electron Physics in CMR Oxides
Manipal University 16/08/2016	Workshop on Nano and Soft Matter Sciences	Nano oxide electronics

Place and period of visit	Purpose of visit	Title of talk
Department of Basic Sciences, SECAB I. E. T, Vijaypur 15/5/2017	Invited talk in Einstein Club	Magnetic nanoparticles and applications
<b>Neena S. John</b>		
Place and period of visit	Purpose of visit	Title of talk
Manipal University 16-17 March 2016	Talk at Manipal University-CeNS workshop	Functional Materials based on reduced graphene oxide hybrids and Metallophthalocyanines
Manipal University 16-17 March 2016	Talk at Manipal University-CeNS workshop	Reduced Graphene Oxide based Nanomaterials for Detection of Dyes
IISc, Bengaluru Dec 12-15, 2016	Research work presentation at the conference 'ICYRAM-IUMRS'	Reduced graphene oxide based iron oxide nanostructures
VIT University, Chennai March 23-25, 2017	Talk at the conference 'International Conference for NextGen Technologies: Silicon to Software'	Hybrids of reduced graphene oxide with metal oxides
<b>K. A. Suresh</b>		
Place and period of visit	Purpose of visit	Title of talk
Kent State University, Kent, Ohio, USA 31 July to 5 August, 2016	Invited talk, 26th International Liquid Crystal Conference. Also attended International Advisory board meeting	Charge transport in mesogenic rod-like, disc-like and polymeric monolayers at air-solid interface
Albany, USA 8 August-19 August, 2016	Colloquium at State University of New York. Also visited for collaborative work	Charge transport in a liquid crystalline triphenylene polymer monolayer at air-solid interface
IIT Dhanbad, Dhanbad 7-9 December, 2016	Keynote address, 23rd National Conference on Liquid Crystals	Electric conductivity in liquid crystalline calamatic, discotic and polymer monolayers at air-solid interface
JNCASR, Bengaluru 11-13 March 2017	Poster presentation, Interaction Meeting of Indo-US on "Nanomaterials for Clean Energy and Environmental Sensors"	Nickel octabutoxy phthalocyanine – graphene oxide alternate Langmuir-Blodgett film: Nanoscale conductivity studies
University College, Mangalore 24-28 November, 2016	Chief-guest and to deliver keynote address	Pioneers in Science
University College, Mangalore 24-28 November, 2016	DST-Inspire Science Camp-2016	Liquid crystals, gels and membranes
Bengaluru 3,4 January, 2017	Chief-guest and to deliver keynote address, Indian Academy Degree College	Science research: Invention and discovery
Bengaluru 3,4 January, 2017	DST-Inspire Science Camp-2016, Indian Academy Degree College	Soft matter: Introduction

**Pralay K. Santra**

Place and period of visit	Purpose of visit	Title of talk
IISc, Bengaluru 15 December 2016	IUMRS-ICYRAM 2016	Molecular Ligands around Quantum Dot Tune Band Energies and Control Superlattice Structure in Quantum Dot Solid
ICTS, Bengaluru 18 February 2017	Indian Statistical Physics Meeting	Molecular Ligands around Quantum Dot Tune Band Energies and Control Superlattice Structure in Quantum Dot Solid
IISc, Bengaluru 25 February 2017	10th Indo-Singapore Joint Physics Symposium	Molecular Ligands around Quantum Dot Tune Band Energies and Control Superlattice Structure in Quantum Dot Solid
CeNS-IISc, JNCASR Bengaluru 12 March 2017	Indo-US Interaction Meeting	Molecular Ligands around Quantum Dot Tune Band Energies and Control Superlattice Structure in Quantum Dot Solid
PETRA-III, DESY, Hamburg, Germany April 11- April 20, 2017	Visited Hard Energy X-ray Photoelectron spectroscopy (HAXPES) measurements at Synchrotron Radiation Centre	

**H.S.S.R. Matte**

Place and period of visit	Purpose of visit	Title of talk
May 13 and June 2 2017	visited Poornaprajna Institute of Scientific Research (PPISR) under collaborative project	

#### 19.4. ACADEMIC ACTIVITIES OF RESEARCH STUDENTS AND POST DOCTORAL FELLOWS

No.	Date(s)	Name & Designation*	Name of Conference	Presentation Mode & Title
1	July 31 - August 5, 2016	Srividhya Parthasarathi, SRF	26th International Liquid Crystal Conference, at Liquid Crystal Institute, Kent State University, Ohio, USA	Oral: Binary system exhibiting the nematic to twist-bend nematic transition: Behaviour of permittivity and elastic constants
2	August 16 - 17, 2016	Sunil Walia, SRF	CeNS-Manipal Interaction Meeting and Workshop	Poster: Transparent Pd Wire Network based Areal Hydrogen Sensor with Inherent Joule Heater
3	August 16 - 17, 2016	Chandan Kumar, SRF	CeNS-Manipal Interaction Meeting and Workshop	Poster: Fourier transform dilatational rheology of a ferroelectric copolymer at air-water interface
4	August 16 - 17, 2016	K. Priya Madhuri, SRF	CeNS-Manipal Interaction Meeting and Workshop	Poster : Local Conductance in Reduced Graphene Oxide-Zinc Oxide Hybrid and Metallophthalocyanine Thin Films
5	August 18 - 19, 2016	Monika M., SRF	National Level Symposium on Materials Characterisation and Manufacturing (MCM 2016), Goa University	Poster: Phasimdic liquid crystals: A bridge between calamitic and discotic liquid crystals



No.	Date(s)	Name & Designation*	Name of Conference	Presentation Mode & Title
6	August 18 - 19, 2016	Rekha S. Hegde, JRF	National Level Symposium on Materials Characterisation and Manufacturing (MCM 2016), Goa University	Poster: Rod- to Bent- to V- shaped mesogens: A systematic study of relationship of molecular structure to liquid crystalline property
7	12-16 September 2016	Vimala S., SRF	International Soft Matter Conference (ISMC -2016), Grenoble, France	Oral: Swifter splay in a Soft Glassy Nematic Liquid Crystal Gel
8	19 -21 September 2016	Vimala S., SRF	RheoSAS workshop, Satellite conference, ISMC-2016. Grenoble, France	Oral: Dynamic and Steady-State Rheological Characterization of a Soft Glassy Nematic Gel
9	14-15 October 2016	K. Priya Madhuri, SRF	International Conference on 'Energy Innovations - Today and Tomorrow at HPCL R&D Centre, Bengaluru	Poster : Nanoscale Photocurrent Distribution in Photovoltaic Materials
10	14-15 October 2016	Chaitali Sow, SRF	International Conference on 'Energy Innovations - Today and Tomorrow at HPCL R&D Centre, Bengaluru	Poster: Stabilizing Au into non-FCC crystal structures and phase transforming to FCC
11	7-11 November 2016	Chandan Kumar,	International Conference on Technologically Advanced Materials and Asian Meeting on Ferroelectricity	Poster: Solvent aided formation of polar and non-polar phases of Poly(vinylidene fluoride) multilayer at air-solid interface
12	21 November 2016	Nagaiah Kambhala,	IIT Madras	Oral : Electrical and magnetic properties of colossal magnetoresistance materials
13	22 November 2016	Chaitali Sow (PhD student)	In house symposium (JNCASR) 21	Poster: A New Type of Gold
14	01-03 December 2016	Chaitali Sow (PhD student)	International Symposium on Solid State Chemistry, JNCASR	Poster: Crystallizing Gold in Non-Cubic Structures and Phase Transforming Back to Cubic
15	01-03 December 2016	Gaurav Shukla JRF	Winter School – 2016 – “Frontiers in Materials Science”, JNCASR, Bengaluru	Poster : Fabrication of copper nanostructures by glancing angle deposition (GLAD)
16	05-09 December 2016	Vimala S., SRF	Winter School – 2016 – “Frontiers in Materials Science”, JNCASR, Bengaluru	Poster: Photo-driven change in the polar environment tunes gelation in a nematic liquid crystal
17	05-09 December 2016	Ravishankar Sugumar, Project Assistant	Winter School – 2016 – “Frontiers in Materials Science”, JNCASR, Bengaluru	Poster : Resistive switching of manganese doped zinc oxide based two terminal memristors for nonvolatile memory application

No.	Date(s)	Name & Designation*	Name of Conference	Presentation Mode & Title
18	07-09 December 2016	Arup Sarkar, SRF	23rd National Conference on Liquid Crystals, IIT Dhanbad, Dhanbad	Oral: Imaging ellipsometry studies on cholesterol and cholesteryl at air-water and air-solid interfaces
19	07-09 December 2016	Veerabhadraswamy B. N., SRF	23rd National Conference on Liquid Crystals, IIT Dhanbad, Dhanbad	Oral: s-Triazine-Based Functional Discotic Liquid Crystals: Synthesis, Mesomorphism and Photoluminescence
20	07-09 December 2016	Sachin Ashok Bhat, SRF	23rd National Conference on Liquid Crystals, IIT Dhanbad, Dhanbad	Poster: Nanoparticles Coated With Dimer-Like Mesogenic Ligands: Synthesis and Characterization of Liquid Crystal-Nanoparticle (LC-NP) Composites
21	11-15 December 2016	Ms. Marlin Baral, JRF	International Conference of Young Researchers on Advanced Materials (IUMRS-ICYRAM 2016) held at IISc	Poster: Influence of thixotropic nanonetwork on electrically switchable fluorescent polysoft device
22	11-15 December 2016	Subir Roy, JRF	International Conference of Young Researchers on Advanced Materials (IUMRS-ICYRAM 2016) held at IISc	Poster: Magnetic and magnetoelectric studies of NiO nanoparticles
23	11-15 December 2016	K. Priya Madhuri, SRF	International Conference of Young Researchers on Advanced Materials (IUMRS-ICYRAM 2016) held at IISc	Poster : Effect of Substrate on Molecular Packing of Lead Phthalocyanine Thin Films and its Conductivity
24	12-16 December 2016	Monika M., SRF	International Conference on Advanced Materials (SCICON-2016), Coimbatore	Oral: Hockey stick-shaped azo compounds: Effect of linkage groups and their direction of linking on mesomorphic properties
25	14-21 December 2016	Bharath B., SRF	JSPS, Japan	Oral & Poster: Solution Based Fabrication of a Fast Response, Broad-Band, Large Area Photodetector
26	18-22 February 2017	Bharath B., SRF	IWAM 2017	Poster: Solution Based Fabrication of a Fast Response, Broad-Band, Large Area Photodetector
27	28 February 2017	S.R. Srither, RA	National Science Day Celebration at CeNS	Design and Demonstration: Single Key Piano using Piezo Varistor
28	11 & 13 March 2017	S.R. Srither, RA	An interaction meeting of the Indo-US Joint R&D Networked Centre on "Nanomaterials for Clean Energy and Environmental Sensors", Bengaluru	Poster: Triboelectric Generator Based on Biocompatible Polymer

No.	Date(s)	Name & Designation*	Name of Conference	Presentation Mode & Title
29	11 & 13 March 2017	Vimala S., SRF	An interaction meeting of the Indo-US Joint R&D Networked Centre on "Nanomaterials for Clean Energy and Environmental Sensors", Bengaluru	Poster: Electric field induced tuning of reflection wavelength in a thermo-reversible photonic gel.
30	11 & 13 March 2017	Sachin Ashok Bhat, SRF	An interaction meeting of the Indo-US Joint R&D Networked Centre on "Nanomaterials for Clean Energy and Environmental Sensors", Bengaluru	Poster: Gold Nanoparticles Coated with Mesogenic Ligands: Synthesis and Characterization of Liquid-Crystalline Nanoparticle Composites
31	11 & 13 March 2017	K. Priya Madhuri, SRF	An interaction meeting of the Indo-US Joint R&D Networked Centre on "Nanomaterials for Clean Energy and Environmental Sensors", Bengaluru	Metallophthalocyanine Based Nanomaterials for Sensing Applications
32	11 & 13 March 2017	Subir Roy, JRF	An interaction meeting of the Indo-US Joint R&D Networked Centre on "Nanomaterials for Clean Energy and Environmental Sensors", Bengaluru	Poster : Signature of memory effect and magnetoimpedance of NiO nanoparticles
33	11 & 13 March 2017	Sunil Walia, SRF	An interaction meeting of the Indo-US Joint R&D Networked Centre on "Nanomaterials for Clean Energy and Environmental Sensors", Bengaluru	Poster: Transparent Pd Wire Network based Areal Hydrogen Sensor with Inherent Joule Heater
34	15-17 March 2017	S. Kiruthika (PhD Student under Project)	Nano India-2017	Poster: Hydrogel-based "smart windows" with low cost transparent conducting electrodes
35	15-17 March 2017	Arup Sarkar, SRF	The 2nd International Conference on Emerging Materials: Characterization and Application (EMCA-2017), NIT Durgapur, Durgapur	Oral : Charge transport in a system of cholesterol on graphene oxide using current sensing atomic force microscope

\*RA: Research Associate; SRF: Senior Research Fellow; JRF: Junior Research Fellow

## 19.5 CONFERENCE / SYMPOSIA / SEMINARS / WORKSHOPS ORGANIZED

1. CeNS-Manipal University Joint workshop on Nanoscience Technology, Dr. S. Krishna Prasad as Convenor, Dr. S. Angappane (Co-Convenor), 17 August 2016, Manipal University, Manipal
2. Indian Science Academies' (INSA, IASc, NASI) Lecture Workshop on Condensed and Soft Matter Physics, Prof. K.A. Suresh with Coordinator: Prof. Yerol Narayana, February 22- 24, 2017, Mangalore University, Mangalore

## ANNEXURE – A

## In Refereed Journals

1. Intrinsic nature of graphene revealed in temperature dependent transport of twisted multilayer graphene, Mogera U.; Walia S.; Bannur B.; Gedda M.; Kulkarni G. U., *J. Phys. Chem. C*, **2017**, DOI: 10.1021/acs.jpcc.7b04068.
2. Fabrication of solar and electrically adjustable large area smart windows for indoor light and heat modulation, Singh A. K.; Kiruthika, S.; Mondal I.; Kulkarni G. U. *J. Mater. Chem. C*, **2017**. Doi 10.1039/C7TC01489A.
3. Nanomaterials for clean energy and environmental sensors: An India–U.S. Workshop, Timothy, S. F.; Kulkarni G. U., *ACS Energy Lett.*, **2017**, 2, 1137–1138.
4. Microscopic evaluation of electrical and thermal conduction in random metal wire networks, Gupta, R.; Kumar, A.; Sadasivam, S.; Walia S.; Kulkarni G. U.; Fisher T. S.; Marconnet, A. *ACS Appl. Mater. Interfaces*, **2017**, 9 (15), 13703–13712.
5. In-Situ GISAXS study of supramolecular nhaving ultrafast humidity sensitivity, Bhattacharyya, A.; Sanyal, M. K.; Mogera, U.; George, S. J.; Mukhopadhyay, M. K.; Maiti, S. & Kulkarni, G. U., *Scientific Reports*, **2017**, 7, 246.
6. Highly conformal Ni micromesh as a current collecting front electrode for reduced cost Si solar cell, Gupta, N.; Rao, K. D. M.; Gupta, R.; Krebs, F. C.; Kulkarni, G. U. *ACS Appl. Mater. Interfaces*, **2017**, 9 (10), 8634–8640.
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10. Self-assembling and luminescent properties of chiral bisoxadiazole derivatives in solution and liquid-crystalline phases, Sivadas, A. P.; Shankar Rao, D. S.; Kumar, N. S. S.; Prabhu, D. D.; Shinto Varghese, Ramachandran, C. N.; Ongungal, R. M.; Krishna Prasad S.; Suresh Das. *J. Phys. Chem. B*, **2017**, 121, 1922. IF=3.187.
11. Effect of pressure on dielectric and Frank elastic constants of a material exhibiting the twist bend nematic phase, Srividhya Parthasarathi; Shankar Rao, D. S.; Nani Babu Palakurthy, Yelamaggad, C. V.; Krishna Prasad, S.; *J. Phys. Chem. B*, **2017**, 121, 896. IF=3.187
12. Dynamic Orthogonal Switching of a Thermoresponsive Self-Organized Helical Superstructure, Zhang, L.; Wang, L.; Hiremath, U. S.; Bisoyi, H. K.; Geetha G. Nair, Yelamaggad, C.V.; Urbas, A. M.; Bunning, T. J.; Li, Q. *Adv. Mater.*, **2017**, 10.1002/adma.201700676 Impact factor: 18.960
13. Confined electroconvective and flexoelectric instabilities deep in the Freedericksz state of nematic CB7CB, Krishnamurthy, K. S.; Nani Babu, P.; Yelamaggad, C. V., *J. Phys. Chem. B*, **2017**, DOI: 10.1021/acs.jpcc.7b03072, IF=3.187.
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27. Effect of atomic-scale differences on the self-assembly of thiophene-based polycatenars in liquid crystalline and organogel states, Pradhan, B.; Vaisakh, V. M.; Nair, G.G.; Shankar Rao, D. S.; Krishna Prasad, S. Achalkumar, *A.S. Chem. Eur. J.* **2016**, 22, 17843. IF= 5.771
28. Reversible polymorphism, liquid crystallinity, and stimuli-responsive luminescence in a bola-amphiphilic  $\pi$ -System: Structure property correlations through nanoindentation and DFT calculations, Roy, S.; Hazra, A.; Bandyopadhyay, A.; Raut, D.; Madhuri, P. L.; Shankar Rao, D. S.; Ramamurty, U.; Pati, S. K.; Krishna Prasad, S.; Maji, T. K. *J. Phys. Chem. Lett.*, **2016**, 7, 4086. IF= 8.539.
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32. Iron(III) metallomesogen of [N2O2] donor Schiff base ligand containing 4-substituted alkoxy chains, Pramanik, H. A. R.; Chanda, S.; Bhattacharjee, C. R.; Paul, P. C.; Mondal, P.; Krishna Prasad, S.; Shankar Rao, D. S.; *Liq. Cryst.*, **2016**, 43, 1606. IF=2.244
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## ANNEXURE – B

### V4 Science Programme @ CeNS

No.	Date	Institution Name & Address	Participation Details		Topic
			Student	Staff	
1.	02.07.2016	SJR Public School Kengeri Bengaluru	21	2	Crystals
2.	23.07.2016	Shanthiniketan Public School, Ramanagar	23	2	Mimicking Nature
3.	22.08.2016	SDC Independent PU College, Kolar	57	5	Liquid Crystals
4.	27.08.2016	Janatha PU College, Kolar	15	1	Nobel-prize winning chemistry problems related to day-today life
5.	03.09.2016	SJR School, Rajajinagar Bengaluru	30	2	Small Cause, Large Effect – Soft Matter
6.	08.09.2016	Sri Sri Ravishankar Vidya Mandir, Vidyaranya, Bengaluru	65	2	Laser – Teaching Aid
7.	17.09.2016	Sheshadripuram High School, Bengaluru	29	2	Solar Cells
8.	24.09.2016	Acharya Degree College	30	2	Microscopy for NanoWorld
9.	22.10.2016	R.V Public School, Bengaluru	27	2	Adaptive Coloration
10.	11.11.2016	Chinmalaya Vidyalaya, Kasargod	25	2	Adaptive Coloration
11.	28.01.2017	BEL High School, BELCampus, Bengaluru	31	2	Visible and invisible light
12.	18.02.2017	PSMO College Tirurangadi, Calicut University	39	3	Lot of things about Vacuum
13.	25.02.2017	B.Sc Microbiology Students of Acharya college, Bengaluru	15	2	‘Seeing is Believing’ and a demonstration of Scanning Electron Microscope at CeNS
14.	22.02.2017 - 28.02.2017	Schools for specially abled children			Convened multiple activities in connection with the National Science Day celebrations of the Centre under the theme “Science and Technology for specially abled persons”, given by DST.
15.	27.04.2017	St Joseph’s College-Devagiri, Calicut	40	4	What is Clean Energy and How Photovoltaics Can Help in Harvesting It?

### V4 Science Programme @ your Institution

No.	Date	Institution Name & Address	Participation Details		Topic
			Student	Staff	
1.	29.02.2016- 02.03.2016	IISER Pune	800		Make your own touchscreen for school students
2.	07.07.2016	Poornaprajna Education Centre, Sadashivanagar	300	5	Why Do Science
3.	17.08.2016	Madhava Krupa School, Manipal	80	2	Soft Matter
4.	17.08.2016	Madhava Krupa School, Manipal	80	-	Small Cause, Large Effect -Soft Matter
5.	17.08.2016	Madhava Krupa School, Manipal	80	2	Magnetic data storage

No.	Date	Institution Name & Address	Participation Details		Topic
			Student	Staff	
6.	22.10.2016	BEL Primary School, Jalahalli, Bengaluru	60	3	The existences of different states of matter and their unique properties
7.	05.11.2016	Davangere University, Davangere	300	10	Nano Science & Technology: Concepts and Applications
8.	11.11.2016	Kendriya Vidyalaya Indian Institute of Technology, Gauhati	70	05	The existence of an incredible state of matter
9.	26.11.2016	Higher Primary School, Doddabommasandra, Bengaluru.	85	06	Global serious concerns and the scientific approaches to resolve them
10.	26.11.2016	Higher Primary School, Ramachandrapura, Bengaluru.	80	06	Waste management: how to avoid usage of plastic in our day-to-day life
11.	03.12.2016	Government's Higher Primary School, Jalahalli, Bengaluru	80	04	Different states of matter and their properties
12.	03.12.2016	Government's Pre-University College, Jalahalli, Bengaluru.	80	05	Liquid crystals: Science and Technology
13.	05.12.2016	Prof. CNR Rao Hall of Science, JNCASR, Bengaluru			Some recent trends in Nanotechnology
14.	10.12.2016	BEL English Medium High School, DB Sandra, Bengaluru	85	01	Liquid crystals: Science and Technology
15.	10.12.2016	BEL English Medium High School, DB Sandra, Bengaluru	85	01	Liquid crystals: Science and Technology
16.	11.01.2017	M. S. Ramaiah Institute of Technology, Bengaluru	10	30	'Nanomaterials: synthesis by chemical routes' to College lecturers under FIP programme
17.	09.01.2017- 14.01.2017	Department of Physics, M.S. Ramaiah Institute of Technology, Bengaluru -54	100	20	Keynote at Faculty Development Program on "New horizon in soft condense matter physics for interdisciplinary research"
18.	20.01.2017	Government High School 16, Hosur, Hubli-Dharwad Road, Hubballi	120	07	Different states of matter and their unique properties
19.	30.01.2017	St. Xavier's College, Kolkata	50	5	Clean Energy Harvesting using Nanomaterials
20.	31.01.2017	BMSIT, Yelahanka, Bengaluru	10	30	'Scanning probe microscopy: Beyond Imaging' to College lecturers under FIP programme
21.	23.02.2017	Sadhu Vaswani International School for Girls, Shanti Niketan, New Delhi	200	05	Noble prize winning chemistry problems related to day-to-day life
22.	23.02.2017	Ramjas School, Sector-IV, R. K. Puram, New Delhi.	120	08	Liquid crystals and Nanoworld: Science and Technology without Boundaries
23.	22.02.2017- 28.02.2017	Schools for specially abled children			Convened multiple activities in connection with the National Science Day celebrations of the Centre under the theme "Science and Technology for specially abled persons", given by DST.

No.	Date	Institution Name & Address	Participation Details		Topic
			Student	Staff	
25.	01.03.2017	St. Philomena's College, Bannimantap, Mysore	400	07	Liquid crystals and Nanoworld: Science and Technology without Boundaries
26.	22.03.2017	Vijaya college, Bengaluru	150	24	Inaugural Function of Science Academies' Lecture Workshop on "Recent Trends in Nano Technology and Material Science"

## ANNEXURE – C

No.	Name of ROI Student	Parent Institute	Mentor
1.	Ms. Meenu Murali	Amrita School of Arts and Sciences, Kollam, Kerala	Dr. Shankar Rao
2.	Ms. Lydia Ann S.	Pondicherry University, Puducherry	Dr. Geetha G. Nair
3.	Ms. Asija P. S.	NIT, Tamil Nadu	Dr. Neena S. John
4.	Mr. Suman Dhara	IIT, Jodhpur	Dr. K.S.Subrahmanyam
5.	Mr. Ankit Bharadwaj	Jamiya Milla Islamia, New Delhi	Dr. S. Angappane
6.	Ms. Shruthi Shastri	Mangalore University, Konaje, Mangalore	Dr. Veena Prasad
7.	Ms. Bindushree A.	Bengaluru University, Bengaluru	Dr. C. V. Yelamaggad
8.	Mr. Sudin Sukumaran	Centre for Materials Science And Technology, Vijnana Bhavana, Mysore	Dr. S. Angappane
9.	Mr. Kaushalendra K. Singh	MIT, Manipal	Dr. Neena S. John
10.	Ms. Pruthvi M.	The National Institute of Engineering, Mysore	Dr. S. Angappane
11.	Ms. Himali Patel	M.S. University of Baroda, Gujrat	Dr. S. Krishna Prasad
12.	Mr. Somen Adhikary	NIT, Durgapur	Dr. P. Viswanath
13.	Ms. Veena S. G.	MIT, Manipal	Prof. G. U. Kulkarni
14.	Ms. Kanika Sharma	Amity University, Noida	Dr. D. S. Shankar Rao
15.	Ms. Sharadhi N. Raj	University of Mysore, Mansagangotri, Mysore	Dr. Geetha G. Nair