

# **TEQIP-II**

Review of  
Centres of  
Excellence (CoEs)

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## Centre (s) of Excellence (CoEs) under TEQIP-II

To support establishment of Centres of Excellence for collaborative and multi-disciplinary research within specific thematic areas of regional or national importance in 13 thematic areas, a total of 30 Centres of Excellence (CoEs) are established in 27 project institutions [i.e. 07 in Centrally Funded, 10 in Government funded, 07 in Government aided and 03 in Private unaided Institutions].

The list of CoEs:

### ▪ Nano-Technology:

S.No.	Centre of Excellence	Name of the Institution
1	Challenges of Nano-Technology for 21 <sup>st</sup> century generation - Indian perspectives in global scenario	Andhra University College of Engineering, Vishakhapatnam
2	Applied Research and Nano Technology	Siddhaganga Institute of Technology, Tumkur

### ▪ Biotechnology:

S.No.	Centre of Excellence	Name of the Institution
1	Bio-resources and Bio-prospecting	Birla Institute of Technology, Mesra, Ranchi

### ▪ Biomedical Engineering:

S.No.	Centre of Excellence	Name of the Institution
1	Systems Biology and Bio Medical Engg.	University College of Technology-University of Calcutta
2	Orthopaedic Tissue Engg& Rehabilitation	NIT Rourkela

### ▪ Chemical Engineering:

S.No.	Centre of Excellence	Name of the Institution
1	Applied Research, training & education in Lipid Science	Harcourt Butler Technological Institute, Kanpur

### ▪ Environmental Engineering:

S.No.	Centre of Excellence	Name of the Institution
1	Environmental Studies	Govt. College of Technology, Coimbatore

### ▪ Water Resources Engineering:

S.No.	Centre of Excellence	Name of the Institution
1	Water Resources and Flood Management	SVNIT Surat
2	Geo-informatics (Remote Sensing, GPS & GIS)	MANIT Bhopal

### ▪ Disaster Management:

S.No.	Centre of Excellence	Name of the Institution
1	Disaster Management	JNTU College of Engineering, Hyderabad

▪ **Signal Processing:**

S.No.	Centre of Excellence	Name of the Institution
1	Atmospheric Remote Sensing and Advanced Signal Processing	SVU College of Engineering, Tirupati
2	Signal and Image Processing	College of Engineering, Pune,
3	Signal and Image Processing	Shri Guru Gobind Singhji Institute of Engineering & Technology, Nanded

▪ **Mechanical and Material Science:**

S.No.	Centre of Excellence	Name of the Institution
1	Advanced Materials Research	BMS College of Engineering, Bangalore
2	Microstructurally Designed Advanced Materials Development	Bengal Engineering and Science University - Howrah
3	Phase Transformation and Product Characterization	Faculty of Engineering and Technology - Jadavpur University, Jadavpur
4	Industrial and Product Design SPC	PEC University of Technology, Chandigarh
5	Advanced Materials	NIT Durgapur

▪ **Process Control:**

S.No.	Centre of Excellence	Name of the Institution
1	Intensification of Chemical and Bio-processes	Osmania University College of Technology, Hyderabad
2	Process Intensification for process industries	Institute of Chemical Technology, Mumbai
3	Complex and Nonlinear Dynamical Systems	Veermata Jijabai Technology Institute, Mumbai

▪ **Data Mining and Computer Science:**

S.No.	Centre of Excellence	Name of the Institution
1	Knowledge Analytics & Ontological Engineering (KAnOE)	PES Institute of Technology, Bangalore

▪ **Electronics Systems:**

S.No.	Centre of Excellence	Name of the Institution
1	Macroelectronics	RV College of Engineering, Bangalore
2	Combedded Systems: hybridization of communications and Embedded Systems	VNIT Nagpur

▪ **Energy Systems:**

S.No.	Centre of Excellence	Name of the Institution
1	Smart Renewable Energy Systems	College of Engineering, Pune,
2	Environment & Energy Management	Thapar University, Patiala,
3	Alternate Energy Research	Govt. College of Technology, Coimbatore
4	Energy Studies in Industries and Agro Systems of Uttarakhand	College of Technology - GB Pant University of Agriculture & Technology, Pantnagar,
5	Practical Renewable Energy System	NIT Rourkela
6	Sustainable Energy Studies	NIT Warangal

<b>Nano-Technology</b>	
Centre of Excellence :	Challenges of Nano-Technology for 21st century generation - Indian perspectives in global scenario
Institution	Andhra University College of Engineering, Vishakhapatnam, Andhra Pradesh

**(i) Focus:**

- To establish composite structures which can replace the existing metallic structures to avoid corrosive, wear and impact effects on ships specifically used in naval operations.
- Development of artificial limbs and attachments which can be used inside the body.
- Fuel cells with different catalysts and different platinum loadings in the catalyst will be tested for their performance.

**(ii) Objective :**

To create a common platform for the researchers in the field of nanotechnology

- To promote research in applications of nanotechnology under various disciplines
- To induct more courses on nanotechnology at UG & PG level
- To offer training to industrial personal
- Research towards product development
- To offer consultancy
- To design collaborative programmes with foreign universities to offer wide variety of programmes to attract students from abroad.
- To get patents on the products developed at the research labs.
- To serve the public by inventing and developing the products to reduce pollution and making life more economical.

**(iii) Activities :**

- Conventional and new materials would be synthesized and studied.
- New materials would be synthesized in the nanometer dimensions and their new properties would be studied.
- While evaporation and sputtering would be used for thin films of some materials, pulsed laser deposition (PLD) technique which has great advantages, would be used for realizing thin films of complex materials. Emphasis would be to realize near-epitaxial / highly oriented thin films of complex materials as they would be highly desirable for device work.
- Techniques would be established to synthesize new materials in nanometer dimensions.
- A basic materials and thin films characterization laboratory would be established.
- A basic lithographic laboratory would be established in a class 1000 clean room.
- A device-structure laboratory for fabrication of basic devices for proof-of-concept work would be established in class 1000 clean room.
- A device / structure measurement laboratory would be established.
- A device simulation laboratory would be also be established.

#### **(iv) Comments of the Review Committee Meeting held on 5<sup>th</sup> June 2014**

The summary of the observations of the Review Committee members are as below:

- **Achievements:**
  - Progress of the project is satisfactory since its inception.
  - Procurement of equipment and recruitment of staff is in progress.
  - More focussed goals are being identified for research
- **Key Issues/Concerns:**
  - Areas of research need to be more focussed taking into account their strength and available infrastructures.
  - Specific component need to be identified for the fuel cell e.g. membrane, catalyst, electrode etc.
  - In composite materials newer approaches/system/materials need to be investigated.
  - The Centre should identify specific components viz. membrane, catalyst, electrode etc. for their fuel Cell.
- **Recommendations:**
  - The Centre should identify/interact with the end user for further utilization in the areas of composites and tribology.
  - Advised to buy FESEM instead of simple SEM due to higher resolution requirement.
  - Projects of MTech students may be based on previous background and training.

<b>Nano-Technology</b>	
Centre of Excellence	Applied Research and Nano Technology
Institution	Siddhaganga Institute of Technology, Tumkur, Karnataka

**(i) Focus :**

It aims to address and solve nationally critical engineering problems in infrastructure, health, hygiene, energy and defense. The CoE – nano - technology efforts are based on sound micro- and nano-electronics hardware. This program is exclusively based on the silicon VLSI of the computer/ memory industry called as “More Moore” (continued miniaturization) path of technology advancement.

The CoE has been crafted with the inter-related thrust areas of:

- nano-electronics
- nano-materials, and
- nano-medicine

These three thrust areas will lead to hardware innovations in semiconductor centric nanotechnology, deliver the highly skilled workforce, and become a catalytic node for building appropriate advanced technology and nanotechnology industries.

**(ii) Objective :**

- Collaborative R&D programs in nanotechnology
- Nanotechnology projects with industry partnerships
- PG, UG, and CE programs in nano-technology

**(iii) Activities :**

Under Component 1.2.1 funding, from April 2013 to present, the following activities were undertaken towards developing a CoE in nanotechnology in this Center of ART facility at SIT:

1. **Team Building:** Five faculty members with international expertise in nano-electronics, nano-materials, and nano-medicine, and four staff members with experience in laboratory build up, research-funding development, and administration were recruited through global advertisement. The CoE was fully staffed by February 2014. There is also some involvement of SIT’s other faculty members, and we aim to encourage and build up this aspect further.
2. **Procurement of Goods/Improvement in Teaching and Learning Facilities:** A list of learning resources comprising of books and textbooks, nanotechnology relevant software, and research journals has been gathered and submitted to TEQIP (uploaded) for approval. Procurement of these learning resource (LR) materials will follow in the coming quarter. Adequate library space in terms of book shelves and computer storage boxes have been set up in the CoE facility using management funds.
3. **Enhancing Masters and Doctoral Programs in Socially Relevant Nanotechnology:**
  - i. **Developing an M. Tech. Program:** A project proposal to roll out an M. Tech. program in appropriate nanotechnology was prepared and submitted to the parent university (Visvesvaraya Technological University, VTU) for approval. A VTU-approved syllabus is already in place, and the faculty members are currently designing the laboratory experiments and the lesson plans. It is planned to commence this program in the 2014-’15 academic year.

- ii. **Developing Research Programs:** Another project proposal and application for the status of university recognized research center for the Center of ART has been submitted to VTU.
  - iii. For items i) and ii), a VTU-appointed committee of expert faculty has already visited SIT, reviewed our preparations and progress, and approval for both is awaited.
  - iv. Four PhD students are pursuing their PhD research through the CoE: Lakshmisagar Perla and Shobha Gaudar on multi-junction solar cells, Mangala Gowri Pandit on quantum dot infrared photo-detectors, and Harisha Kumara on dislocation reduction in epitaxial GaN. Plans are underway to advertise and enroll more PhD students for research in nano-materials and nano-medicine, and “PhD in industry” programs, which will be accelerated upon securing the status of VTU-recognized research center.
4. **Collaborations with Industry:** Center’s faculty worked at SSPL with our SSPL collaborators on MOCVD related problems. One MoU was signed with Anu Solar Power following mutual visits and discussions. This industry, engaged in solar module manufacturing, will be collaborating with the CoE to develop photovoltaic thermal systems and concentrator solar cell modules. Currently, additional industry engagements are being pursued for research and development of i) low RF loss alumina substrates, ii) high performance thermal barrier coatings for gas turbine and jet engines, iii) low-cost, nano-composite compressed earth blocks for rural housing, and iv) drug synthesis and drug delivery. An eventual goal of the i-i-i cell is to secure 2-3 industry-funded Research Chairs in nanotechnology as well as to develop placement paths for our graduates in the industries.
5. **R&D Collaborations with Academic and R&D Organizations:**
- a. **R&D:** A number of collaborative research project proposals are being developed, with immediate focus on three: i) High-efficiency multi-junction solar cells, ii) An integrated photovoltaic thermal energy generation and storage system, iii) low-cost, nano-composite compressed earth blocks for rural housing, and iii) drug discovery and drug delivery processes for Ayurveda based formulations.
  - b. **Collaborative Visits:** We visited a number of national research institutions, universities, and industries for forming collaborative linkages, and this effort is ongoing. Currently, the CoE faculty members are engaged in collaborative research proposal development work with three academic institutes/universities and one industry.
  - c. **Laboratory Development:** Some laboratory equipment have been designed, procured, and installed in the laboratory space, and some others are at various stages of design, machining, procuring, or installation. These laboratory development activities and tools are completely funded by the management. Details are shown separately below.
6. **Faculty and Staff Development:** Our faculty and research scholars participated in four conference/workshop/training programs, and engaged in nine collaborator visits. They also organized and conducted two project proposal development workshops at SIT with our collaborators. About 20 of our collaborators joined and undertook proposal development trench work with our faculty in each of these two-day workshops.
7. **Distinguished Visitors:** Three distinguished visitors (one scientist from Japan and two from within India) and a delegation of professors from Taiwan visited the Center and held extensive discussions with the CoE faculty and staff.



**(iv) Comments of the Review Committee Meeting held on 5<sup>th</sup> June 2014**

The summary of the observations of the Review Committee members are as follows:

- **Comments:**
  - Organization is spending money to build the required infrastructure of the project.
  - Need to define project taking into account their strength, their collaboration and infrastructure.
  - Very few PhD and MTech students are available for the project
  - Not all faculty members have background in the theme area i.e. nanotechnology
  
- **Achievements:**
  - Building of Infrastructure of the Project is in progress
  - Efforts to recruit PhD students are underway.
  - MTech students and staff have been recruited.
  
- **Good Practices:**
  - New MTech programme under CoE in Nano-Technology has been designed and will be implemented soon.
  
- **Recommendations:**
  - Need aggressively recruitment of PhD and MTech students and faculty with appropriate background.

<b>Biotechnology</b>	
Centre of Excellence :	Bio-resource and Bio-prospecting
Institution	Birla Institute of Technology, Mesra, Ranchi

**(i) Focus:**

The Centre aims to isolate and characterize the valued compounds from the Bioresources. The products have applications in the food, flavour, fuel industry, pharmaceutical, and other related industries. The identified areas of interest are:

1. Developing a microbial process to convert lignocellulosic biomass to produce value added products.
2. Study of Biodiversity of Medicinally Important Plants
3. Maintaining the biodiversity
4. Production of Biofuels.
5. Plant Derived Chemicals
6. Nutritional supplements and other “natural health and wellness” products.

**(ii) Objective:**

- To explore the biodiversity of medicinally important plants.
- Molecular documentation of these plants.
- In situ and ex situ conservation.
- Micro-propagation of medicinal plants through tissue culture technique.

**(iii) Activities:**

- 5 thematic areas of research has been identified for CoE i.e. Medicinal Plant, Microbial resources, Microbial Transformation, Biofuel Production, and Plant derived chemicals
- 16 faculty, 14 PhD scholars and 26 MTech students are involved for doing research in the thematic areas.
- Initial research has been started in the 15 specific topics in the thematic areas. It is decided that the faculty working in CoE will try to get sponsored research projects in these 15 thematic areas to strengthen the CoE for which seed money is provided by NPIU.
- 3 faculty members are supported from CoE to bring new sponsored projects in the thematic areas of CoE.
- Assistantship to M. Tech. and Doctoral students has already been started
- 3 faculty members where supported for presentation of 6 papers in conferences.
- 15 research articles of faculty and students working in CoE have been accepted for presentation in prestigious conferences.
- Dr. Rajib Bandopadhyay, Asst. Professor, Biotechnology, visited to Osmania University from 13.06.13 to 26.06.13 for training in the thematic area.
- 3 students where supported for paper presentation in conference seminar.
- Dr. Rajib Bandopadhyay has published one research article in International Journal (Bioresource Technology) of impact factor 4.5.

**(iv) Comments of the Review Committee Meeting held on 2<sup>nd</sup> June 2014**

- **Comments:**
  - Reasonably good progress in achieving the goals.
- **Achievements:**
  - Workshop organised
  - Equipment procured
- **Good Practices**
  - Comprehensive analysis has been done
  - Work being done along several streams concurrently
  - Strong publication track
  - Pathway of methanogenesis in Coal mine
  - Collaboration with Industry
- **Recommendations:**
  - Project should continue
  - Consumable support may be extended
  - Collaboration with Industries and Utility of products in industry should be strengthened
  - Testing can be done at other places

<b>Biomedical Engineering</b>	
Centre of Excellence :	System Biology and Bio Medical Engineering
Institution	University College of Technology-University of Calcutta

**(i) Focus :**

The Centre will focus on the following thrust areas:

- Optical methods for non-invasive diagnosis and/or prognosis of malignancy
- Design and implementation of microfluidic based biochips as point-of-care biochemical analyzers
- Development of Computer Aided Diagnostic modules for various imaging modalities.
- Identification of cellular and bio-molecular genotypic markers indicative of phenotypic changes
- Development of a low cost diagnostic tools e.g., digital microscope

The holistic goal of the Centre is to develop infrastructure, excellence, techniques and methodologies to provide cost effective support to the medical healthcare systems. To achieve such a goal, several scientific, technological, biological, and medical knowledge components have to be combined in a systematic manner. The specific goal of the Centre will be:

- capturing of biological images
- processing of images
- gathering of data and their analysis
- study and knowledge development of comprehensive understanding of basic biological mechanisms for the observed phenotype.

The entire methodology will be developed for non-invasive medical diagnosis.

**(ii) Objectives:**

- Automated and fast diagnosis
- Decision making without human error
- Support to the existing rural healthcare system where there is a shortage of medical practitioners

**(iii) Activities :**

- i) Place for the COE has already been identified in the Technology Campus, at Saltlake, CU, Room No. 109.
- ii) Call for the Quotations to complete the Civil as well as Electrical jobs.
- iii) Technical and Financial issues are in the process of settlement and the minor construction work will be starting in June, 2014.
- iv) Research work, and other related activities are in good shape in the respective individual investigators' laboratories

**(iv) Comments of the Review Committee Meeting held on 2<sup>nd</sup> June 2014**

- **Comments:**

- Project aims for the:

- Development of computer-aided diagnosis : image processing
- Efficient image pre-processing techniques
- Optical Method for Non-invasive diagnosis
- Cell systems modelling
- Digital Micro-fluidics
- Chromatic maker for RBC
- Genomic data profiling
- Chromatic dots
- M.Tech in “ Medical Instrumentation”

- Need to get more patient data through collaboration with hospitals

- Good progress made

- **Achievements:**

- Collaboration with industry initiated
- De-noising of orthopaedic X-Ray images – image sharpness enhancement
- Fusion of CT and MRI images
- Scoliotics Deformity analysis
- Tracking of movements of metallic implants
- Genome data profile
- Estimating parasitaemia

- **Good Practices:**

- Collaboration with industry & clinics
- Data collected from hospitals
- Analyze genomic data, gene-expression data and metabolic data
- Rice metabolic model- very good progress
- Multi-pronged approaches to image processing
- Custom hardware design for image processing
- Building links with industry
- Web-based tools developed

- **Key Issues/Concerns**

- Further efforts should be made to obtain clinical data from Hospitals for image analysis.

- **Recommendations:**

- Clinical validation will be important
- Better data base with close collaboration of hospitals

<b>Biomedical Engineering</b>	
Centre of Excellence	Orthopedic Tissue Engineering & Rehabilitation
Institution	National Institute of Technology, Rourkela

**(i) Focus :**

The research program at the centre will cover multiple projects each covering activities from conception to product. These products and techniques developed will address the musculoskeletal problems by evaluating the efficacy of current orthopaedic implants and surgical techniques, developing improved implants & tissue grafts for the treatment of the diseases and defects of bone, joints, cartilage, tendon, ligament and skeletal muscle.

**(ii) Objectives:**

- To create opportunities and support to faculty and students to undertake research activities in the proposed emerging field
- To offer high quality post graduate and PhD programme in the proposed field.
- To contribute quality research output to solve the orthopaedic related human healthcare problems in close collaboration with the medical colleges & hospitals, research organization, industries in India & abroad.
- To encourage multidisciplinary collaborations by developing the network of research groups of various institutions, medical industries, medical colleges and hospitals in the related field.
- To intensify the exchange of knowledge and to develop better approaches for tissue engineering by educating students, researchers, hospital personnel by conducting short term training programs, specialised laboratory training, workshops etc.
- To organize seminar, conferences at national & international level to disseminate the knowledge and the research outcome among the researchers and the teaching community in the related area
- To provide the institution with expanded opportunities for collaboration with the global education & research group, medical industries and hospitals
- To facilitate the administration of externally supported projects
- To develop good potential to reach the international forefront in the related field
- The centre will be developed as an expert body to handle national policy level issues in the field of tissue engineering
- To provide technical know-how and act as advisory body for the establishment of tissue engineering industry in India.

**(iii) Activities:**

**A. Wireless EMG based control system**

An EMG biopotential amplifier, having an overall gain of 1000, was developed in-house using AD620 Instrumentation Amplifier. The DC potential introduced in the signal was eliminated using an integrator. The common mode power-line interference was eliminated using active ground. Disposable pre-gelled surface electrode was used for the acquisition of the EMG. The output from the biopotential amplifier was interfaced with the Arduino UNO microcontroller for acquiring the signal in a laptop, being operated in battery mode, for processing the signal and subsequent classification. After the classification was achieved successfully, the same

analogy was implemented in the Arduino UNO microcontroller and generation of control signals. A 4 LED panel was used for testing the efficiency in generating the control signals. After successfully testing the efficiency of the control signals, the control signals were transmitted using Xbee transreceiver. The transmission of the control signals at the receiver end was again tested by controlling the glowing conditions of a 4 LED panel.<sup>10</sup>

## **B. Servo-motor driver circuit**

The control signals at the receiver end of the Xbee transreceiver was used to control the servo-motors of the wheelchair. The program was made to move the wheelchair model in four directions, namely: forward, backward, rotate, stop.

### **(iv) Comments on Review Committee Meeting held on 2<sup>nd</sup> June 2014:**

The summary of the observations of the Review Committee members are as below:

- **Comments:**
  - Multiple large research group already researching each element.
- **Achievements:**
  - Characterization carried out :
    - CO<sup>++</sup> doping
    - FT-IR Spectrophotometer, XRD
    - Biological cell proliferation
  - Angiogenesis checked
  - Several publications
- **Good Practices:**
  - Systematically carried out project
  - Good cross-disciplinary linkages
  - Gait analysis included in research
  - Orthotic footwear designed
  - Tissue engineered Cartilage
  - Synthesis of doped hydroxyl apalite
- **Key Issue/concerns:**
  - Animal house is the area of concern
  - Problems may be too complex in totality, as projected over a 15-20 year span
  - Multiple large group already researching each element
- **Recommendations:**
  - Focused research - Take-up more discrete parts /elements of programme separately-tackle one at a time or may lose focus & impact

<b>Chemical Engineering</b>	
Centre of Excellence :	Applied Research, training and education in Lipid Science
Institution	Harcourt Butler Technological Institute, Kanpur

**(i) Focus :**

The research program will focus on the follow five research tasks:

1. Oleo-chemicals and advance Oil Processing Technologies
2. Novel Surfactants, eco-efficient soaps and detergents
3. Renewable feed stock based technologies for Lubricants and fuels (bio fuels)
4. Nutraceuticals, bioactive compounds
5. Eco-efficient polymers and coatings.

The CoE will facilitate, strengthen and will be instrumental in the development of newer novel surfactant molecules from renewable and cost effective feed stocks.

**(ii) Objectives:**

To realize an environmentally friendly society and guarantee for food and energy security, it is necessary to establish sustainable solution systems in the future. For this goal, the department of Oils and Paints Technology of HBTI, Kanpur proposed "Establishment of CoE on Centre of Applied Research, Training & Education in Lipid Science CARTELS.

Outline of CARTELS

1. Research Program
2. Education Centre
3. Information Centre supporting Research, Education and Industry
4. Consultancy and industry service centre

**(iii) Activities:**

<b>Thematic Area</b>	<i>Novel Surfactants, eco-efficient soaps and detergents</i>
<b>Research Project-1</b>	
<b>Name of the research project</b>	<i>Amino acid based Gemini surfactants derived from Lysine and fatty acids</i>
Objective of the work	Gemini surfactants derived from renewable sources not only possess excellent surface active & performance properties but also have excellent biodegradability. Amino acid based gemini surfactants are future alternative for conventional surfactant on account of above mentioned facts. The objective of this study is : <ul style="list-style-type: none"> <li>• To synthesize the amino acid based Gemini surfactant by reaction between chloride derivative of fatty acid(lauric &amp; Myristic) and Lysine (amino acid)</li> <li>• Evaluation of physio-chemical and surface active properties of synthesized amino acid based surfactants.</li> </ul>
Methodology	<ul style="list-style-type: none"> <li>• Conversion of fatty acids into their respective chlorides</li> <li>• Synthesis of amino acid based Gemini surfactant by reaction between chloride derivative of fatty acid and</li> </ul>



	<p>Lysine (amino acid).</p> <ul style="list-style-type: none"> <li>• Optimization of reaction variables like temperature, molar ratios of reactants and duration for the synthesis of amino acid based surfactants.</li> </ul>
Instrumentation and characterization	<ul style="list-style-type: none"> <li>• The synthesized lysine based gemini surfactants were characterized for surface active properties viz. CMC, Krafft temperature, surface Tension &amp; Interfacial tension</li> <li>• Characterization of synthesized amino acid based surfactants by modern instrumentation viz. FT-IR, <sup>1</sup>H NMR &amp; ESI-MS.</li> </ul>
Results and Discussion	<ul style="list-style-type: none"> <li>• FT-IR spectral data of the synthesized surfactants :  C<sub>12</sub>SDLL : 2955(C-O-H bending), 1557(N-H primary amide), 1317(-CH<sub>2</sub> bending), 1194 (C-N), 922(C-O), 724(-CH<sub>2</sub> rocking), 539(S-S disulphide)  C<sub>14</sub>SDML : 2954(C-O-H bending), 1557(N-H primary amide), 1320(CH<sub>2</sub> bending), 1190(C-N), 904 (C-O), 722(-CH<sub>2</sub>rocking), 549(S-S disulphide)</li> <li>• <sup>1</sup>H NMR spectral data of the synthesized surfactants :  C<sub>12</sub>SDLL : δ4.46(d,1H,CHCOONa), δ3.74(d,1H,SCH<sub>2</sub>), δ2.57(d,2H,COCH<sub>2</sub>CH<sub>2</sub>), δ1.26(s,2H,COCH<sub>2</sub>CH<sub>2</sub>), δ1.11(s,16H(CH<sub>2</sub>)<sub>10</sub>), δ0.72(t,3H,CH<sub>3</sub>)  C<sub>14</sub>SDML : δ4.64(d,1H,CHCOONa), δ3.77(d,1H,SCH<sub>2</sub>), δ2.59(d,2H,COCH<sub>2</sub>), δ1.28(s,2H,COCH<sub>2</sub>CH<sub>2</sub>), δ1.17(s,16 H(CH<sub>2</sub>)<sub>12</sub>), δ0.75(t,3H,CH<sub>3</sub>)</li> <li>• ESI-MS base peak(m/z) of the synthesized surfactants:  C<sub>12</sub>SDLL : 527.25  C<sub>14</sub>SDML : 446.32</li> <li>• Based on the evaluated surface active properties, the amino acid based surfactants derived from lauric acid (SDLL) proved to be superior as compared to amino acid based surfactants derived from myristic acid (SDML). Besides this, yield of the C<sub>12</sub>SDLL surfactant was also more than that of C<sub>14</sub>SDML.</li> </ul>
Conclusion	<ul style="list-style-type: none"> <li>• The optimum molar ratio of Lysine and lauroyl/ Myristoyl chloride was found to be 1:2.5 for the synthesis of C<sub>12</sub>SDLL surfactants as well as C<sub>14</sub>SDML surfactants.</li> <li>• The reaction temperature of 10-15<sup>0</sup>C was found to be more appropriate for the synthesis of both C<sub>12</sub>SDLL and C<sub>14</sub>SDML surfactants.</li> <li>• The yield of the synthesized C<sub>12</sub>SDLL surfactant and C<sub>14</sub>SDML surfactants was found to be 79.5% and 72.2% respectively. <ul style="list-style-type: none"> <li>• Based on the evaluated surface active properties, C<sub>12</sub>SDLL surfactant has better surface active properties in comparison to C<sub>14</sub>SDML surfactant.</li> </ul> </li> </ul>
<b>Research Project-2</b>	
<b>Name of the research project</b>	<i>Studies on novel methyl diethanolamine based esterquats</i>

Objective of the work	<ul style="list-style-type: none"> <li>• Synthesis of methyl diethanolamine based esterquats and study of their surface active properties.</li> <li>• Evaluation of surface active and performance properties of synthesized esterquats.</li> </ul>
Methodology	<ul style="list-style-type: none"> <li>• Procurement of raw materials viz. palm fatty acids and methyl diethanolamine.</li> <li>• Synthesis of diesters by esterification of palm fatty acids using methyl diethanolamine.</li> <li>• Optimization of reaction variables like temperature, molar ratios of reactants and duration during synthesis of diester</li> <li>• Conversion of synthesized diesters into esterquats by quaternization of diesters.</li> <li>• Evaluation of physiochemical and surface active properties of synthesized esterquats.</li> </ul>
Instrumentation and characterization	<ul style="list-style-type: none"> <li>• Characterization of synthesized esterquats by modern instrumental techniques, viz. FT-IR, <sup>1</sup>H-NMR, <sup>13</sup>C-NMR.</li> <li>• Properties of diester obtained at 160°C Acid value : 2.91 Saponification value : 136.05</li> </ul>
Results and Discussion	Under processing.
Conclusions	Under processing.
<b>Research Project-3</b>	
<b>Name of the research project</b>	<b><i>Studies on novel phosphate anionic gemini surfactants</i></b>
Objective of the work	<p>Gemini surfactants are promising surfactants of the future as they have excellent surface active &amp; performance properties as compared to conventional surfactants. They find wide industrial applications and are used in minute quantities. The basic objective of the present work is :</p> <ol style="list-style-type: none"> <li>1.Synthesis of phosphate anionic gemini surfactant and study of their surface active properties</li> <li>2.Study of synergism in mixture of phosphate anionic gemini surfactant with anionic(SDS) and non-ionic surfactant(Triton 100X).</li> </ol>
Methodology	<ul style="list-style-type: none"> <li>• Procurement of raw materials viz. dihydroxy alkanes(neopentyl diol), phosphorus oxychloride and fatty alcohols such as dodecanol.</li> <li>• Synthesis of bisphosphate gemini surfactant by phosphorylation of dihydroxy alkanes using phosphorus oxychloride and further alkylation with long chain alcohols viz. dodecanol.</li> <li>• Optimization of reaction variables like temperature, molar ratios of reactants and duration of the synthesis of bisphosphate Gemini surfactants.</li> <li>• Characterization of synthesized bisphosphodiester gemini surfactant</li> <li>• Evaluation of properties of synthesized gemini</li> </ul>

	surfactant and their comparison with conventional anionic and non ionic surfactants.
Instrumentation and characterization	<ul style="list-style-type: none"> <li>• The synthesized gemini surfactant was analysed using FT-IR, <sup>1</sup>H NMR and <sup>31</sup>P NMR</li> <li>• The Gemini surfactant was characterized for Critical Micelle Concentration(CMC) &amp; surface tension</li> <li>• The surface active properties and performance properties of mixed surfactant systems were evaluated.</li> </ul>
Results and Discussion	<ul style="list-style-type: none"> <li>• The most appropriate temperature for obtaining higher yield of Neopentyl-bis(dodecyl phosphate) surfactants was found to be 30 ± 1°C.</li> <li>• Surface tension and Critical Micelle Concentration of Neopentyl bis(dodecyl phosphate) were found to be 26.2 ± 0.2 mN/m and 0.028 mM/L, respectively</li> <li>• FT-IR spectral data of the synthesized gemini surfactant : 2924 (-CH<sub>2</sub> bending), 2854(CH<sub>3</sub> bending),1699 (P-OH), 1012 (P-H), 721(P-O)</li> <li>• <sup>1</sup>H NMR(500MHz, CDCl<sub>3</sub>)spectral data of synthesized gemini surfactant, δ ppm: 0.80(t,6H,2CH<sub>3</sub>) 1.73(m, 4 H, 2CH<sub>2</sub>) 3.32-3.97(m,8H, 4CH<sub>2</sub>-O)</li> </ul>
Conclusions	<ul style="list-style-type: none"> <li>• The yield of the synthesized Neopentyl-bis(dodecyl phosphate) surfactant was found to be optimum at 2:1 molar ratio of dodecanol &amp; neopentyl diol at 30 ± 1°C reaction temperature and was amounted to 47.5%</li> <li>• Based on the evaluated surface active properties of mixture of anionic conventional surfactant SDS and Neopentyl-bis(dodecyl phosphate), the mixture showed synergistic effect as it further reduced the surface tension as compared to SDS alone. On the other hand, there was no significant effect of mixing of Neopentyl-bis(dodecyl phosphate) with SDS on foaming.</li> <li>• The surface active properties of mixed solution of non-ionic surfactant (Triton X 100) and neopentyl-bis(dodecyl phosphate) showed marginal reduction in surface tension. On the other hand, there was marginal effect of mixing of C<sub>12</sub>PGS with Triton X 100 in lowering the foaming ability.</li> </ul>
<b>Thematic Area</b>	<b><i>Nutraceuticals, bioactive compounds</i></b>
<b>Research Project-1</b>	
<b>Name of the research project</b>	<b><i>Natural antioxidants and synthetic antioxidants: a comparative study</i></b>
Objective of the work	The objective of this research project is to deeply study the antioxidant activity of the antioxidants present in peanut seed coat and dried tulsi(basil) leaves in order to examine their impact on the stability of a specified oil.
Methodology	<ul style="list-style-type: none"> <li>▪ Collection of samples from natural sources like tulsi (basil) leaves and peanut skin coat.</li> <li>▪ Samples were first dried at normal room temperature till the entire moisture gets released and then crushed using the conventional grinder.</li> <li>▪ The grounded extracts were stored separately for later analysis in different bottles.</li> </ul>

	<ul style="list-style-type: none"> <li>▪ Samples were mixed separately in alcohol preferably ethanol for the extract preparation and kept overnight in first method and in second method, stirred on orbital shaker at a particular rpm .</li> <li>▪ Entire solution containing sample and alcohol was filtered using Wattman Filter paper and the extract was separated out using condenser assembly.</li> <li>▪ A pasty mass was obtained in case of tulsi and dried flakes were obtained in the case of peanut skin and the extracts were stored separately in amber colored bottles for further analysis.</li> <li>▪ The total phenolic component was also calculated separately using spectrophotometer.</li> <li>▪ Oxidation Stability Index (OSI) of oil was studied using Rancimat by comparing it with a control sample and sample containing synthetic antioxidant for a period of 20-25 days.</li> <li>▪ Other parameters like peroxide value, p-anisidine value were also monitored for the desired period of days keeping control samples (blank) as reference.</li> <li>▪ The calibrations were done according to the readings achieved.</li> <li>▪ Then the TOTOX Value was calculated as per the peroxide and p-Anisidine values measured</li> </ul>
Instrumentation and characterization	<p>For comparing the antioxidant activity of Natural Antioxidants with the Synthetic Antioxidants, various analysis for measuring the antioxidant activity of sample on basis of storage time was done.</p> <ul style="list-style-type: none"> <li>▪ Total Phenolic Component (TPC )at 760 nm absorbance using Spectrophotometer in each of the natural source was measured in order to calibrate the concentration required to monitor the peroxide value, p-anisidine value, OSI Values and TOTOX Values.</li> <li>▪ Calibration of OSI Values was done using 743 Rancimat (Herisau, Switzerland) at 120° C following the AOCS Official Method Cd 12b-92 (1999) (2) .The test was performed to study the induction period (oxidative stability) of soybean oil with the addition of two Natural extracts i.e., Peanut skin and tulsi leaves and calibrate their comparative analysis with a Synthetic Antioxidant(BHA).The induction time readings were recorded at an interval of 5 days for a total period of 25 days.</li> <li>▪ In the Analysis of Peroxide Value the hydroperoxides formation in all four oil samples each of peanut skin and tulsi leaf extract were kept for a storage period of an interval of 5 days for 30 days in contrast to the samples of BHA and control which were monitored using the formulae:</li> </ul> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <math display="block">PV = \frac{(S-B) * N * 1000}{M}</math> </div> <p>where, S = reading of Sample</p>

	<p>B = reading of Blank  N = Normality of Sodium thiosulphatesolution  M = Mass of the oil sample</p> <ul style="list-style-type: none"> <li>The chemical analysis method for p-Anisidine Value determines the amount of aldehydes present in vegetable oils and fats by reaction of these compounds with the p-Anisidine. This reaction highlights the concentration of the quantity of <b>aldehydes and ketones</b>, giving the dimension of the secondary oxidation of the fat matrices. The lower <b>the p-Anisidine Value</b>, the better the quality of fats and oils analyzed. The official method (AOCS Official Method Cd 18-90), a spectrophotometric analysis method measuring the absorbance at 350 nm, requires the use of two different reagents. The p-Anisidine Analysis was carried out for the two natural extracts using the formulae:</li> </ul> $pAV = \frac{25 \cdot (1.2 \cdot A_1 - A_2)}{m}$ <p>where,  A<sub>1</sub> = absorbance of test solution (b) at 350 nm,  A<sub>2</sub> = absorbance of test solution (a) at 350 nm,  m = mass of the substance to be examined in test solution (a), in grams</p> <ul style="list-style-type: none"> <li>TOTOX value is used to describe the total oxidation to which an oil has been exposed. TOTOX Value is a combination of Peroxide value and p-Anisidine Values. These values are summed up to compare with the values appearing for BHA and Control as a contrast. It is calibrated as:</li> </ul> $PV \times 2 + pAV = TOTOX$
Result and discussions	<ul style="list-style-type: none"> <li>In the readings calibrated each for Tulsi and Peanut Skin it was seen that the OSI values tend to decrease on storage for each sample but it was noted in both the cases that as the conc. of antioxidant increased, the values tend to increase in contrast to the values of the Synthetic Antioxidant (BHA) and control sample.</li> <li>In the plot of both the graphs for p-Anisidine Value and Peroxide Value it was concluded that as the conc. of natural antioxidant increase both the values increases as per a particular day analysis in contrast to the values of Synthetic Antioxidant and when monitored on storage basis it was also found that the values for Natural Antioxidant increases gradually than that of Synthetic Antioxidant(BHA).</li> <li>In the readings calibrated each for Tulsi and Peanut Skin it was seen that the TOTOX values tend to increase on storage for each sample but it was noted in both the cases that as the conc. of antioxidant increased the values tend to decrease than that of the Synthetic Antioxidant (BHA) as per day analysis</li> </ul>

Conclusions	The use of added natural antioxidants like extracts of tulsi leaves extract and peanut skin extract in vegetable oils have proved to sustain the oil for a much longer period of time without causing any harmful effect as it was seen in the case of Synthetic Antioxidants. Though they are costly but when looking for a long term remedy to protect the oil from deterioration then to meet the customer satisfaction Natural Antioxidants are considered far much better than the Synthetic ones. Natural Antioxidants as they show no carcinogenic effect on human body on consumption even after being added in larger amounts as compared to the lesser quantity of Synthetic Antioxidant as permitted by the Food Department.
<b>Research Project-2</b>	
<b>Name of the research project</b>	<i>Isolation of nutraceuticals from crude palm oil</i>
Objective of the work	To isolate nutraceuticals by saponification process followed by column chromatography method and analysis by HPLC.
Methodology	<ul style="list-style-type: none"> <li>• Collection of crude palm oil from industry.</li> <li>• Characterisation of crude palm oil (Physico-chemical, spectroscopic and chromatographic evaluation).</li> <li>• Recovery and purification of crude palm oil by saponification followed by column chromatography method.</li> <li>• Evaluation of final purified nutraceuticals by HPLC.</li> </ul>
Instrumentation and characterization	<p>For Vitamin E : Waters HPLC equipped with an isocratic solvent delivery system and Waters 470 Scanning Fluorescence Detector with excitation and emission wavelengths set at 295 nm. A Zorbax analytical silica column (25cm× 4.6mm ID, stainless steel, 5µm) was used with the mobile phase of hexane : tetrahydrofuran : isopropanol (1000 : 60 : 4 v/v/v) at a flow rate of 1 ml/min.</p> <p>For Carotene : Waters 486 HPLC (Millipore Corporation, Milford, MA) equipped with a variable wavelength (190–900 nm) and Crest-Pak C18S MLC-01-250465 (250 × 4.6 mm i.d.) column (JASCO Corporation, Tokyo, Japan). The isocratic mobile phase was acetonitrile/dichloromethane (8:2, vol/vol). The flow rate was 1.0 mL/min.</p>
Results and Discussion	<p>ETHANOL FRACTIONS: Carotene and Vitamin E concentration was obtained as 15110 ppm and 26145 ppm, respectively.</p> <p>ACETONE FRACTIONS: Carotene and Vitamin E concentration was obtained 14997 ppm and 25947 ppm, respectively.</p> <p>HEXANE : ETHANOL FRACTIONS : Carotene and Vitamin E concentration was obtained 18612 ppm and 25174 ppm, respectively.</p> <p>HEXANE : ACETONE FRACTIONS- Carotene and Vitamin E concentration was obtained 18213 ppm and 24802 ppm, respectively.</p> <p>HEXANE FRACTIONS : Carotene and Vitamin E concentration was obtained 18094 ppm and 16262 ppm, respectively.</p>

Conclusions	<p>Concentration and recovery of Vitamin E was found to be in following order: Ethanol &gt; Acetone &gt; Hexane : Ethanol &gt; Hexane : Acetone &gt; Hexane.</p> <p>Concentration and recovery of Carotene was found in the following order: Hexane : Ethanol &gt; Hexane : Acetone &gt; Hexane &gt; Ethanol &gt; Acetone.</p>
Thematic Area	<b><i>Oleochemicals and Advance Oil Processing Technologies</i></b>
Research Project-1	
Name of the research project	<b><i>Refining of crude rice bran wax</i></b>
Objective of the work	Upgradation and value addition of crude rice bran wax.
Methodology	<ul style="list-style-type: none"> <li>Refining of crude rice bran wax in two steps, first one is defatting of crude rice bran wax using solvents (Hexane and Isopropanol) and second one is bleaching of defatted wax by using sodium hypochlorite as bleaching agent.</li> <li>Analysis of properties of refined rice bran wax.</li> </ul>
Instrumentation and characterization	<ul style="list-style-type: none"> <li>Analysis of properties such as moisture content, melting point, specific gravity, iodine value, acid value, saponification value and unsaponification value of crude rice bran wax.</li> <li>Refined wax was characterized by chromatographic method.</li> </ul>
Results and Discussion	<ul style="list-style-type: none"> <li>Crude RBW contains about 55-60% oil with slip melting point 65°C. It has moisture content 2.8, specific gravity 0.8625, acid value 34.65, saponification value 110.25, unsaponifiable matter 47% and iodine value 17.06.</li> <li>In this study, the optimal conditions are wax: hexane ratio is 1:6 (w: v), refluxed temperature maintained at 67°C for 40 min. After that the mixture was cooled to 20°. It was again dissolved in iso-propanol in 1:7 (w:v) ratio to remove remaining oil and impurities. Deoiled wax was then bleached with sodium hypochlorite (15% solution) to prepare light colored wax. It yielded 32-36% pure wax.</li> <li>After refining melting point of wax was obtained 85 °C. The moisture content of purified wax reduces to 0.048, specific gravity 0.8943, acid value to 12.5, saponification value 99.11, unsaponifiable matter 90.4 and iodine value 6.52.</li> </ul>
Conclusions	The purified wax obtained was in light yellow color crystal form with melting point 85°C. The acid value of purified RBW reduces to three times of crude RBW. The properties of refined wax show that it has very good potential to be used in

	pharmaceutical, cosmetic industries and food industries.
<b>Research Project-2</b>	
<b>Name of the research project</b>	<b><i>Enzymatic synthesis of monoglycerides from soybean oil using lipase</i></b>
Objective of the work	<ul style="list-style-type: none"> <li>• Main objective of this work is to provide a solvent free process for the synthesis of monoglycerides which is acceptable to the food industry.</li> <li>• Another objective of the invention is to provide a process that can enhance selectivity for monoglyceride over diglyceride.</li> </ul>
Methodology	<ul style="list-style-type: none"> <li>• Collection of raw materials viz. Refined soybean oil, and glycerol.</li> <li>• Enzymatic synthesis of monoglycerides from <b>LIPEX: <i>Thermomyces lanuginosus</i></b>(solvent-free system) by glycerolysis.</li> <li>• Separation and analysis of monoglycerides from sample mixture of mono and diglycerides.</li> </ul>
Instrumentation and characterization	Characterization of synthesized monoglycerides by modern analytical techniques, viz. GC, HPLC,HPSEC.
Results and Discussions	Under processing
Conclusion	Under processing
<b>Thematic Area</b>	<b><i>Renewable feedstock based technologies for lubricants and fuels ( biofuels)</i></b>
<b>Research Project-1</b>	
<b>Name of the research project</b>	<b><i>Growth optimization of algae for biodiesel production.</i></b>
Objective of the work	<p>The objectives of this studies are as follows:</p> <ul style="list-style-type: none"> <li>• Optimization of culture parameter that affects the growth of algae.</li> <li>• Extraction of algal oil.</li> <li>• Conversion of algal oil to biodiesel.</li> </ul>
Methodology	<ul style="list-style-type: none"> <li>• Harvesting of algal growth.</li> <li>• Production of Biodiesel from algal biomass by following methods :  (1) Oil Extraction from Algal Biomass followed by transesterification  (2) Direct Transesterification from Algal Biomass</li> <li>• Optimization of Algae Growth by variation in culture parameters such as temperature, growth media, pH,</li> </ul>



	light.
Instrumentation and characterization	Characterization of Biodiesel by modern analytical technique i.e. FT-IR, GC-MS .
Results and Discussion	<ul style="list-style-type: none"> <li>• The optimal growth rates of this <i>Spirulina</i> strain were obtained at pH levels between 8-9, temperature regimes of 28-32°C , light intensities of 1500-2500 lux.</li> <li>• The <i>Spirulina</i> medium was found to be best for <i>Spirulina sp.</i></li> <li>• Further results are under processing.</li> </ul>
Conclusions	Under processing
<b>Research Project -2</b>	
<b>Name of the research project</b>	<b><i>Winterization of rice bran oil to separate stearine and its use in manufacturing of metal cutting Lubricant</i></b>
Objective of the work	The main aim of this study is to make metal cutting lubricant from RBO stearine and mineral oil to improve the kinematic viscosity, lubrication property, frictional property and cooling effect during machine operations.
Methodology	<ul style="list-style-type: none"> <li>• Hundred gram of the processed RBO was mixed with the same volume of hexane, and the solution was heated at 65 °C until the solution became transparent.</li> <li>• It was cooled to room temperature, and then placed in an incubator at 20 °C for 1 hr.</li> <li>• After the winterization was finished, the yellowish crude rice bran stearine was recovered after the solution was centrifuged at 10 °C for 20 min.</li> <li>• The weight of the stearine was measured, and the yield from the processed RBO was calculated.</li> <li>• RBO stearine and mineral oil in different ratio was mixed and also anticorrosion, viscosity improver biocidal agent is added.</li> </ul>
Instrumentation and characterization	Analysis of physiochemical properties such as acid value, iodine value, saponification value, flash point, pour point & kinematic viscosity & pour point of rice-bran oil, rice-bran stearine, & corrosion test of metal cutting lubricant.

Results and Discussion	<ul style="list-style-type: none"> <li>• Rice-bran oil has acid value 5, saponification value 185 &amp; flash point 120.</li> <li>• Rice-bran olein has Iodine value 102 and stearine acid has Iodine value 5.</li> <li>• Metal cutting lubricant has saponification value 8 &amp; iodine value 5, acid value 3, flash point 165 °C, pour point 1°C and kinematic viscosity at 40 °C is 35 cst.</li> </ul>
Conclusions	<ul style="list-style-type: none"> <li>• The yield of stearine was 3.53%</li> <li>• Rice-bran oil has good biodegradability thus induces the potential for long term pollution control of the environment.</li> <li>• The mixing of RBO stearine in mineral oil make it sustainable for long duration and it has recycling property making it more valuable.</li> <li>• Mineral oil based lubricants are limited and steadily decreasing resource whereas the vegetable based oils are sustainable.</li> </ul>
<b>Thematic Area</b>	<i>Eco- efficient polymers and coatings</i>
<b>Project -1</b>	
<b>Name of the research project</b>	<i>Synthesis and characterization of polyurethane resin from vegetable oil</i>
Objective of the work	The objective of this study is to develop bio-based poly urethane from vegetable oil as renewable resource. To achieve this goal the experimental work was focused on exploiting the reactivity of unsaturated fatty acid compound to prepare asset of polyol for polyurethane synthesis by synthetic methodology.
Methodology	<ul style="list-style-type: none"> <li>• Synthesis of epoxy from an edible oil i.e. soybean oil.</li> <li>• Synthesis of polyol from prepared epoxy</li> <li>• 3. Synthesis of polyurethane resin from polyol</li> </ul>
Instrumentation & Characterization	Fourier transform infrared spectroscopy
Results and Discussion	Under processing
Conclusions	Under processing

<b>Project-2</b>	
<b>Name of the research project</b>	<i>Use of Rice Bran Olein in Surface Coating</i>
Objective of the work	The basic objective of the research is to assess the suitability of rice-bran olein for surface coating
Methodology	<ul style="list-style-type: none"> <li>• Collection of rice bran-oil</li> <li>• Characterization of rice-bran oil</li> <li>• Separation of rice-bran olein by winterization</li> <li>• Epoxidation of rice-bran olein</li> <li>• Blending of epoxidised rice-bran olein and novolec resin in different ratios and curing of blends with DETA</li> <li>• 6. Evaluation of chemical resistance and mechanical properties of cured films.</li> </ul>
Instrumentation and characterization	<ul style="list-style-type: none"> <li>• All physico-chemical properties were determined according to standard methods of AOCS</li> <li>• Epoxidised rice-bran olein was characterized by FTIR.</li> </ul>
Results and Discussions	Under processing
Conclusion	Under processing

### 1. Workshop on thematic area

In order to disseminate the basic knowledge in the thrust areas it was planned to organize workshops, seminars, conferences etc. in the thematic areas. In continuation to the planned activities a workshop was organized on Advances in Soap and Detergents during March 27-28, 2014 at H.B.T.I., Kanpur. About ten expert lectures were delivered from senior people from academia and industry viz. I.I.T., Kanpur, H.B.T.I., Kanpur, CCPIL, New Delhi, Corona Plus Industries, Kanpur, Biomass, Kanpur etc. There were deliberations on the latest trends in the raw materials, process and product development technologies. There were also deliberations on the quality assurance, packaging technologies and innovations in the machinery used for production of soaps and detergents along with innovative marketing strategies for these FMCG's. The workshop was attended by more than 300 students, faculty and industry people.

### 2. Procurement of equipment's

In order to enhance the research ambience in the center of excellence, the following equipment's were identified and are under the process of procurement:

- i. Automatic Bomb Calorimeter
- ii. Gas Chromatograph
- iii. Rotary Evaporator
- iv. High Performance, Touch Screen Specialized Spectrophotometer ( SAFTEST II ANALYZER
- v. UV/VIS Spectrophotometer
- vi. SFC/UHPLC

### **3. Enhancement of Faculty Competence**

To keep abreast with the latest technological advancement in the thematic area the faculty members are looking for an appropriate opportunity for undergoing training in the industries and research organizations working in the thematic areas during the summer vacations.

### **4. Establishment of Knowledge resource center**

An appropriate location for establishing the knowledge resource center under the COE has been identified at H.B.T.I. and has been allotted for the purpose of COE activities and necessary actions for refurbishment of the same are in process.

### **5. Research Publications**

The members of the COE are engaged in the research activities related to the thematic areas. Some research articles and research papers are published in the journals of repute and some are in the process of publishing their research work.

#### **(iv) Comments of the Review Committee Meeting held on 2<sup>nd</sup> June 2014:**

- **Comments:**
  - Project is in a very nascent stage
  - Oleo-chemicals and advanced oil processing technologies, Novel surfactants, eco-efficient soaps and detergents
  - Insufficient progress owing to late identification of coordinator
  - Equipments procured (research yet to start)
  - Methodology not available
- **Achievements:**
  - Workshop organized in the thematic area
- **Good Practices:**
  - Industrial Collaboration
- **Recommendations:**
  - More characterization and experimentation with surfactants are necessary
  - With due course of time progress has to be shown

<b>Environmental Engineering</b>	
Centre of Excellence	Environmental Studies
Institution	Government College of Technology, Coimbatore

**(i) Focus :**

The Centre for Environmental Biotechnology will focus on broad sector of biotechnology in its application in industry and to environmental problems. The target areas for industrial biotechnologies are as below:

- Industrial supplies (biochemical, enzymes and reagents for industrial and food processing);
- Environmental (pollution diagnostics, products for pollution prevention and bioremediation);
- Energy (fuels from renewable resources).

**(ii) Objectives:**

- Fundamental research
- Applied research and technology transfer
- Knowledge transfer for students
- Long and short training courses
- For companies and industries- Assessments & Consultancy
- For scientific community- publications in scientific journals
- Organization of workshops and International conferences

**(iii) Activities :**

Centre for Environmental Biotechnology and Nanotechnology specifically directed to:

- Environmentalists
- Microbiologists
- Aqua culturists
- Biochemists
- Bioengineers
- Chemical engineers
- Food and pharmaceutical chemists
- Policy makers and lawyers also.

**MOUs signed:**

- Central Leather Research Institute ,Chennai- Aug 2013
- E.K.M Tanneries , Erode – May 2014
- Michighan State University – under progress through Video conferencing
- Aban Infra Structure Pvt. Ltd, Chennai – under progress

**Training organized:**

- One day International Workshop on “Bio-diesel recovery from various biomass by algae and Oleaginous yeast” and MoU with Michigan University, USA on 11th November in GCT Coimbatore on 11th November 2014
- FDP on Biological wastewater treatment: Innovations, Perceptions and Challenges, GCT,Coimbatore along with CLRI, Chennai from 25.2.2014 – 27.2.2014.

**Engagement of Various departments:**

- Department of Chemistry– Analysis of Chemical composition for biomass, water and waste water and production of polymers for heavy metal removal.
- Department of Biotechnology - Culturing microbes , dynamic study of microbial population and process control.
- Department of Physics - Developing Fuel cell and production nano materials for water and waste water treatment.

**(iv) Comments of the Review Committee Meeting held on 30<sup>th</sup> April 2014**

The summary of the observations of the Review Committee members are as below:

The Centre has made good progress on procurement and students are using equipments. It is a more Laboratory intensive research work. It has a fine networking with other institutions, still lot more is required.

The institute should:

- Focus on one or two problems to take further these to implementation scale
- Look for more MSc students
- Enter into signing of MoU with Dept of Science & Technology, Mohali
- Wide publication and acceptance of papers in the CoE areas are required. They should aim for filing and availing patents on the research done.
- Find out other areas/agencies engaged in similar work
- Ensure that the Centre has enough networking to scale up things
- Focus towards objectives – technologies developed should have a wide scale usage
- Submit the revised objectives and scope of work
- Move from lab to the outside world, how is the work relevant for actual water treatment.

<b>Water Resources Engineering</b>	
Centre of Excellence	Water Resources and Flood Management
Institution	Sardar Vallabhai National Institute of Technology, Surat

**(i) Focus :**

Centre of Excellence (COE) on Water Resources and Flood Management aims to develop world class manpower and laboratory facilities in the area of Hydraulics and Water Resources Engineering in the Institute.

**(ii) Objectives:**

- a) To develop knowledge centre in the area of water resources Engineering and Flood Management by pooling the expertise from academic institutes and field industries through national and international collaborations.
- b) To strengthen existing Computational Hydraulics lab and Advanced hydraulics Lab which would help in water resources management, flood forecasting, flood mitigation and study the behaviour of river models, in general, and flood control measures, in particular, for solving specific field problems.
- c) To propose the research projects in the priority area of Water Resources Engineering, i.e. climate change, sea water intrusion, rain water harvesting, watershed management and morphological behaviour of the rivers, through National (IIT Bombay; CWC, CWRPS Pune, NWRWS, SMC Surat VNIT Nagpur, MANIT Bhopal and WREMI (MSU Baroda) and International collaborations (Dr. Sridhar, Department of Civil Engineering, Biose State University, USA) to produce world class research output.

**(iii) Activities :**

- a) The surrounding industries and research organizations like CWPRS Pune, GERI Baroda; MERI Nasik, CWC, NWRWS&KD and SMC will be interacted to facilitate their people to upgrade their qualifications by acquiring M. Tech (Research)/ Ph.D. in Water Resources Engineering through proposed centre. The faculty and students of SVNIT would be exposed to the field situations through the proposed centre.
- b) Regular short term training courses, Staff development programs (SDP), Workshops, Seminars and Field visits will be conducted through the proposed centre to develop the expertise in the area of Hydraulics and Flood control Engineering among the faculties of surrounding government, private technical institutions and the engineers of field industries.
- c) To make the proposed centre self sustaining by taking up the research projects in the priority area of water resources engineering and provide consultation services to the field organizations to resolve their problems in the area of Hydraulics and Water Resources Engineering.

**Department of Civil Engineering, SVNIT Surat:**

- a) Strengthening of existing Computational Hydraulics Lab and Advanced Hydraulics.
- b) Development of hydrologic and hydraulic models for Tapi Basin to predict inflow into the reservoir and reservoir operation model for Ukai reservoir.
- c) Development of hydrodynamic models downstream of Ukai reservoir by taking releases from the dam as upstream boundary condition while tidal level in the sea as downstream boundary condition.
- d) Development of library facility in the centre, and
- e) Strengthening of existing PG course on 'Water Resources Engineering' and PhD programme by jointly guiding the students with collaborating institutions

**Department of Mechanical Engineering, SVNIT Surat:**

- a) To develop expertise and the laboratory facilities in the area of Computational Fluid Dynamics (CFD) by improving the present interdisciplinary work in the domain of consultancy, research project and PhD guidance.

**Boise State University USA:**

- a) Development of hydrological and hydraulic models of Tapi river.
- b) Joint guidance of PhD theses on thematic area of CoE.

**Indian Institute of Technology Bombay:**

- a) Inflow prediction into Ukai reservoir and reservoir operation
- b) Development of coastal hydrodynamic faculty at the proposed centre of COE
- c) Joint guidance of PhD theses on thematic area of CoE.

**MANIT Bhopal:**

- a) Development CFD tools and expertise in the centre through joint research projects and PhD guidance.
- b) Development of experimental and hydraulic facilities related with testing of pump and turbine at SVNIT as a part of CoE activities. This will help in making the centre self sustaining through research and consultancy.

**VNIT Nagpur:**

- a) Development of facility related to the physical model studies in the Advanced Hydraulics Laboratory of SVNIT through joint research project and consultancy.

**Water Resources Engineering and Management Institute (WREMI) Baroda:**

- a) Working jointly in the area of surface irrigation systems and evolve the methodologies to improve the efficiency of surface irrigation system



**(v) Comments on Review Committee Meeting – *Not present due to election duty.***

- **Comments**
  - Objectives are clearly stated and the CoE is coming along fine.
  - Methodologies are appropriate for the stated objectives and on the right path.
  - Research programmes have been presented clearly and have been focussed
  - Teaching/Research/Collaborations have been highlighted and are deemed to be well planned.
  - Clear focus on Teaching/Research and Continuing Education Initiatives.
  - Infrastructure development is also progressing at a good pace.
- **Achievements:**
  - Infrastructure is in the process of being set up and we see a reasonable progress.
  - Data has been collected through Central Water Commission.
- **Good Practices:**
  - Well thought processes have been followed to achieve the objectives and lot of collaborations with experts have been envisaged
- **Recommendations:**
  - The Centre must accelerate the plan to achieve the objectives and lead to final outcomes
  - The Centre should survey the literature available elsewhere on the objectives and try to incorporate the same in order to avoid overlapping of the work already done elsewhere.

<b>Water Resources Engineering</b>	
Centre of Excellence	Geo-informatics (Remote Sensing, GPS & GIS)
Institution	Maulana Azad National Institute of Technology, Bhopal

**(i) Focus :**

The Centre will be an interdisciplinary and it will be serving the geospatial community worldwide. The major research areas are:

- 1) improved methods for estimating unknown parameters from multivariate data, particularly from generic blind data, data obtained by multi-spectral imaging remote sensing satellites.
- 2) advancing the state-of-the-art for various purposes
- 3) use of satellite data to characterize the earth.

Centre will be primarily involved in research related to advanced mapping techniques such as LIDAR, microwave, hyper spectral etc. and will be fully equipped with related facilities. Centre is planning to provide real time experience in advanced mapping, processing and positioning techniques and using them in various domains such as agriculture, urban planning, space technology, defence etc.

**(ii) Objectives:**

Specific objectives of the Center of Excellence.

- Foster researches in various geo spatial techniques and their use in different domains
- Provide adequate training and education in geospatial domain through Masters and Doctoral programmes
- Investigate the possible integration of remote sensing and geospatial techniques to enhance other disciplines
- Foster collaborative researches with various national and international organisations to enhance the interdisciplinary research in related areas
- The Centre will be an interdisciplinary Centre of Competence for Geoinformatics, serving the geospatial community.
- By integrating basic and applied research with graduate/post-graduate education and outreach activities, we will be contributing for the application of new technologies and developing methodology.
- Geographic Information Systems (GIS) can serve as an important interface between the real and the virtual worlds. The concept of 'Digital Earth' addresses public participation and 'spatially thinking citizens', including education and learning across all disciplines and levels.
- The centre is planning to foster through academic & outreach programmes, the above mentioned needs.

**(iii) Activities :**

- In the institute students are working for their UG and PG projects in the area of Geoinformatics. The PG course titled M.Tech. in Geoinformatics & its Applications is running in the institute and the facilities developed through this project will strengthen quality of academics, research and consultancy activities.

- 4 Ph.D. students are doing Ph.D. in the area of Geoinformatics techniques under the guidance of Dr. S. K. Katiyar.
- 2 Ph.D. students are doing Ph.D. in the area of Geoinformatics techniques under the guidance of Dr. Jyoti Sarup
- One research project titled “**Performance Evaluation of Automatic Registration and Resampling Techniques for IRS Imagery**” from ISRO under respond scheme for an amount of Rs. 18.1 Lakhs sanction letter has been received and for this Dr. S. K. Katiyar is project investigator
- One research project titled **DEVELOPMENT OF TECHNIQUES FOR FEATURE EXTRACTION FROM HIGH RESOLUTION REMOTE SENSING IMAGERY AND GIS TOOLS FOR DISASTER MITIGATION AND FACILITY MANAGEMENT APPLICATIONS** has been submitted to Bhabha Atomic Research Centre (BARC) for funding under BRNS scheme & under active consideration and hopeful for getting its approval very soon
- Intereaction with NASA ,USA for the sanction of research project titled Geointelligence framework for Astrobiological Researches and discussion is going for the sanction of project
- Another collaborative Research work offer from NASA, USA has been received for climate change studies by developing satellite data centre at Bhutan (Dr. S. K. Katiyar as Principal Investigator)
- Rs. 1.94 Crore amount consultancy projects are going on in the institute as per details given
- MANIT Bhopal has been recognized as the agency for the consultancy services to Chattisgarh state govt. mining deptt. for DGPS survey of mining areas
- In the coming months Training workshops have been planned on the DGPS Technology & GPRS based remote sensing applications
- Expert lecture on GIS applications was delivered by Dr. P. K. Garg Professor, IIT Kanpur
- After developing the proposed centre facilities need based training courses will be organised.

**(iv) Comments of the Review Committee Meeting held on 30<sup>th</sup> April 2014:**

The summary of the observations of the Review Committee members are as below:

- The objectives are very sketchy, no methodology is presented
- The institute is concentrating only on Procurement/Softwares
- The plan to utilize these equipments needs to be presented
- The institute is already active in Research and Consultancy wok in Geo-informatics. CoE s have been established with the objective to evolve from the basic research platform that the Institute already has. It should be able to explain as to what on-going research work has been taken to a higher level.
- In general presentation needs to be improved – Slides on Research activities/Research ideas, Sustainability need to be presented
- There is no evidence as to how funding will help scale up the work
- Needs to better articulate what the institute wishes to do with the Centre in future and propose how funds can leverage the existing set up.
- **The institute is required to submit a revised Action Plan by 20<sup>th</sup> June 2014 on what sort of strengthening and innovation can be achieved over the existing one. The proposal will be reviewed again in another 3 months.**

<b>Disaster Management</b>	
Centre of Excellence	Disaster Management
Institution	JNTU College of Engineering, Hyderabad

**(i) Focus :**

Disaster Management Center is planned to understand the present global and regional variations of surface, subsurface and atmosphere in the Indian Ocean and pursue rigorous research to enhance and configure the models fit for local conditions with a thrust in improving the prediction accuracy. It is also proposed to develop research in the areas of structural safety to assist natural and manmade hazard mitigation in the country. With the help of Wireless Sensor Networks capturing, processing, and transmission of critical data in real-time with high resolution will be achieved. This fulfills a very important need for any real time monitoring, especially in hazardous or remote scenarios.

**(ii) Objectives:**

Disaster Management Center is planned to understand the present global and regional variations of surface, subsurface and atmosphere in the Indian Ocean and pursue rigorous research to enhance and configure the models fit for local conditions with a thrust in improving the prediction accuracy.

**(iii) Activities :**

- GIS architectures and scope is finalized and is in procurement stage
- Hardware setups are identified – specifications and is in procurement stage
- Network Planning, Fractal modelling, p-Median modelling, knowledge shell for accident analysis and simulating templates are identified.
- Literature review is completed
- Abstract of three conceptual papers are submitted for international conference in IIT mumbai
- Central hall – GIS architectures - lead mapping is ready
- Study areas are identified
- Road development plans are in procurement stage
- Technology gadgets are in procurement stage
- GIS architectures are identified and is in procurement stage
- Methodology is identified
- Base map Khammam District is developed in GIS environment is developed.
- Mine area of Singareni collieries – shape file is developed
- Technology specifications like sensors, communication system, emitter and receiver specifications are identified and up loaded.
- Methodology, GUI , GIS setups are in working mode
- GIS architectures – are identified and is in procurement stage.
- Hardware setup specifications and in procurement stage
- Study area is identified and shape files, base maps are in generation
- Methodology is identified
- Literature review on work plan is completed
- Interactions on industries for hardware set ups are going on

**(iv) Comments on Review Committee Meeting held on 30<sup>th</sup> April 2014 :**

The summary of the observations of the Review Committee members are as below:

- The Centre has considered a large number of disasters and presented a sketchy picture following multidisciplinary random approach. The presentation addresses only an overview of the several proposed disaster areas. It was advised that the institute should focus on limited areas (2-3) with limited scope which are useful to the society so as to have a positive impact.
- The Centre should also focus on developments happening in the field of Disaster Management elsewhere in the world also, as most of the technologies discussed during the presentation are already available.
- There was no visible correlation between various areas of Disaster Managements. It was opined that the Centre may not come out as a real disaster management Centre.
- **The institute is advised to submit a revised Action Plan to the experts by 20<sup>th</sup> June 2014 covering specific activities encompassing common goal, Technology developments etc indicating how funds of Rs 5.0 crore can leverage the existing set up. Activities not directly linked to the goal should be done away with. The Centre should have a national character. It should be clearly defined whether the Centre is focussing on fundamental research or applied research on the subject. The proposal will be reviewed again in another 3 months.**

<b>Mechanical and Material Science</b>	
Centre of Excellence	Advanced Material Research
Institution	BMS College of Engineering, Bangalore

**(i) Focus :**

The Centre will support long-term materials, research and development leading to potential breakthroughs in areas such as Synthesis, Characterization and Processing of Nanocomposites, Polymer composites and metal matrix composites and Phase Change Memory materials and its application in the relevant industrial components manufacturing. This initiative also addresses development of a balanced infrastructure for under graduate and post graduate education and training of future advanced materials human resource. With a concern in ethical, legal and social implications of advanced materials there will be sustained transfer of knowledge and technology gained from the research and development efforts to young minds.

**(ii) Objectives:**

- To develop core competences in Synthesis, Characterisation and Processing of Nanocomposites, Polymer and metal matrix composites and Memory Materials to offer a powerful research platform that could lead to a wide spectrum of innovations.
- To provide an environment to seek innovative solutions in the field of Nanocomposites, Polymer and metal matrix composites and Memory Materials.
- To develop a community of resourceful individuals in advanced materials.
- To disseminate research findings to the stake holders and to the nation.
- To be a source of information about materials, processes and technologies.
- To provide high quality education programs in Post graduation and PhD in advanced materials science and technology.
- To conduct seminars, conferences and other educational activities related to the synthesis, fabrication, and processing of advanced materials as well as applications.
- To establish strategic multidisciplinary body in basic sciences and engineering to promote faculty collaborations across institutes, industries.

**(iii) Activities :**

1. Nanocomposite (Polymer based) - which will result in structural components with a high strength-to-weight ratio. For example epoxy containing carbon nanotubes can be used to develop nanotube-polymer composite which finds its application in windmill blades. This results in a strong but lightweight blade, which makes longer windmill blades practical. These longer blades increase the amount of electricity generated by each windmill.
2. Metal Matrix Composites – Metal matrix reinforced with boron carbide fibres can be developed to find its application in automotive components like drive shaft, Disc brakes, cylinder liners and piston rings.
3. Material for Phase Change Memory (PMC) applications. The material which will be developed will find its application in Non volatile random memory device (RAM).

4. Conducting polymers and Ceramics as sensors - Sensors are widely used in many fields. Our interest is to develop Humidity & Gases sensors. It has become evident in the recent years that the influence of humidity is of paramount importance in many areas; such as in moisture sensitive products, storage areas, computer rooms, hospitals, museums, libraries
5. Processing of MMC's - Machining of MMC's is difficult with conventional cutting tools and because of this it is finding limited applications. Hence unconventional machining techniques can be tried and process capability studies can be made. This helps the industries to adopt MMC's as an alternative to conventional alloys.
6. Starting of a New PG program in Manufacturing science and engg at BMSCE
7. Establishment of state of the art Advanced materials lab at BMSCE.

**(iv). Comments of the Review Committee Meeting held on 30<sup>th</sup> May 2014.**

**Comments:**

- The Centre has made a little progress so far and still planning to procure the proposed instruments (funds released by the State in May 2014 only).
- The objectives need to be specified more selectively. The proposed ones are too general.
- Methodology is not very clear. Specific methods proposed in the proposal should be followed in quantitative manner.
- Synthesis, characterization, processing of multiple applications is too ambitious. Focussing on a few materials and couple of applications desirable. The development of materials is not taken up carefully.
- The group should confine interacting with the groups within the country rather than so many groups from foreign countries to avoid diluting the work.

• **Achievements:**

- Signing of MoU with NAL – Thermal Barrier Coatings
- MoU with Avero university – Underway
- R&D with TATA Advanced Mterials – underway
- New PG Prog in Manufacturing Science & Engg – to be started in 2014-15

• **Good Practices:**

- The Centre has not formulated and exercised any Good practice so far.

• **Recommendations:**

- Inherent strength has to be demonstrated

<b>Mechanical and Material Science</b>	
Centre of Excellence	Microstructurally Designed Advanced Materials Development
Institution	Bengal Engineering and Science University – Howrah

**(i) Focus :**

The proposed work is expected to result in the following benefits:

- Reliable and minimally invasive techniques for on-line monitoring and analysis of the damage signals of the components.
- A damage informatics system for prediction and optimization of material, process, operational and environmental parameters.
- Enhancement of service life of the components by employing both on-line and off-line refurbishment schedules using the appropriate surface engineering techniques.
- Possibilities of modification and replacement of existing materials by superior material

Overall, the project will result in better economy, reduced down time and reduced operational hazards.

**(ii) Objectives:**

The centre was created with an aim to promote the role of microstructural understanding in the efforts on designing advanced materials. The contemporary materials technology utilizes the potential of microstructural knowledge mostly for the characterization purpose and development of microstructure-property correlation based on imprecise framework. The potential of microstructure essentially lies in the fact that it serves as the footprint of the compositional and property variables and the blueprint of the properties. Therefore efforts are warranted to promote the microstructural description and understanding in the quantitative and constitutive framework. In view of this, the centre has taken up comprehensive program on microstructure based design of structural and functional materials. At the stage of inception the following areas have been identified for implementation of the microstructure based design of advanced materials.

**(iii) Activities :**

Structural materials

The following activities have been initiated with the existing facilities:

1. In the effort of developing the computational composition-process-microstructure-property correlation, FEM model has been identified to predict the microstructure formation during hot rolling and cooling at the runout table. The cooling rate has been estimated using a finite volume based heat transfer model. Soft computing model has been employed for modeling of CCT diagram of the hotrolled microstructure. Another hybrid framework involving fuzzy inference technique and a physical model proposed in literature has been developed to correlate the composition-process-microstructure and properties. Finally an attempt will be made to combine such models and to use the combined framework as the objective function for optimisation of strength and ductility of the hot strips.
2. A micromechanical model has been developed to predict the stress and strain distribution in the multiphase microstructure. This model will allow to identify the volume fraction, morphology and distribution of phases for minimisation of stress/strain concentration.



- An attempt has been initiated to develop insitu intermetallic dispersed Al-alloy microstructure. In this effort a novel technique has been adopted to form well distribute intermetallic phases within the Al-melt which would result in the finer and unifrm distribution of the intermetallic phases in solified Al-alloys.

#### **Magnetic materials:**

The following activities have been initiated with the existing facilities:

Research effort has been initiated to develop composite microstructure with constituents having different magnetic cproperties. Based on the magnetic properties of individual elements an attempt will be made to simulate the composite microstructures. Micro-magnetic behaviour will be estimated by emplying suitable method for modeling the magnetic interaction and domain coupling among the different constituents.

#### **Sensor materials:**

This effort is based on development of mixed electrolyte for evolution of metaloxide nanofms with optimum combination of surface area and oxyzen vacancy. The objective is to achieve maximum response (surface area dependence) with minimum activation energy for electron transport (oxyzen vacancy dependence).

#### **Bio-implants**

In this effort the objective is to achieve the optimum por distribution in the implant materials to minimize the effective elastic moduls. The FEM modelling has been employed for assessment of the mechanical behaviour of the porous microstructures under different loading condition.

The following table summarises the activities:

Research area	Coordinator	Number of research scholar	Status of laboratory development	Status of research
Structural materials	P. P. Chattopadhyay	2	Computational facilities are available. Order has been placed for development of experimental facilities	Computational activities are in progress
Magnetic materials	A. Basumallick	2	Computational activities have been initiated. Order has been placed for procurement of magnetic characterization facility	Preliminary experimental work has been initiated. The development of micro-magnetic model is in progress
Developm ent of sensor materials	P. Bhattacharyya	3	Order has been placed for procurement of magnetic characterization facility	Initial experimental results have been generated in the existing laboratory. Computational work has been initiated.
Bio-implants	A. Roy Choudhury	3	The laboratory already exists.	Development of the micro-mechanical model is in progress.

**(iv) Comments of the Review Committee Meeting held on 30<sup>th</sup> May 2014**

- **Comments:**
  - The Centre should expedite the equipment purchase process to accelerate R&D
  - The Materials design is taken up but the parameters should be decided according to the experiment observations.
- **Achievements:**
  - Modelling of materials synthesis design is taken up well and the Numerical modelling work has proceeded at a good pace
- **Key Issues/Concerns**
  - The methodology of developing magnetic materials is not clear – identification of Magnetic material to be developed is required. The Group should interact more with groups working specifically in the specific disciplines.
- **Recommendations:**
  - Progress should be more.

Purchase of equipment needs to happen fast so that research can be accelerated

<b>Mechanical and Material Science</b>	
Centre of Excellence	Phase Transformation and Product Characterization
Institution	Faculty of Engineering and Technology – Jadavpur University, Jadavpur

**(i) Focus :**

The Centre will focus on the following Specific Area of excellence:

- Controlling the solid state phase transformation process on the framework of thermodynamics and kinetics for specific requirements of automotive sectors.
- Product (Solid) characterization in terms of microstructure, mechanical properties, tribology, corrosion to find the sustainability of the product under different mechanical and environmental conditions.
- Solidification modeling.
- Small length scale deformation.

**(ii) Objectives:**

The primary objective of the proposed CoE is to attain research excellence in the areas of:

1. Solid-solid and liquid-solid phase transformation within the framework of thermodynamics and kinetics with the objective of controlling the microstructure of phase transformation products.
2. Characterising the phase transformation product microstructure to find the fitness of the phase transformation products for specific applications, and
3. Development of new alloys system by controlling thermodynamics (chemistry) and phase transformation reaction kinetics (thermal cycle) with targeted property requirements.

**(iii) Activities :**

1. Eight Research fellows have been selected.
2. Postgraduate M.E/M.Tech. students (second year first semester) will be offered assistantship on the basis of their project areas will be offered assistantship from July 2014.
3. Discussion has been initiated with Corus – The international operations of TATA Steel Ltd. for joint research projects. A visit to Corus in Europe is being planned for formulation of joint research programmes.  
In the recently concluded Annual Technical Meeting held during 12-15 November at IIT (BHU), Varanasi three oral presentations and one poster presentation has been made by postgraduate students, DST – Inspire Faculty Fellow

**(iv) Comments on Review Committee Meeting held on 30<sup>th</sup> May 2014:**

• **Comments:**

- The Centre has not presented any Technical data or details of activities conducted under CoE.
- No research specific to the CoE was presented except foreign trips for Short – Term Research trips by Principal Investigators.
- The presentation included only previously ongoing research in the participating departments
- The Progress achieved so far is very poor – very abrasive and non-specific
- It was difficult to observe the good practice initiated in the investigation

- **Achievements:**
  - Active Collaborations - Open University, UK , COROS, Tata Steel & BHEL
- **Key Issues/Concerns:**
  - No technical data or details of activities conducted under CoE were presented.
  - Late release of money
- **Recommendations:**
  - The approach is very diffused and non-focussed. Materials and Methods should be identified
  - Very critical to NPIU & MHRD and did not seem to continue with CoE
  - A serious review has to be done for continuing with CoE.

<b>Mechanical and Material Science</b>	
Centre of Excellence	Industrial and Product Design SPC
Institution	PEC University of Technology, Chandigarh

(i) **Focus :** The Centre will focus on the following Specific Area of excellence:

1. Ergonomics
2. Design Applications in Automotive Industries
3. Design Applications in Medical Sciences
4. Design Applications in Other Industries

Identified activities in this area include the following:

- i. Development of rapid prototyping models that can be used for teaching medical students.
- ii. Use of rapid prototyping for pre-surgical planning and establishing the utility of this procedure.
- iii. Development of custom implants to be fitted in a human body.
- iv. Development of dental drill guides and utilization of rapid prototyping in maxillofacial processes.
- v. Integration of RPT in product development life cycle of automotive components.
- vi. Development of manufacturing tools (fabrication and assembly tools) and end-use parts (finished goods) for automotive sector.
- vii. Development of condition monitoring products for elderly and pediatric use.
- viii. Development of products for grading various food grains (wheat, rice) and tea.

**(ii) Objectives:**

- i. Improvement in research and development facilities through establishment of new laboratories for applicable thematic research and knowledge resource center (Library) in the thematic area.
- ii. Providing Teaching and Research Assistantships for enrolment in Masters and Doctoral programmes in topics linked to economic or societal needs in the thematic areas.
- iii. Collaboration with Industry for applicable research and product development.
- iv. National/International collaboration for Research and Development activities with academic institutions and R&D organizations.
- v. Enhancing research competence of faculty and knowledge sharing in thematic areas, both within and abroad.
- vi. Incremental Operating Cost.

**(iii) Activities :**

- Ergonomics/form/usability evaluation of industrial systems, hand tools and consumer products:
  - Study of Indian male workers doing manual jobs in industry
  - On the exposure of Human Operators to HAV and WBV
  - An Ergonomic Evaluation of Ingress and Egress motion of users for CTU buses
  - Evaluation of consumer products (school bags, handy cams)
- Design Applications in Medical sciences and other industries:
  - Development of custom orthopedic implants
  - Development of remote health monitoring products for elderly and pediatric use
  - Quality grading of various food grains (wheat, rice) and tea
  - Development of rapid prototyping models for pre-surgical planning and teaching
  - Development of dental drill guides and utilization of rapid prototyping in maxillofacial processes
  - Development of phantom blood vessels and blood flow simulations
- Design Applications in Automotive Industries
  - Ergonomic evaluation of vehicle assembly line

**(iv) Comments on Review Committee Meeting held on 30<sup>th</sup> May 2014**

- **Comments:**
  - The development of R & D and education are well formulated, planning and execution is very good.
  - The proposed methodologies for various disciplines are well formulated
  - Some industry related products are proposed
- **Achievements:**
  - Good progress in identifying and initiating Projects
  - CoE activities seriously taken up
    - 04 Labs being set up including Human Engg Lab
    - Satisfactory progress achieved
    - Planning and execution is very good
    - Commendable work in short period of time
    - Approach is taken up well for domestic materials and uses
- **Good Practices:**
  - Good contribution to the Society
- **Recommendations:**
  - The Centre should start a graduate programme in Human Engineering.
  - Highly recommended for continuation of the project.

<b>Mechanical and Material Science</b>	
Centre of Excellence	Advanced Material
Institution	National Institute of Technology, Durgapur

**(i) Focus :**

The CoE focus will be:

- a) To develop new materials with diverse functionalities directly useful to the industry and eventually to the society
- b) To establish a platform for interdisciplinary research on developing and exploring new and advanced materials with diverse practical applications through the active collaboration between partnering departments/faculties.
- c) To improve the research ambience within the institute by the presence of a state-of-the-art research facility with inter-disciplinary research objective.
- d) To improve interaction with industries, R&D, academia through organizing events like workshop, seminars, invited lectures etc.
- e) To help in career advancement, upgradation of research competence of faculties, knowledge sharing and networking.
- f) To help the quality of the faculties of the neighbouring institutes by offering them short-term training, work-shop, as well as through part-time Ph.D. program.
- g) The large investment to be received in this CoE will benefit the local suppliers who will supply various equipment and resources under this program which will benefit them economically.
- h) To offer additional scholarship to M. Tech. and PhD students
- i) To set up a Research cell which will monitor and facilitate research and industry-institute interaction

**(ii) Objectives:**

- Preparation and characterization of nanocrystalline materials having multiferroics behaviour at room temperature.
- To find out new materials having large magneto-dielectric coefficient.
- Measurement of both dc and ac conductivity, dielectric response to understand the detail charge transport mechanism.
- To study the coupling between magnetic and ferroelectric ordering with particles size.

**(iii) Activities :**

- Ph. D. students recruited: **Four** (**two** joined in August and **two** joined in Dec, 2013)
- Participation in short-term courses by students of CoE: **three**
- Presentation of invited Seminar (National) by CoE faculty members: **three**
- Foreign visit by CoE faculty members: **two completed**, three planned in early June, 2014
- Industry visit: **One in July, 2013** (Alloy Steel Plant in Durgapur)
- International conference: **one planned in Dec, 2014**
- National Short-term course: **One planned in September, 2014**

**(iv) Comments on Review Committee Meeting held on 30<sup>th</sup> May 2014**

- **Comments:**
  - The Centre has very well conducted/planned activities with impressive output.
  - The objectives are well defined.
  
- **Achievements:**
  - Good progress has been made, Proposed methodologies are followed well
  - Several kinds of nano-composites were prepared & characterized well in-terms of microstructure and other properties
  - Practices followed are reasonably well, Some application of the materials should be developed
  
- **Recommendations:**
  - Highly recommended for continuation of the Research grant.



<b>Process Control</b>	
Centre of Excellence	Intensification of Chemical and Bio-processes
Institution	Osmania University College of Technology, Hyderabad

**(i) Focus :**

The Centre will support long-term advance research and development leading to potential breakthroughs in areas such as manufacturing, renewable energy sources, green environment initiations, process modeling and computation etc. This initiative also addresses development of a balanced infrastructure, novel approaches to the education and training of future green process engineers, the ethical, legal and social implications of processing methods, and rapid transfer of knowledge and technology gained from the research and development efforts. The interplay between fundamental research and technology development will be supported for synergistic results.

**(ii) Objectives:**

The Centre of Excellence for Intensification of Chemical and Bio Processes is aimed to develop innovative systems and practices in process technologies. In addition to its scientific focus on chemical transformations, the centre will also serve as a nodal point to bring changes for the development of advance research incorporating the full diversity of institutional scientific potential. The broad objectives of the proposed centre of excellence are:

- To introduce, promote and popularize the concept of Process Intensification for green processing techniques through thematic areas in Environmental Engineering, Energy Engineering, Nano Technology and Biotechnology.
- To identify and formulate the demand driven research projects in the field of process intensification for green process technologies and to train new generation researchers & scientists involving interdisciplinary approach.
- To establish national and international collaborations in the development of integrated research in process intensification for green process technologies.
- To establish nodal centre for evaluation of environmental debits in association with various monitoring agencies.
- To support industries in process intensification by providing technical know-how developed in the CoE.
- To attract the attention of funding agencies in the thematic areas of research for self sustenance of the centre.
- To expose the students & stakeholders to research in thematic areas and to inculcate innovative practices to strengthen PG and Doctoral Programs.

**(iii) Activities :**

- Collaboration between faculty members from the departments around a common research programme in the campus.
- All the collaborating departments are expected to share their physical and intellectual resources with each other.
- Emphasis on emerging industry and societal needs in close collaboration with industries and users, within India and abroad.
- Inculcate an R&D culture in the institutions as evidenced by significant increases in research outputs, collaborative and sponsored research, publications, patents, innovations, commercialized products and PhD enrolments.
- Enhancing postgraduate education through increased enrolments for Masters and Doctoral programmes in topics closely linked to economic and societal needs.
- Increased collaboration with National and International research institutions to improve quality of research and development, further tap into global pools of knowledge and create a critical mass with potential for global research and development.

**(iv) Comments on Review Committee Meeting held on 28<sup>th</sup> May 2014**

- **Comments:**
  - The CoE aims at implementing eight projects.
  - Objectives of each of these projects have been explained.
  - The Methodology of achieving the deliverables has been explained and most of the sub-projects aim at fabricating the reactor or procuring it from suitable source.
- **Achievements:**
  - Laboratory scale performance will be studied once reactors are available
  - So far work plans have been made and some preliminary studies have been done, procurement is under process
  - A pilot scale Fluidised bed has been fabricated
- **Good Practices:**
  - Experiments have been planned so that the performance of the reactors can be evaluated properly
  - Fabrication of some of the reactors have also been planned
  - Collaboration with industry
- **Key Issues /Concerns:**
  - Some of the topics envisaged in the CoE have also been addressed by other researchers.
  - Progress is bit slow.
- **Recommendations:**
  - The uniqueness of the work needs to be established and the problems need to be better defined highlighting novelty of approach
  - Along with intensification, other issues like energy consumption maintenance Cost and ease of operation should also be considered.
  - Project may be continued
  - May explore collaboration with ICT who are working on a similar projects

<b>Process Control</b>	
Centre of Excellence	Process Intensification for process industries
Institution	Institute of Chemical Technology, Mumbai

**(i) Focus :**

The methodologies will allow environmentally friendly process design with the most efficient use of raw materials and energy with affordable cost. The programme has broad objective to take into account greater efficiency in the use of raw materials in general and of increasing pressures to design processes which are environmentally friendly. It aims to change process design practice, by developing and disseminating new process design and integration methods for clean and efficient use of raw materials and energy at lower cost.

The process intensification and integration will be based on interactions between elements of the chemical and physical processes that take into account during the process design the material and energy flows. The resulting integrated processes exploit synergies between the system components, leading to processes with superior performances, in terms of their raw materials consumption, energy demand, process economics, environmental impact and sustainability. Process design and integration in the context of utility systems (steam, cooling water and power), reactions, separations, reactive separations, petroleum refining, gas processing and biochemical processes will be addressed. The new designs and processes will be developed by employing appropriate process analysis, modeling and optimization techniques and applying these models and methods.

**(ii) Objectives:**

- (A) To excel in research areas where the existing faculty members have developed expertise and explore new frontier areas of research:
  - i. Process intensification for improved processes, reactions and new reactor designs
  - ii. Developing synthetic protocols for organic molecules which have importance in pharmaceutical, dyestuff and oleochemical industries
  - iii. Developing processes based on reusable catalysts, environmentally benign solvents, surface active agents and energy efficient reaction steps
  - iv. Synthesize of nano-materials and nano-composites that have relevance in wide range of applications in Chemical Process Industries and Allied Industries.
- (B) To bring out innovations in research to address the issues required for technology development in Indian context and to strengthen the base of research activities with high quality publications, patents and technology development
- (C) To develop quality human resources in terms of number of Masters and PhD students.
- (D) To upgrade laboratories with modern, facilities and ambience to facilitate cutting edge research. Institute of Chemical Technology, CoE Proposal for Process Intensification for Process Industries
- (E) To develop necessary research atmosphere conducive for intra- and inter Institutional collaboration with other educational, research and industrial establishments to improve skills of the Faculty members and research students.
- (F) To focus on research which is of utmost relevance to the state and country, new processes for existing ones which are of utmost relevance to the country today.
- (G) To attract funding from government and industry and encourage collaborative research.

**(iii) Comment on Review Committee Meeting held on 28<sup>th</sup> May 2014.**

- **Comments:**

- The Centre has clearly specified the overall objectives of the project
- The objectives of 13 sub-projects have also been elaborated clearly
- The proposed methodology has been explained
- In all the cases the reactor will be designed, fabricated and its performance will be studied through experiments

- **Achievements:**

- Based on thorough literature survey, work plan has been proposed
- Excellent quality of Research : Some chemicals/catalyst synthesized and promising results obtained in several projects
- The work plan and grouping of projects is systematic

- **Key Issues /Concerns:**

- Some theoretical modelling is required to understand / generalise the principle of intensification

- **Recommendations:**

- More characterization and experimentation with surfactants are necessary
- Some generalization of results for similar reactors (like ultrasonic or micro wave) should be made

<b>Process Control</b>	
Centre of Excellence	Complex and Nonlinear Dynamical Systems
Institution	Veermata Jijabai Technological Institute, Mumbai, Maharashtra

**(i) Focus :**

- Fundamental Research Areas: Advanced Mechanics, Dynamics, Fluidics (Charged Fluid-Plasma),
- Application Areas: Robotics, Renewable Energy (Integration of Solar, Wind to Power Grid), Pulse Power & Plasma Dynamics, Structural Dynamics, Fluid Dynamics
- The proposed CoE is aimed at developing a rigorous and unified framework for both theoretical and applied research in the area of complex and nonlinear dynamical systems by interconnecting scattered groups to create critical mass and complementarity.

Following are the key objectives:

- To foster in both ways fundamental studies and applications by collaborative research
- To develop a basis for a unified framework harnessing complex and nonlinear systems
- To motivate and integrate multi-disciplinary approaches to complex problems
- To contribute in nation's growth- technologically & socially by synthesising the obtained results and methodologies into unified strategies, criteria and procedures for design of new devices and processes.
- Facilitate the interchange of scientific results and ideas between various institutes, industries and research organizations within and outside India
- Promote use of open-source softwares in fundamental research areas

**(ii) Objectives:**

The proposed CoE is aimed at developing a rigorous and unified framework for both theoretical and applied research in the area of complex and nonlinear dynamical systems by interconnecting scattered groups to create critical mass and complementarity. Following are the key objectives:

- To foster in both ways fundamental studies and applications by collaborative research.
- To develop a basis for a unified framework harnessing complex and nonlinear systems
- To motivate and integrate multi-disciplinary approaches to complex problems
- To contribute in nation's growth- technologically & socially by synthesising the obtained results and methodologies into unified strategies, criteria and procedures for design of new devices and processes.
- Facilitate the interchange of scientific results and ideas between various institutes, industries and research organizations within and outside India ☑ Promote use of open-source softwares in fundamental research areas

### **(iii) Activities :**

- Two day workshop on “Nonlinear Dynamical Systems: Modeling & Analysis”, 27th & 28th May, 2013.
- One week workshop on “Matrix Computation for Complex Systems” from 17th to 21th December, 2013 at IIT Bombay conducted by Prof Harish Pillai & Prof Madhu Belur
- A one week workshop on “Nonlinear State Estimation” from 6th -10th January, 2014 at VJTI conducted by Prof Shankar Narasimhan, Prof Ragunathan Rengasamy and Prof Nirav Bhatt from IIT Madras
- One week international workshop on “Perspectives in Dynamical Systems & Control” from 17-22 March, 2014 in collaboration with IIT Bombay
- Resource Persons: 1. Dr. R. Brockett (Harvard University, USA) 2. Dr. D.E Chang (University of Waterloo, Canada) 3. Dr. A.J Krener (University of California, USA) 4. Dr. P.S Krishnaprasad (University of Maryland, USA) 5. Dr. T. Ratiu (EPFL, Switzerland) 6. Dr. W. Respondek (INSA de Rouen, France)
- One week international workshop on “Passivity-based Control: New Vistas” being conducted from 19-23 May, 2014 at VJTI in collaboration with European Embedded Control Institute (EECI) and HYCON 2 network of European Union
- Resource Persons: 1. Dr Mark W. Spong (Dean, School of Engg & Computer Sciences, University of Texas, Dallas, USA) 2. Dr R. Ortega (Directeur de Recherche CNRS, LSS, Supelec, France) 3. Dr Francoise Lamnabhi-Lagarrigue (Head HYCON & EECI) 4. Dr Alessandro Astolfi (Imperial College, London) 5. Dr Alexander Fradkov (Russian Academy of Sciences) 6. Dr Dimitri Jeltsema Delft University, The Netherlands

### **2.2 National & International Collaborations:**

- MoU with IIT Bombay already signed ☑ MoU with IIT Madras is approved by IIT Madras Senate
- MoU with European Embedded Control Institute (EECI) signed on 19th May, 2014
- Proposed MoU with IOWA State University, USA ☑ Proposed MoU with University of Western Australia (UWA)

### **2.3 Industry Linkages through MoU:**

- MoU signed with India Smart Grid Forum (ISGF) on 13th September, 2013
- MoU signed with Portescap India Pvt Ltd on 27th March, 2014
- MoU proposed with Larson & Toubro Control & Automation group
- MoU proposed with ABB Bangalore
- MoU proposed with Gyandata, an IIT Madras incubated company

### **2.4 Industry driven workshops**

- One Day Workshop on “Synergy in Energy- Bridging Gap between Industry & Academia”, (September 13th , 2013)
- A one week workshop on “Smart Grid: Perspectives in Cyber Security” was organized from 13<sup>th</sup> to 17<sup>th</sup> January 2014 in technical collaboration with India Smart Grid Forum (ISGF).

### **2.5 Industry Driven Product Development**

- Submitted product development proposal to DST under “India-Israel Initiatives for Industrial R & D” on 31/10/2013 with Israel industry called CyberX in association with India Smart Grid Forum (ISGF), Ministry of Power (MoP), Government of India

- Product development on machine learning based smart grid cyber security tool with L & T Electrical & Automation. Letter of Intent received from L & T Electrical & Automation on 29th November, 2013. Work has started on product development. Proof of concept is accepted by the company
- Consultancy on vibration analysis and structural dynamics to Mandhana Pvt Ltd. Letter received from the company on 7/11/2013. The work is completed
- Request letter received from Larson & Toubro Ltd Electrical & Automation group for product development in high voltage power electronics on 19th May, 2014. Work is in progress.

## 2.6 Patents:

- One patent filed in the CoE thematic area of Plasma Dynamics by CoE team member Dr Dattatray Wavhal
- Title “Covalently Functionalized Particles for Synthesis of New Composite Materials ”, Submitted to United States Patent Application: 20140011955 on January 9, 2014

**Abstract:** The present invention includes compositions and methods for synthesis of composite materials involving gas phase plasma polymerization to covalently plasma graft an organic molecule onto inorganic particles; covalently binding an organic monomer to the functionalized inorganic particles; and, polymerizing the organic monomers into inorganic/organic hybrid polymer composite materials.

### (iv) Comments of the Review Committee Meeting held on 28<sup>th</sup> May 2014.

- **Comments:**

- The Centre lacks good plan. Research contents are not clear. Problems to be studied in the centre are not well defined. Work taken up does not fit in the area “Non-linear Dynamics” - the Objectives, deliverable and methodologies should be linked properly – some of the objectives and methodology be reframed based on each projects.
- So far only work plan has been provided. Not much achievement during this time period, commonality between different problems not established. Only preliminary work done so far. Progress appears to be slow.

- **Good Practices:**

- The Centre has held several good international workshops
- Collaboration with IIT Bombay, IIT Madras and BARC

- **Key Issues /Concerns:**

- Different projects being taken up in the Centre do not appear to be related to each other.

- **Recommendations:**

- Aims and objectives of the centre may be clearly defined along with research problems to be studied
- Some experiments should be thought so that the validity of the algorithm, analysis can be studied
- Centre can be renamed as “Centre for Modelling and Simulation”

Project may be continued.

<b>Data Mining and Computer Science</b>	
Centre of Excellence	Knowledge Analytics and Ontological Engineering (KAnOE)
Institution	PES Institute of Technology, Bangalore, Karnataka

**(i) Focus :**

The centre's overall objectives are to explore new research opportunities that have opened up at the intersection of knowledge analytics and ontological engineering.

The proposed new term knowledge analytics explore the power of analytics on knowledge structures. Ontology-based methods are rapidly growing in both promise and prominence in the fields of semantic web, e-business and knowledge management. Ontological engineering is a focused area of applying sound engineering principles to semi-automatically develop and apply large scale ontological resources. Combined with knowledge analytics, the proposed field of research promises to deliver immense benefits by unleashing the power of analytics on quantified knowledge maps and other semantic structures derived from knowledge bases, text repositories and semantic datasets in a variety of application areas.

**(ii) Objectives:**

To establish an internationally recognized research center in the new area at the intersection of *Knowledge Analytics* and *Ontological Engineering* with a focus on India-specific socially relevant problems.

**(iii) Activities :**

- Only submission from India in Global Semantic Web Challenge – ISWC-2012, MIT, USA & ISWC-2013, Sydney
- First Semantic LOD (Linked Open Dataset) published from India <http://datahub.io/dataset/load-it>
- 20+ people working at the KAnOE centre
- 14 workshops/tutorials held already
- Several ongoing R&D projects
- International collaboration
- 30 publications already
- Additional funding

**(iv) Comments on Review Committee Meeting held on 29<sup>th</sup> May 2014.**

• **Recommendations:**

- The Centre should interact with and engage in collaboration with more established counterparts in IITs and other institutions and NLP community in India.
- It should focus on only one/two problems to make an impact and publish in good journals and conferences
- The project is recommended for continuing



<b>Electronics Systems</b>	
Centre of Excellence	Macroelectronics
Institution	RV College of Engineering, Banaglore

**(i) Focus :**

The key focus of all research is to maintain an interdisciplinary nature of the work and also a focus on indigenization and provision for scale up in collaboration with industries. All our research activities can be broadly classified under the following groups.

The broad areas of interdisciplinary research are as mentioned below:

- Materials & Manufacturing Engineering with additional capability for Design for Optimization of Manufacturing processes and production.
- The broad areas of materials worked include polymers, composites, wide range of nano materials (metals, ceramics and semiconductors) and amorphous materials.
- Sensors, Networks and Communication(RF & THz)
- Nano Science, Surface Engineering & MEMS
- Data Mining/ Data warehousing or Business Intelligence, Cloud Computing,
- Environment And Sustainable Technologies with a focus on Smart buildings and
- Smart Cities
- Clean & Renewable Energy, Energy Efficiency & Management
- Large Area and Plastic / Printable (Flexible) Microelectronics
- Advanced Instrumentation
- Highways and Transport technology

**(ii) Objectives:**

- To enhance the knowledge base in Large Area Microelectronics enabled devices and Systems upto Tera Hertz range.
- To establish state of art facilities, which can be extended to other organizations for inter disciplinary research.
- To enrich interdisciplinary research activity and to promote PG and doctoral programmes.
- Study, growth, fabricate and characterize new class of materials and devices based on nano materials, amorphous semiconductors, polymers, metal oxides, associated fabrication technologies related to large area and flexible microelectronics, polymer/flexible electronics, MEMS and Vacuum Nanoelectronics with operating frequency ranges from DC to RF and THz.
- To develop less expensive, rugged, lighter ,portable, flexible microelectronics devices, sensors and TFTs for various applications in health care, defense, communication, leading to finally IoT.
- To collaborate with premier institutions for consultancy and revenue generation for sustainability
- Train academics and students in this emerging area of electronics, which is an amalgam of nano, micro and macro electronics technology.
- To enhance the knowledge base in Large Area Microelectronics enabled devices and Systems upto Tera Hertz range.

- To establish state of art facilities, which can be extended to other organizations for inter disciplinary research.
- To enrich interdisciplinary research activity and to promote PG and doctoral programmes.
- To develop less expensive, rugged, lighter ,portable, flexible microelectronics devices, sensors and TFTs for various applications in health care, defense, communication, leading to finally IoT.
- To collaborate with premier institutions for consultancy and revenue generation for sustainability
- Train academics and students in this emerging area of electronics, which is an amalgam of nano, micro and macro electronics technology.

**(iii) Activities :**

- Creating facility for starting from a simulation of an atom or molecule to developing materials, devices and integrated systems including packing for Large Area & Flexible Electronics (Macroelectronics) with indigenous technology.
- Procuring software tools to enable simulation of atom to molecule to new material and design of devices & systems.
- Bringing out prototypes for sensors, solar cells, TFTS and vacuum Nanoelectronic devices and MEMs based systems working from up to Terra Hz range .
- Develop indigenous and sustainable manufacturing technology for Macroelectronics.
- Fabricate devices and systems on non conventional substrates.

**Facilities Created: Infrastructure:**

- Physical infrastructure in terms of clean room facility has been created for growth and characterization to the extent of 576 Sq m is established. Care has been taken to ensure safety and security.
- 80% Equipments have been designed and fabricated indigenously through funded projects and management support & installed, in spite of the institute not being supported for procurement of equipments.
- 70% of Characterization tools / instruments have been procured.
- Device Measurement and Wireless communication laboratory is set up in association with M/S Agilent Technologies. The lab has facilities to test and measure signals up to 6 GHz (Vector signal generators and Spectrum analyzers, Arbitrary signal generator, MIMO test set) some of these are upgradable.

**Facilities Created for testing & Characterization:**

- E-beam and PVD system: Box Coater
- DC Plasma deposition system for nano carbons
- Solar Metallization s(sputtering of metal and metal oxides)
- Plasma enhanced chemical vapor deposition (PECVD) for solar cells and TFTs

- Device tester
- UV-VIS-NIR Spectroscopy
- Solar Simulator
- Gold Sputtering Unit
- Near Scanning Optical Microscope (NSOM)
- RAMAN Spectrometer
- Photoluminescence system
- Probe station and Electrometers
- SEM, AFM, XRD system
- Semiconductor Device characteristic Analyzer
- Laser lithography
- 3-D inkjet Printer (metals & polymers)

### Overview of TEQIP & CoE KPIs:

- Five M.Tech programs are started during TEQIP (two related to CoE), intake is increased in three relevant M.Tech programs and three B.E. Programs.
  - M.Tech in RF & Microwave Engineering which leverages a large component of acroelectronics is started, as there was no nomenclature of Macroelectronics in AICTE & VTU.
  - M.Tech in Chemical engineering.
- Totally 562 papers are published in various journals in two years out of which 43% publications are related to CoE related topics, including new electronic materials growth and characterization, Bio medical applications, polymers, solar PV, solar thermal, vacuum nanoelectronics, large area and flexible microelectronicis, image processing and signal processing, characterization, communication etc.
- 384 Publications in various conferences out of which 50% related to CoE.
- **One paper is accepted** for presentation in the 56<sup>th</sup> Electronic Materials Conference at University of California, Santa Barbara, USA, June14 and **Two papers are accepted** for presentation at the 27<sup>th</sup> of the International Vacuum Nanoelectronics Conference, Switzerland, July14. (some of the world's premier conference in the area of Macroelectronics).
- 14 PG Students, 2 full time PhD students and 2 Research Scholars are working on the projects in this area in developing TFT based circuits and sensors in the CoE Laboratory. All of them are getting assistantship. (Rs. 10.38lacs).
- 5 workshops and 3 expert lectures were arranged under CoE.
- Faculty members and research scholars attended workshops to enhance their knowledge in this field.
- 2 faculty members have visited various universities and industries in Australia and Canada. Some of them have already made reciprocal visits Six (3 from Canada and 3 from Australia groups) to take forward the initiative.
- 09 faculty members are pursuing PhD in this area.
- 130 faculty members are involved from various departments and submitted 50 proposals under seed money grant.
- Prototypes are developed.

### **Industry interaction:**

- Interaction with industries (HHV , Omicron Scientific & Agilent technologies) has been initiated and Rs. 10 Crore worth of projects are ongoing.
- Advanced processing facility for Nano, Micro and Macro Electronics materials, devices, sensors and systems is being set up in collaboration with Industry Hind High Vacuum company (HHV).
- RF Communication lab & Networking labs have been setup for simulation and measurement with M/s Agilent Technologies & Tejas Networks respectively.
- Samsung India Limited, Texas Instruments, Intel India, NXP Semiconductor, Freescale semiconductor, Robert Bosch, Pace technology labs are setup and helping in technology transfer.
- Nano Ram is facilitating in developing the prototypes.

### **Workshops Conducted:**

- workshop "***Thin Film Coating and Vacuum Technology for Large Area Flexible Electronics***" on 20<sup>th</sup> Sep - 21<sup>st</sup> Sep 2013, with hands on session on modeling
- Workshop on "***Vacuum Technology for green industry***" from 2-4<sup>th</sup> Dec 2013
- Workshop on "***RF & Digital Communications using Systems View***" from 3-7 Feb 2014.
- Workshop on "***Synthesis and Characterization of Thin Films & Nano materials***" from 12-14 Feb 2014.
- Workshop on "***Fabrication and Characterization of Thin Film Sensors***" from 17<sup>th</sup> to 19<sup>th</sup> March 2014.

#### **(iv) Comments on Review Committee Meeting held on 29<sup>th</sup> May 2014**

- The Centre is required to focus on some special end-to-end design problems
- They must collaborate with some IITs & IISc to quickly gain expertise and experience especially the nano-electronic centres
- Publish in good journals and conferences and stress on documentation
- Project is recommended for continuation

<b>Electronics Systems</b>	
Centre of Excellence	Combedded Systems: hybridization of communications and Embedded systems
Institution	Visvesvaraya National Institute Technology, Nagpur

**(i) Focus:**

Through this CoE the major area emphasized is hybridization of Communications and embedded system. Hence there is ample scope to achieve soci-economic growth with following type of activities supported and executed by the proposed CoE.

1. Encouraging research initiative using these two fields for improving the level of rural life. Problems related to remote connectivity, education, low cost medicine etc. for solving real life problems.
2. Also by executing special design and development projects for assistive technology for differently able people.
3. Encouraging manufacturing and entrepreneurship efforts
4. The employability of Engineering gradates and undergraduates will be enhanced due to skill enhancement.

**(ii) Objectives:**

- IP Development
- Academic & Industry collaboration
- State of the art
- Product development and incubation
- Training and skill enhancement

**(iii) Activities:**

**A. Research & Development**

**I. Various R&D project, currently undergoing**

Various R&D projects that are currently supported by VNIT-CoE are theme wise categorized in to following groups

- a) Projects related to Assistive Technologies
- b) Projects related to Security and Surveillance.
- c) Projects related to Education through ICT
- d) Projects related to Healthcare
- e) Projects on Robotics
- f) Projects having socio Economic Relevance.

**a) Projects related to Assistive Technologies.**

**1) Design of Navigational Assistant for Blind or Low vision persons.**

The device is useful for blinds as an assistant while moving in real life. It uses ultrasonic sensor to sense the distance between the handheld gadget and the obstacles in the movement path covering all five directions i.e. left, right and front and also up and down. The feedback is given to the disabled person in the form of vibrations generated by motors located at each fingertip. The device is completely driven by rechargeable battery and is non contact type device. It also has a feature of compatibility with an android phone using which one can get a rough about the location of the user. First prototype is ready and patent is filed.

2) **Design Buccinatory Sensing based PC interactive device for specially abled persons.**

A gadget using buccinatory sensing is under development. This will be useful for patients suffering with total muscular dystrophy for computer control. First prototype will be ready soon.

3) **Design of assistive glove for smart control.**

A hand glove with conducting polymer based touch sensors located on every finger section has been designed for vision and speech impaired persons. Such a person can generate electronic speech for some prefixed messages corresponding to each sensor. The assignment of such sentences to sensors is programmable. Using the sensors basic computer commands can be issued.

4) **Design and development of Prosthetic leg**

Using embedded system a n intelligent prosthetic leg is under development. The prototype is ready

5) **Design of handheld Toy for low color vision or colour blind persons.**

Specially abled children and many color vision impaired adults have slow sensitivity development rate of ratinal color sensors named rods and cons. There is enough published evidence to suggest that if such subjects are exposed to the basic color light wavelengths like Red, Green, Blue , Yellow and White the sensitivity their retinal sensors may be enhanced and the color vision improves. The proposed toy generates pulsating flash lights of these basic colors for viewing by the subjects. Clinical trials will be carried with the help of a few schools for specially abled children.

**b) Projects related to Security and Surveillance.**

1) **Design of Ground Penetrating Radar**

Commercial GPRs are available but their frequency of operation is in licensed band in India. The frequency 866 MHz is license free in India and potentially useful for GPR application. The proposed design is intended for detection of metallic objects up to three meter depth.

Current status: One prototype is ready and analysis of received signal for various conditions is in progress. Also evaluation of Time domain and frequency domain i.e. both methods is currently in progress.

2) **Expression Invariant Face Recognition System.**

Identity recognition is a key security issue for senior citizens and also for vision impaired persons. An embedded system that can detect spoofing of human faces is proposed to be developed. Initially a small database of around 100 faces can be stored in the system along with its statistical features. A small camera and image grabbing module will accept a query and detect 3D features from a human face. It will further compute and match the 3D features with those of the database entries and detect a nearest match. The system is expected to be build around embedded board like Texas beagle bone-1. The algorithmic work of expression invariant face recognition on a data base of around 100 images has been already implemented. The matching algorithms use contourlet transform based features and LDA.

**c) Projects related to Education through ICT:**

- 1) **Design of an interactive low cost electronic slate-**This project is just started and is in initial stage and the prototype is under development.

**d) Projects related to Healthcare.**

- 1) **Low cost access device based health monitoring or medical decision making system.**

In this project compact interfacing modules are under development which when connected with low cost access device like tablets can be used for medical diagnosis and health monitoring. One such prototype system with ECG signal analysis facility is ready.

- 2) **Near set based medical image segmentation based embedded image processing system for cancer related diagnosis.**

One such system for breast cancer detection using mammogram images is under development. The algorithmic work is implanted and is tested for two standard databases.

**e) Projects on robotics**

- 1) **Rapid Reconfigurable Bipedal System:**

This is a snake robot that can take shape of a bipedal (two legs) humanoid robot. It can crawl like a snake and also walk like a human. It uses precisely controlled servo motors using a digital control card controlled through a ARM or LAPTOP. This can be used for narrow passages or extreme condition in accessible areas where humans can't go. First prototype is ready and patent is filed.

- 2) **Design of complete humanoid with speech and vision capabilities is proposed and is under development.**

**f) Projects having socio economic relevance.**

- 1) **Design of GPS/GSM based RF tags for health motoring and tracking of cattle.**

This project is being jointly executed with a social organization Gorakshan Sabha of Nagpur dedicated to Cow protection and care. The organization has expressed willingness to donate Rs. 1 lakh as seed grant for this project. The project is under initial stage and prototype tag is under development.

- 2) **Smart Communicating structure system.**

This interdisciplinary project is intended for developing a wireless sensor network based system which will be used for real time continuous monitoring of structures, so that in case of man-made or natural disasters the information provided by the sensor network can be used for minimizing casualties and losses.

**3) Intelligent Acoustic improvement System**

Using interdisciplinary approach between architecture and ECE department this project has recently started.

**4) Smart Light Control System**

Using Approach of Embedded system this interdisciplinary project has recently started.

**(iv) Comments on Review Committee Meeting – 29<sup>th</sup> May 2014**

• **Recommendations:**

- The Centre is required to strongly ensure that work done is documented properly
- It should look beyond small projects only and develop some bigger projects that can be constantly improvised over time.
- Publish papers in good journals and conferences
- Project is recommended for continuation



<b>Energy Systems</b>	
Centre of Excellence	Smart Renewable Energy Systems
Institution	College of Engineering, Pune

**(i) Focus :**

Through this CoE the major area emphasized is hybridization of Communications and embedded system. Hence there is ample scope to achieve socio-economic growth with following type of activities supported and executed by the proposed CoE. Encouraging research initiative using these two fields for improving the level of rural life. Problems related to remote connectivity, education, low cost medicine etc. for solving real life problems. Also by executing special design and development projects for assistive technology for differently able people. Encouraging manufacturing and entrepreneurship efforts. The employability of Engineering graduates and undergraduates will be enhanced due to skill enhancement.

**(ii) Objectives:** To work in the following areas of energy studies :

**[a] Power generation and utilization using wind and solar energy**

- Development of 10 kw micro grid using 2-3 kw wind mills and 2-3 kw solar plant
- Development of permanent magnet generators for small wind 2-5 kw wind turbines
- Development of efficient power converters

**[b] Real time system simulation of energy systems**

- Real time simulation of power converters
- Real time simulation of electrical machines
- Real time simulation of interconnected systems
- Real time simulation of microgrid

**[c] Solar Thermal System**

- Community solar water heating systems[SWHS]
- Constant temperature delivery from SWHS
- Solar Food Dryers
- Parabolic trough concentrator systems
- Optimization of low and medium temperature solar thermal systems
- Mobile energy audit unit

**[d] Demand side management through energy Conservation**

- Energy related consultancy to consumers
- Consultancy in preparing and implementing energy efficiency measures
- Creating energy awareness and demonstrations through case studies
- Pilot demonstration model development for educational institutes

**[e] Demand side management through development of energy efficient systems**

- Research and consultancy in the area of energy efficient equipment.
- Design and Development of permanent magnet motors for fixed and variable speed applications
- Development of switched reluctance drive / PM motor drive for solar pump

**[f] Development of power conditioners, digital controllers for RES**

- Development of high performance controllers
- Application of modern control algorithms for renewable energy systems
- Development of DAS for the low power renewable energy

**(iv) Comments on Review Committee Meeting held on 20<sup>th</sup> June 2014**

- **Comments:**

- The objectives are well defined to cover various aspects of energy studies
- Research areas are well articulated
- Different working groups covering different areas are proposed
- A well defined administrative structure and a fund flow chart is proposed
- In order to improve the existing facilities new laboratories shall be developed.
- Research shall be carried out in collaboration with other academic institutions.

- **Achievements:**

- Good progress on individual projects and laboratory development.
- Working groups from different departments are identified to initiate the different activities.
- Collaboration process with other institutions and industries has been initiated, appointment process for manpower is initiated
- Five M.Tech projects on different themes have been completed and five patents are filed.

- **Good Practices:**

- Based on research carried out, work is being published through number of publication.
- Funding for research engineers.
- Link with existing M.Tech projects across departments

- **Key Issues/Concerns:**

- Facing difficulties in getting registration of PhD students in the college

- **Recommendations:**

- The research carried out so far is simulation or computer program based. There is a need to take up field and industry oriented research projects.
- Barrier related to enhancing or starting with new M.Tech programmes in Energy and PhD guidance and intake should be removed.
- Increased autonomy to permits CoE, Pune to start MTech in Energy and enhance and support PhD in these areas
- Set baseline and targets for development oriented research
- Catalyse groups across departments and should focus predominantly electrical, electronics.
- Have stakeholders, industry meets to disseminate results and get feed back.
- Progress is satisfactory

<b>Energy Systems</b>	
Centre of Excellence	Environment & Energy Management
Institution	Thapar University, Patiala

**(i) Focus :**

**i. Specific Area: Environment Management**

The sub areas proposed to be worked on are:

- Reduction & control of pollutants generation
- Utilization of industrial wastes for producing useful products
- Advanced treatment methods
- CO<sub>2</sub> capture for sequestration
- Design of pollution control systems
- Environmental audit
- Environmental impact assessment (EIA)
- Socio-economic impact of selenium biofortification studies and selenium toxicity problem

**ii. Specific Area: Energy Management**

The sub areas proposed to be worked on are:

- Energy audit – electrical, mechanical, thermal
- Energy management systems
- Energy technology
- Alternate/ new energy sources

**(ii) Objectives:**

- Prevention and control of environmental pollution
- Improving energy efficiencies of SMEs
- Developing energy technologies
- Developing environment and energy management systems

**(iii) Activities:**

Collaborative **Shastri (Indo-Canadian) Research Grant (SRG)**: A research project “Application of adsorption process for removal of emerging pollutants from drinking water” with University of Saskatchewan (Canada) sanctioned – Feb.-June 2014.

–As per provision of the project, Prof. P.K. Bajpai (Distinguished Professor of Chemical Engineering) visited University of Saskatchewan, Saskatoon during May 21-28, 2014 for interaction and formulating a new & bigger collaborative research project.

**Workshop/ Training Programs for Industry**

1. Training programme on “Air Quality & Weather Monitoring (AQWM-2014) planned on March 6-7, 2014
2. Workshop on Renewable Energy Technologies (RET-2014) planned on March 20-21, 2014

**Collaborative Research Projects with Industries** in Punjab – discussed and preliminary formulations were made.

**(iv) Comments on Review Committee Meeting held on 20<sup>th</sup> June 2014:**

The summary of the observations of the Review Committee members are as below:

- **Comments:**
  - More specific objectives are required
  - Proposed research methodology is satisfactory
  - Focus on MSME-Energy Management can be extremely useful
  - Methodology needs to be more explicitly articulated
- **Achievements:**
  - Not much progress is made, as the funds are yet not received by the institute
- **Good Practices:**
  - A PG program in “Energy Technology and Management” is being started from July 2014
- **Recommendations:**
  - Funding should be initiated at the earliest.
  - CoE should create a vision for energy and environment management in MSME's.
  - Provide leadership for MSME's, industry in the region.
  - Course content of the PG program should be examined critically in view of the combination of energy technology and environment management.

<b>Energy Systems</b>	
Centre of Excellence	Alternate Energy Research
Institution	Government College of Technology, Coimabto

**(i) Focus :**

- i) Electrical and power electronic converters involved with modern wind generation system
- ii) Control techniques for wind turbines and solar photo-voltaic (PV) modules
- iii) The issues of integrating wind turbines and solar (PV) systems into power systems.

**(ii) Objectives:**

- Maximum Power Point Tracking (MPPT) for
  - (i) Solar power system under varying light and load conditions
  - (ii) Fixed and Variable speed Wind power system
  - Obtaining the optimum operating point for maximum power delivery for all possible radiation levels and wind speeds.
  - The main goal of the MPP tracker is to operate solar panels and wind turbine generators at the optimal operating point.
- Design and development of converter systems with intelligent controllers for
  - Efficiency Improvement in energy conversion systems
  - Meeting or exceeding the power quality as specified by the International standards.
- Modeling and simulation of solar PV /Wind Generating systems to study the impact of solar and wind power penetration on the grid.
  - Software - MATLAB, PSIM, DigSILENT
  - Solar/Wind energy systems under grid faults (Fault Ride Through)
- Identification of reliable and effective energy storage technologies for solar and wind energy Systems
  - Energy storage using Super capacitors and Batteries

Design and develop a single stage power interface for photovoltaic (PV) panel to the grid with a novel non-iterative Maximum Power Point Tracking (MPPT) method using a current controlled voltage source inverter.

**(iii) Activities :**

- (1) Both Dr.N.Devarajan and Prof.K.Yasoda have been actively working in the alternate energy resources.
- (2) Prof.K.Yasoda (Principal Investigator2) is currently pursuing her Doctoral Research program under the guidance of Dr.N.Devarajan (Principal Investigator1) in this area.
- (3) Er.A.D. Thirumoorthy, who is listed in the proposal as one of the important researcher from the private sector/knowledge user partner, is actively involved in the research area proposed.
  - \* Area of research "Power quality analysis of wind mill connected substations under the guidance of Dr.N.Devarajan (Principal Investigator1).

- (4) Principal Investigator1 has successfully produced the following two doctoral graduates in this research area from Anna University, Chennai.
- (i) Dr.V.Vanitha “Power Quality Improvement of Grid Connected Wind Electric Generator using Static Synchronous Compensator with Super capacitor”
  - (ii) Dr.B.Baby Priya “A Novel Genetic Fuzzy Controller for Power Quality Improvement of DFIG Wind Turbine System”

**Publications:**

- (i) Baby Priya B, Devarajan N, ‘Simulation and Analysis of a DFIG Wind Energy Conversion System with Genetic Fuzzy Controller’ International Journal of Computing and Engineering (IJSCE), Vol. 2, Issue 2, 2012.
- (ii) Vanitha V, Devarajan N, ‘Analysis of Transient Stability Margin of a Wind Farm using Squirrel
- (iii) Cage Induction Generator with Fixed Capacitance Compensation’, European Journal of Scientific Research, Vol. 59, No. 3, 2011, pp 370-382.

**(iv) Comments on Review Committee Meeting held on 20<sup>th</sup> June 2014**

• **Comments:**

- Focus is clear needs to be more interdisciplinary
- Proposed methodology and progress is satisfactory.
- No link with Academic programmes
- Process for procurement of equipments/instruments is started.

• **Achievements:**

- Reasonable work in PV- wind. Attempt to link industry.
- Few elective subjects on the proposed theme are formulated to introduce to PG students.

• **Good Practices:**

- The research is being carried out in collaboration with industries.
- Some subjects in thematic area have been introduced as Elective Subjects. Seminars/Workshops are being organized.
- Industry Advisory committee is formed

• **Key Issues/Concerns:**

- Registration of Ph. D. students in the college is not easily done.

• **Recommendations:**

- Most of the work presented is on electronics bases only. There is need to carry out research on development of fluid mechanics/ mechanical aspects for micro turbine development in the area of wind energy.
- Need to increase course offering in Energy i.e. MTech
- Already a lot of research work is going on in these areas; specific areas are required to be identified for carrying out research.
- Should link up with Mechanical Engineering and examine small wind turbine design, controls.

<b>Energy Systems</b>	
Centre of Excellence	Energy Studies in Industries and Agro Systems of Uttarakhand
Institution	College of Technology – GB Pant University of Agriculture & Technology, Pantnagar

**(i) Focus :**

- To design and develop energy efficient devices/processes.
- Computational Intelligence
- Energy Saving Devices
- Intelligent Energy Management and Demand Response Controller with Real Time Model Simulation
- Learning of the concepts of Smart Micro Grid

**(ii) Objectives:**

- Design and development of energy efficient devices/processes
- Intelligent Energy Management and Demand Response Controller with Real Time Model Simulation
- Identification of research topics for PG and PhD programmes in the thematic areas
- To develop Computational Intelligence techniques and tools for Energy Management
- To provide training workshops about energy conservation and efficiency for the Industries and agro systems of Uttarakhand
- To provide consultancy to industries in the thematic areas
- To transfer the results of energy studies to the users through research scholars and university Extension Services
- Further, the center will strive to develop trained manpower who can play instrumental role in helping the society for adoption of energy efficient technologies.
- The center will facilitate youths for self employment and entrepreneurship.
- The technologies developed by the center can be effective for Drudgery reduction in hills, particularly women of Hills.

**(iii) Activities :**

**1-Improvement in research and development facilities including procurement of goods:**

- In order to develop R&D facilities in the thematic areas procurement plan for necessary equipments has been started from January 2014.
- Procurement Plan for Centre of excellence amounting Rs. 2.75 crores has been uploaded in PMSS.
- All the technical details for procurement are collected by the indenters of all the participating departments.
- The procurement procedure has been initiated by the respective indenters of each associated department.

**2- Providing Teaching and Research Assistantships for UG, Masters and Doctoral programmes in topics linked to economic or societal needs in the thematic areas**

Research proposals from students of College of Technology were invited in the **October 2013** for providing Research assistantship to students to pursue research in the thematic areas of CoE, Pantnagar. A total number of **25 proposals** were received, and the approved committee recommended 20 proposals for the grants as per requirement.

### **3-Enhancing research competence of faculty and knowledge sharing in thematic areas, both within India and abroad**

In order to get aware of the advances in knowledge, technologies and research methodologies for improving the performance in the subject knowledge and research competence a training programme was attended by **10 faculty members** at Hyderabad during **April 23-27, 2014** conducted by Engineering Staff College of India (ESCI), Hyderabad, on the topic **“Renewable Energy Management Development Programme”**.

#### **(iv) Comments on Review Committee Meeting held on 20<sup>th</sup> June 2014.**

- **Comments:**

- Energy and Agriculture are important and neglected niche area.
- There is a need to specify the energy resources and energy systems to be undertaken to meet out the proposed objectives.
- Research competence of the faculty shall be enhanced through collaboration with National and International institutions and industries for product development.
- Proposed methodology and progress is satisfactory

- **Achievements:**

- Project proposals on different aspects in thematic areas were prepared and amount is allocated accordingly.
- Some system based an improved technology are developed under M.Tech. Projects.
- Training programs in thematic area were attended by the faculty and research scholars and visits to other institutes were made by them in order to have the exposure in research activities.
- Process of collaboration with industries after interaction has been started.
- Product orientation is good and linked with the field.

- **Good Practices:**

- The main work being carried out is products development oriented.
- Lack of awareness of research in the thematic area.
- Open process forwarding funding for development projects
- Rural Electrification Corporation has established REC Professor Chair in the College.

- **Key Issues/Concerns:**

- No inter-disciplinary focus
- Limited Research focus.
- Lack of awareness in thematic areas

- **Recommendations:**

- Lot of work has been done on product development but research component is missing. There is a need to introduce research component to enhance the publications and patents.
- Catalyse inter-disciplinary faculty teams.
- Encourage patenting - patenting workshop.
- Emphasise analysis and research apart from product development.
- Obtain professional design inputs.
- Encourage incubation.



<b>Energy Systems</b>	
Centre of Excellence	Practical Renewable Energy System
Institution	National Institute of Technology, Rourkela

**(i) Focus :**

**The Research foci of the Centre are as follows:-**

- The specialty of the Centre is practical and complete renewable energy systems with focus on working systems rather than focus on specific principles.
- To model single and Hybrid Renewable Energy Systems (HRES) involving PV, wind and storage devices.
- Design of a simple and practical PV-power based institutional air conditioning system
- Modeling of a distributed air conditioning system and power requirement with season and time
- To design converters for MPPT for Photovoltaic (PV) and Wind Energy System (WES)
- Design of Bi-directional DC/DC converter.
- To design DC/ AC Converter for PV System Control.
- Modeling of Thermal Energy storage device for delivery of cooling during off hours
- To develop a sun tracker for efficient utilization of solar radiation.
- To develop a Charge Controller for storage device (battery).
- To study the operation of the HRES when connected to utility grid
- To propose advanced controllers for PV and wind systems
- Development of control strategies for Micro-grid power system
- Grid Integration of Hybrid Energy Sources
- Supervisor Control for a Standalone Hybrid Energy System
- PSO/BFO based Frequency Controller for Hybrid Energy System

**(ii) Objectives:**

- (i) To produce qualified professionals and researchers in this specialization to cope up with the increasing demand of such professionals in the industry, research and academic organizations.
- (ii) To encourage and spread research and trainings an interdisciplinary platform in the field of Power System in the institute.
- (iii) To float an industry intended programme in power system that will be integrated with research work in the areas of control theory, control implementations.
- (iv) To establish industry-institute interaction by way of training of industry engineers and providing solution to the industrial problems in the power system category.
- (v) To create innovative learning processes in the Institute utilizing latest technologies in Renewable Energy Sources.

**(iii) Activities :**

**PHASE-I (2012-2013):**

- (i) Setting up of the following laboratories for the center
  - Smart Grid Control Laboratory
  - Industrial Electronics Laboratory
  - Modeling, Simulation & Design Laboratory
- (ii) Procurement of measuring equipments and prototype set-ups and their installation in different laboratories.
- (iii) Hiring of Technical staffs, scientists and Research Engineers
- (iv) Initiating the process of floating M.Tech programme in Energy System Engineering
- (v) Procurement of research monographs, reference books and hand books

**PHASE-II (2013-2014):**

- (i) Inducting Research scholars at Masters and doctoral levels for different areas of research.
- (ii) Running PG programmes as mentioned in item (iv) Phase-I
- (iii) Focus on the theoretical analysis, model development, simulation studies of different systems
- (iv) Necessary mathematical rigour such as performance analysis, convergence study, issue of stability will be carried out.
- (v) Organize a workshop on the state of the art technologies of various areas research of the centre.

**PHASE-III (2014-2015):**

- (i) Theoretical findings will be substantiated by developing necessary hardware models
- (ii) Experimentation on the developed hardware set-ups to validate the theoretical findings.
- (iii) Organization of international conference to share our research findings with the peers in the community.

**(vi) Comments on Review Committee Meeting held on 20<sup>th</sup> June 2014**

• **Comments:**

- Objectives are well defined in the proposal.
- Research shall be carried out by Ph.D. and M. Tech students in collaboration with other institutions and industries.
- Proposed methodology and progress made is satisfactory

• **Achievements:**

- Procurement process of equipment and systems is under progress.
- Research collaborations with International/ National institutions/industries are made.
- Research work are carried out by Ph.D scholars/M.Tech. students mainly on MPPT, analysis and simulation on PV array and active & reactive power control of DFIG based Grid connected WECS.
- Published good number of papers.
- Good research outputs, referenced with literature.

• **Good Practices:**

- Research collaboration with International institutions and industries
- Leveraged research grants from other funding agencies

- **Key Issues/Concerns:**
  - Almost all the work are based on electronics, there is a need to create other engineering related facilities.
- **Recommendations:**
  - Need to create some mechanism for field and industry oriented research.
  - Need to look at impact of research for the real world with focus on industry.
  - Compare algorithms, hardware developed with existing technologies.
  - Need to increase inter-disciplinary teams.

<b>Energy Systems</b>	
Centre of Excellence	Sustainable Energy Studies
Institution	National Institute of Technology, Warangal

**(i) Focus :**

Centre has identified the following broad areas of research:-

- **Solar Energy** – Solar Photovoltaic and galvanic Cells, Solar Thermal Applications, Fuel Cells, **Bioenergy** – Integration of solar and renewable sources with electric grid.
- Execution of R&D activities will be aimed at the following:
  - To develop cost effective, efficient and durable QDSSC materials for Solar Photo Voltaic Cells and Photo galvanic Cells.
  - To evaluate the performance of these SPV and SPGs with concentration and tracking
  - To study, develop and test new, efficient and cost effective PV convertor topologies and/or control methodologies with respect to its application in various areas.
  - To develop efficient and user friendly solar thermal appliances such as solar cookers, solar refrigeration systems.
  - To develop low and high temperature based PEM fuel cell technology and design of Hydrogen storage systems.
  - To develop nano-composite electro-catalyst for Direct Methanol and related fuel cells.
  - To develop efficient and economic photo bio reactor technology for the production of biofuels and to evaluate the performance of Internal combustion engines running on these Biofuels.

**(ii) Objectives:**

- To identify optimum engine design parameters for efficient use of biofuels.
- To develop cost effective fuel cells and identifying optimum parameters.
- To develop technologies to address problems associated with grid integration of Solar photovoltaic power and convertor topologies and controls.

**(iii) Activities :**

• **Mechanical Engineering Department:**

1. Prof. A.V. Narasimha Rao, Mechanical Engineering Department, CoE Coordinator - Working in the area of Solar Energy.
2. Prof. S. Srinivasa Rao, Mechanical Engineering Department -Working in the area of Biofuels, SPV cells.
3. Dr. K. Kiran Kumar, Mechanical Engineering Department - Working in the area of solar thermal system design, Low temperature applications of Solar Energy.
4. Dr. G. NagaSrinivasulu, Mechanical Engineering Department -Working in the area of Fuel Cells.
5. Dr. V.R.K. Raju, Mechanical Engineering Department -Working in the area of Solar Thermal Energy

- **Electrical Engineering Department:**

6. Prof. N. Subramanyam, Electrical Engineering Department - Working in the area of Grid Integration and Converter topologies
7. Dr. Sachin Jain, Electrical Engineering Department - Working in the area of Grid Integration, Converter topologies and control strategies.

- **Chemical Engineering Department:**

8. Dr. Shirish Sonawane, Chemical Engineering Department - Materials for SPVs, Energy Storage such as lithium batteries
9. Dr. P.V.Suresh, Chemical Engineering Department - Materials for Fuel Cells.

- **Chemistry Department**

10. Prof. A. Ramachandraiah, Department of Chemistry – Working in the area of Photovoltaic Cells and Photo galvanic Cells
11. Dr. K.V. Gobi, Department of Chemistry – Working in the area of Materials for Fuel Cells

- **Physics Department**

12. Dr. Azeem , Department of Physics - Working in the area of Materials for SPVs.

- Purchase of Programmable Fuel Cell Test station is under process – PO to be released.
- Purchase of Electrochemical Impedance Analyzer is under process.
- Purchase of Single fuel cell, 1 kW fuel cell stack and other peripherals is under progress.

**(iv) Comments on Review Committee Meeting held on 20<sup>th</sup> June 2014**

- **Comments:**

- Well defined objective.
- The areas given in the proposal are very enthusiastic in nature, need to be critically examined by getting the feedback from earlier studies.
- Proposed facilities shall be established covering the thematic area.
- M. Tech. program in Energy system shall be started.
- Based on the research outcomes, commercially viable techniques shall be developed.

- **Achievements:**

- Significant achievements in the areas of biofuels, Fuel Cells and Solar energy.
- Future plan for carrying out studies in the thematic areas are worked out.
- Two research scholars and two M.Tech students are working on different projects.
- Research publications are good.
- The proposed methodologies and progress made is satisfactory.

- **Good Practices:**
  - Research carried out by Ph.D. and M.Tech students is published and development work in collaboration with industries is in progress.
  - Funding for PhD students
- **Recommendations:**
  - All the groups of different areas are required to work together.
  - Research topics selected in the thematic area are of different nature and are very enthusiastic in nature, need to be critically examined by getting the feedback from earlier studies.
  - Efforts are required to link up 3 areas-PV, Fuel Cell and Biofuels.
  - Create mechanism for internal review, goal setting and review across the three themes to see if any inter-group work can emerge