Summary Report

About Department/Center/School: Rubber Technology Centre is a unique centre in IIT system only exists in IIT Kharagpur. This centre was established in the year 1981. Earlier it was a special section of the then Department of Applied Chemistry since 1954. This centre offers M.Tech programme in Rubber Technology and PhD programme in Rubber & Polymer Science and Technology. This centre has very strong interaction and collaboration with rubber and polymer industries in India and abroad.

1. **Academic Programs (Range of Degrees and Disciplines):**
   i) M.Tech. Program in rubber technology & polymer science
   ii) M.Tech. + Ph.D. in polymer science & rubber technology
   iii) Ph.D. in Rubber Technology & polymer science
2. **Major 4-5 Thrust Areas of Research:**
   i) Rubber product design & development
   ii) Polymer blends, polymer (nano)composites and recycling of polymers & rubbers.
   iii) Synthesis of tailor-made polymers and modification of polymers/rubbers
   iv) Green approach in polymer synthesis and technology
   v) Smart polymer & nanocomposites in novel applications; electrical, electrical, self-healing & biomedical applications
3. **Curriculum and Courses & Teaching Environment**

Items	**Ratio/ Number**	**Items**	**Number/%**
Teacher-student Ratio	**1:10**	Average No. of students motivated (%) to opt of careers Eng/ Tech. Sectors **UG/PG/PhD**	**NA/60/40**
No. of Faculty members as on today	**7**	Average No. of students motivated (%) to opt of careers in Science sectors **UG/PG/PhD**	**NA/nil/nil**
Average No. of Tutorial Assistants	**Nil**	No. of teaching labs	**7**
No. of UG/DD students	**55 (Elective subject)**	Average No. of students per experiments in core courses	**12**
No. of PG students/PhD students	**25 /45**	No. of Students' workshops/``Tinkering'' Labs	**Nil**
Average no. of tutors with more than 100 students	**NA**	No. of new courses introduced	**New Course-2 Modified course-3**
Average Students placements (%) (UG/DD/**PG**)	**90%**	No. of New program introduced	**Nil**
No of major curriculum review in both UG & PG level	**1**	Undergraduate Vs PhD strength expressed as Percentage	**NA**
No of UG lab (teaching labs) developed/set-ups	**NA**	No of PG/research labs developed/new set up	**Nil**
No of E class rooms	**Nil**	No. of lab classes per week	**2**
Average No. of Course done per student for B. Tech/DD/**M. Tech/Ph.D**	**12/5**	No. of core/elective/seminar/projects	**6/6/2/2 (For B.Tech. one**

		subjects taken for B. Tech, DD, and **M. Tech** respectively	**elective course per semester)**

4. Research and Development & its Environment

Items	Number	Items	Number	Items	No.
Total No. of Publications in Journals (2008-13)	**310**	Average no. of citation per paper	**26**	No of large interdisciplinary research projects	**-**
Total No. of Publications in Conference & Symposium	**162**	Average Journal publication per year	**62**	Number of Int. conf./workshops attended by students	**25 in 5 yrs.**
Total No of Books & e-books published	**5**	h-Index of the department since 2008/overall h-index in Scopus	**17.5/22**	No. of PDF hired in the Institute	**Nil**
Total No of Edited Conference Proceedings/book chapters	**4/12**	Number of papers with citation more than the average no. of citation of the Journals	**28 (based on i-10 index)**	No. of international Students as PhDs/PDFs	**Nil**
Total No. of Technology Developed/transferred	**5**	No. of recognitions & Awards, fellows etc to faculty/students (provide break up if necessary)	**Faculty: 4/6** **Students: 3**	No. of International visiting researchers/adjunct faculty stayed here for at least a week	**2**
Total No. of Patents Filed/Obtained	**12/3**	Average Retention(%) of Young faculty for at least 10 years	**67 %**	No. of short courses/workshops /conf. organized with international participations	**Course: 5 Conf.: 4**
Total No. of Copyright Filed/Obtained	**12**	No. of Sponsored research Project /fund(lakh) generated from non-internal source	**28 / 496(lakhs)**	Average No. of PhD granted per year	**6.4**
No. of Publications per Faculty/Masters/PhD students	**66/1/12**	No. of Consultancy /fund (lakh) generated from non-internal source	**12/63 (lakhs)**	Average No. of PhD Granted per year per faculty	**0.9**
No. of Publications per Faculty/Masters/PhD students in Top Ten Journals as Identified by the department	**66/1/12**	No of Internal and external Collaborations research papers/research projects/PhD students	**39/04/05**	Patent granted per faculty	**0.5**
Average No. of	**234.3**	No of M. Tech	**39/20**	Number of articles	**18**

Citation per faculty per year		students motivated into pursuing PhD/PhD graduates motivated to pursue career in Academics(abroad or IIT etc)		in collaborations with Ten countries*	
Ranking of the department in terms of average citations per paper within the Institute	**Not known**	Ranking of the department in terms of total number of Journal publications within the Institute/publications per faculty	**Not known**	No of articles of the dept. contributing towards h-index of the Institute since 2008	**310**

5. External Stakeholder Engagement and others

Items	**Number**	**Amount (Lakh)**
No. of PhD/Master students' thesis funded by Industries	**5/30**	**65**
Total number of Industry sponsored projects and its income (Lakh)	**5**	**75**
No. of Curriculum Development Initiative for Industries	**5**	**13**
No of Technology transfer/adopted by Industry/Labs	**1**	**30**
No. of Nationally relevant research projects	**16**	**333**
No of Policy inputs/consultancies provided	**11**	**62**
No. of Research grant and seed money from internal savings of the Institute per young faculty of the department and its total fund	**Yet to receive**	
No. of Community Relevant projects	**3**	**11.5**

6. Vision for the Future (in brief):

(a) Departments/centers/schools should spell out its Mission and Vision Statements, (b) Plans for future to achieve the projected goals and (c) measures adopted towards above.
Rubber Technology Centre being a unique academic Centre of all IIT System has established itself as an important Centre for teaching and research through collaboration with Rubber & Polymer Industry in India and abroad. Our aim is to fulfill the vision 2020 of the Institute through achievement of excellence in i) teaching ii) research iii) tailor-made short courses for Indian rubber Industry iv) collaboration with industries and academia in India and abroad v) resource generation. The Centre is making its own road map for its transformation to a Centre of Excellence in teaching and research in Rubber & Polymer Technology. Our goal is to be among top 20 Centres of the World in the field of Polymer Science and Rubber Technology.

7. External peer review of the Dept./centre/schools (in brief):

(a) Date of the peer review: 19th November, 2013.

(b) Name of the Experts involved and their affiliations in short:

I. Dr. D. K. Setua,
Director,

Advance Centre of Research in High Energy Materials (ACRHEM)
University of Hyderabad, Hyderabad

II. Mr. T. K. Mukherjee
Ex- Managing Director, Phoenix Conveyor Belt Ltd.,
Ex- President, All India Rubber Industries Association (AIRIA)
Kolkata.

(c) Overall recommendations of the peer review committee strengths, weaknesses, suggestions and comments.

The activities of the Centre are in good agreement with the objectives of the Mission and vision of the Institute. The Reviewers have made several suggestions for improvement;

- The Centre should be renamed as **"Advanced Centre on Rubbers and Polymers (ACRP)"**
- The M.Tech. course should be named as **"Master of Technology on Rubber Technology and Polymer Science"**.
- In order to make the above title of M.Tech. course the curriculum should be revised accordingly.
- The performance of the Centre is affected by the shortage of space, non-availability of 'smart' classroom and lack of sufficient laboratory space.
- Old and unserviceable equipments should be disposed as early as possible.
- AMC should be done for all the new and sophisticated instruments for better monitoring, calibration and upgradation of the old software/ accessories.
- Centre should explore the possibility of implementation of ISO 9000-2008; as applicable for routine testing following standard SOP for instruments and their QA & QC aspects.

(d) Measures adopted/action taken at the department level to address the recommendations of the peer review report:

A departmental committee has been set up to formulate a road-map to take necessary action for the betterment of the centre. At present the centre has acute space problem. This is well known. IIT authority has sanctioned more space in new building, which is under construction. The changes of name of the Centre and the M. Tech. course are well justified, as teaching and research of the Centre are not confined only to rubber technology, it includes large portion of the science and technology of different polymers other than only rubbers.

8. **Strengths, Weaknesses, Opportunities & Threats (SWOT) Analysis of the Department**

STRENGTHS:	**OPPORTUNITIES:**
The most unique Centre in the IIT Family. Excellent interaction with rubber & polymer industries in India and abroad. Excellent research output in terms of publications in peer-reviewed journals & in patents Good brand image of the Centre in Indian Rubber & Polymer Industries since its inception in 1981. Excellent placement record.	This Centre can grow up as "Centre of Excellence in Rubber & Polymers" The Centre can take part actively in creating opportunity for development of technical manpower for rubber & polymer industries in India. **THREATS:** * Acute shortage of space is posing threat

Alumnis are in the top-most position in many rubber & polymer industries. **WEAKNESSES:** Acute shortage of space. Low faculty strength. Low strength of trained technical staffs (No replacement after their superannuation). If the name of degree is changed from Rubber Technology to Rubber Technology & Polymer Science, the job opportunities for the M. Tech. students as well as for the Ph.D. students will be improved.	to the normal growth of the Centre. * Shortage of suitable qualified faculty members in entry level. * Shortage of trained technical staffs is a threat for the development of this Centre.

9. Additional Information, if any

***Note: Ten countries: US, UK, Germany, Japan, Canada, France, Italy, Australia, Singapore, South Korea (optional :China may be replaced with anyone if department wants)**

Important Highlights

Indian Institute of Technology (IIT) at Kharagpur, the first member in IIT family, is pioneer in establishing first rubber technology laboratory in the country in 1955 under the collaborative program with the British Government, the USA Government and Ministry of Education Government of India. In the early period the rubber laboratory was attached to the then applied chemistry department. An independent Rubber Technology Centre was established in 1981. The centre acquired advance processing, testing and characterization equipments from Indo-British, Indo-French collaborative programs and also a large research projects by CSIR, DST, DAE, ISRO, ARDB, DRDO, DBT etc.

Different Courses:

- **Two years M.Tech. course:** It is offered to the undergraduates derived from different engineering streams such as Mechanical, Chemical, Plastics & Rubbers, Rubber Technology, as well as post-graduates from science stream such as Master of Science in chemistry and/or polymer science.
- **Doctoral degree (Ph.D):** The centre offers numerous fellowships to pursue research in the frontiers of rubber and Polymer Science and Technology.
- **Courses to undergraduate (B.Tech and M.Sc) students:** The centre offers courses on Basic Rubber Science and Technology as well as Rubber Process Engineering in two semesters.
- **Courses on biomaterials and polymers for bio-medical application:** They are offered to MBBS students who are pursuing their postgraduate courses in the School of Medical Science and Technology in this IIT.
- Short term courses in specific areas as a part of training and continuing education program for practicing technologists / engineers / scientists of different companies or research laboratories and university teachers. Since 1981 the Centre has organized more than 26 short term courses on different topics of rubber technology.

Since its inception 1981, the center has produced nearly 300 M.Tech. students and 80 Doctoral students (Ph.D.). The Centre has organized more than 26 short-term courses on all categories.

Current research and development:

The centre coordinates sponsored research and development in both basic and applied field of rubber and polymer science and Technology. A brief account of the different fields of research is given below.

Sponsored research and developmental work:

- ❖ Design and development of different Rubber and Polymer Products for strategic and specialty application.

- ❖ Polymer blends and alloys.
- ❖ Synthesis of polyurethane and its composites.
- ❖ Preparation of reversible and smart materials.
- ❖ Thermoplastic Elastomers (TPE) and thermoplastic vulcanizates (TPV).
- ❖ Electron beam as well as chemical Modification of polymers.
- ❖ Novel techniques of polymerization to prepare electroactive, bioactive and functional polymers.
- ❖ Preparation of polymer and rubber nanocomposites.
- ❖ Controlled / living polymerization to prepare tailor-made polymers and rubbers with interesting architecture; like block graft and star polymers.
- ❖ Development of Flexible EMI shielding materials.

Broad Area of Research:

Rubber Technology Centre (RTC) is pursuing coordinates sponsored research and developmental work in both basic and applied research not only in the rubber science and technology but also broadly in the polymer science and engineering. A brief account of the different fields of research is given below.

- Rubber Product Development Textile reinforcement of Rubber Products.
- Polymer blends and alloys
- Adhesion science and technology
- Thermoplastic Elastomers and thermoplastic vulcanizates
- Modification of natural and synthetic polymers
- Development of Polymer composites for electrical & electronic application
- Recycling of waste rubbers and plastics
- Degradation and bio-degradation of rubbers
- Dynamic Mechanical properties of rubbers
- Polymer Rheology and processing
- Novel techniques of polymerization
- Nanocomposites
- Polymers for biomedical application
- Conductive polymer composites

Placement:

The M.Tech students get opportunity to go abroad (USA, Europe and Asia) different composites of for pursuing their higher study. Some of them get opportunities to serve in different industries like in Apollo Tyres, JK industries, paints and coatings industries and in other organizations working in rubber and polymer products. To encourage the M.Tech students several prizes are awarded every year like Incab Prize, Modi Rubber Prize, Hari Shankar Singhania gold medal for the overall best student of rubber technology centre. The Ph.D. students go to USA or Europe and Asian countries on the post-doctoral fellowship or get absorbed in the National or International research laboratories or Institutes. They also find lucrative offers as research scientists, polymer technologists from different National and International companies like General Electrical (GE), DuPont and Reliance etc.