Summary Report

About Department/Center/School: *The Department of Electronics and Electrical Communication Engineering came into existence in 1951, immediately after the institute was founded, headed by Prof. H. Tischner, through a collaborative programme with the University of Illinois. The department has come a long way since then to become a leading centre of learning in the field of Electronics and Electrical Communication today. Pioneering research activities, state-of-the-art laboratories and a tremendous growth in the field of electrical communication have catapulted the growth of the department and made it a favoured destination for students and researchers.*

1. **Academic Programs (Range of Degrees and Disciplines):**

   - B.Tech. Hons. in Electronics & Electrical Communication Engg.
   - Dual Degree Hons. in Electronics & Elect. Comm. Engg. + M.Tech in Fibre Optics and Lightwave Engg. / Microelectronics & VLSI Design / RF and Microwave Engg. / Visual Information & Embedded System / Telecommunications System Engg. / MBA
   - M. Tech. in Fibre Optics and Lightwave Engg. / Microelectronics & VLSI Design / RF and Microwave Engg. / Telecommunication Systems Engg. / Visual Information and Embedded Systems Engg.
   - M.S.
   - PhD

2. **Major 4-5 Thrust Areas of Research:** Microelectronics and VLSI Design, Wireless Communication, Image and Signal Processing, Microwave Engineering

3. **Curriculum and Courses & Teaching Environment**

Items	**Ratio/ Number**	**Items**	**Number/%**
Teacher-student Ratio	1:23	Average No. of students motivated (%) to opt of careers Eng/ Tech. Sectors UG/PG/PhD	100/100/100
No. of Faculty members as on today	34	Average No. of students motivated (%) to opt of careers in Science sectors UG/PG/PhD	Nil
Average No. of Tutorial Assistants	10.78	No. of teaching labs	20
No. of UG/DD students	452/80	Average No. of students per experiments in core courses	120.41
No. of PG students/PhD students	172/92	No. of Students' workshops/``Tinkering'' Labs	2
Average no. of tutors with more than 100 students	10.78	No. of new courses introduced	8
Average Students placements (%) (UG/DD/PG)	96.4/97.6/79.65	No. of New program introduced	1 (EC8)
No of major curriculum review in both UG & PG level	UG 1 PG 3	Undergraduate Vs PhD strength expressed as Percentage	540/97

No of UG lab (teaching labs) developed/set-ups	20	No of PG/research labs developed/new set up	4
No of E class rooms	8	No. of lab classes per week	22
Average No. of Course done per student for B. Tech/DD/M. Tech/Ph.D	62/71/18/4.2	No. of core/elective/seminar/projects subjects taken for B. Tech, DD, and M. Tech respectively	B.Tech: 54/7/0/1 DD: 62/7/0/2 M.Tech: 8/7/2/1

4. Research and Development & its Environment

Items	**Number**	**Items**	**Number**	**Items**	**No.**
Total No. of Publications in Journals (2008-13)	1053	Average no. of citation per paper	3.45	No of large interdisciplinary research projects	4
Total No. of Publications in Conference & Symposium	2046	Average Journal publication per year	210	Number of Int. conf./workshops attended by students	3.2 per student
Total No of Books & e-books published	15	h-Index of the department since 2008/overall h-index in Scopus	21/44	No. of PDF hired in the Institute	NA
Total No of Edited Conference Proceedings/book chapters	10	Number of papers with citation more that the average no. of citation of the Journals	123	No. of international Students as PhDs/PDFs	Nil
Total No. of Technology Developed/transferred	1	No. of recognitions & Awards, fellows etc to faculty/students (provide break up if necessary)	17	No. of International visiting researchers/adjunct faculty stayed here for at least a week	One
Total No. of Patents Filed/Obtained	24	Average Retention(%) of Young faculty for at least 10 years	88.88	No. of short courses/workshops /conf. organized with international participations	02
Total No. of Copyright Filed/Obtained	0	No. of Sponsored research Project /fund(lakh) generated from non-internal source	51 (17 Crores)	Average No. of PhD granted per year	12
No. of Publications per Faculty/Masters/PhD students	91.15/ 18.01/ 33.68	No. of Consultancy /fund (lakh) generated from non-internal source	26 (383 Lakhs)	Average No. of PhD Granted per year per faculty	0.35
No. of Publications per Faculty/Masters/PhD students in Top Ten Journals as Identified by the department	1/ 1.1/ 1.2	No of Internal and external Collaborations research papers/research projects/PhD students	966/77/35	Patent granted per faculty	0.71

Average No. of Citation per faculty per year	3.45	No of M. Tech students motivated into pursuing PhD/PhD graduates motivated to pursue career in Academics(abroad or IIT etc)	5	Number of articles in collaborations with Ten countries*	
Ranking of the department in terms of average citations per paper within the Institute	NA	Ranking of the department in terms of total number of Journal publications within the Institute/publications per faculty	NA	No of articles of the dept. contributing towards h-index of the Institute since 2008	

5.External Stakeholder Engagement and others

Items	**Number**	**Amount Lakh**
No. of PhD/Master students' thesis funded by Industries	16/47	
Total number of Industry sponsored projects and its income (Lakh)	51	17 crores
No. of Curriculum Development Initiative for Industries	Nil	
No of Technology transfer/adopted by Industry/Labs	01	
No. of Nationally relevant research projects	04	
No of Policy inputs/consultancies provided	26	383
No. of Research grant and seed money from internal savings of the Institute per young faculty of the department and its total fund	02	33
No. of Community Relevant projects	Nil	

6. Vision for the Future (in brief):

In accordance with the Vision 2020 of the Institute, the department has chalked out its own course of action to align itself with the overall mission and vision of Institute. The department has set its own objectives and goals to become a leading centre to promote advancements in the domain of Information and Communication Technology. The vision of the department is to be counted as the best one in the country in the domain of Information Technology and reach the level of the top 20 departments of the world. The Department strives continually to improve in the following to attract highest quality students and researchers, both from India and abroad: (i) Improvement in teaching via curricula revisions and introduction of state-of-the-art subjects and topics, (ii) More fundamental and applied research works for contribution to the industry and society, (iii) Collaborations with international faculties, (iv) Industry Collaborations, (v) Improving Visibility.

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

(a) Date of the peer review: 25/3/2013

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

- Prof. B.P. Pal, Dept. of Physics, IIT Delhi
- Prof. H. Rahaman, Dept. of IT, Bengal Engineering and Science University, Shibpur
- Prof. S. Chaudhury, Dept. of Electrical Engineering, IIT Mumbai

- Prof. R.K. Mallik, Dept. of Electrical Engineering, IIT Delhi
- Prof. S.C. Sahasrabudhe, Director, Dhirubhai Ambani Institute of Information and Communication Technology, Gandhinagar

(c) Overall recommendations of the peer review committee: Strengths, weaknesses, suggestions and comments:

For UG Curriculum:

1. The overall 'math' content in the curriculum is quite low. There should be a complete overhaul of math related courses – there should be at least 3-4 math courses for ECE students.
2. The course "Probability and Random Processes" should ideally be offered by ECE department so that the communication flavor can be brought in during teaching.
3. The BTP-I is a supervised learning course which should stay, but BTP-II should be made optional, based on the performance of the student in BTP-I.
4. The nature of UG education at IITs and the post-degree landscape have changed substantially over the years. There is no need for compulsory industrial training or internship.
5. The lab component in the curriculum is quite string and is a strength of the current UG programme.
6. The course loading should be ideally more towards the earlier years of the programme and less in the last two semesters.
7. It will be good to move some of the 4^{th} year elective courses to the 3^{rd} year to imbibe a greater interest in the programme by the students.

For Fiber Optics and Lightwave Engineering:

1. To inject the flavor of interdisciplinary nature by involving active participation of relevant faculties from departments like Physics, GSSST, and Computer Science.
2. The course should be renamed as, "Optoelectronics and Optical Communication Engineering".
3. The elective course "Nonlinear Optics" should be dropped, however, certain topics like nonlinear effects in optical fibers and its impact on optical communication networks, mitigation of these effects in certain situations like DWDM networks as well as upcoming devices like supercontinuum light source can be added to the existing "Optical Communication" course.
4. The course contents of "Optical Fibers, Components and Devices" should be split into two separate courses under the proposed names: (i) Optical Transmission as a core and (ii) Optical Components and Devices as an elective.
5. The lab needs to be modernized by adding few modern experiments as well as the infrastructures related to components/instruments like precision translation stages, optical breadboards, electro-optic and acousto-optic modulators and BER measurement instruments.
6. The elective course "Lightwave Networks" can be brought into the core course curriculum and "Advanced Optical Communication System" can be offered as an elective.

For Fiber Microelectronics and VLSI Design Engineering:

1. Well organized curriculum was noted for postgraduate level.
2. An increase in the offering of various elective courses needed.
3. The key factors that are narrowing down the scope of offering newer electives should be analyzed and worked out.
4. The factors responsible for overstretching of (a) infrastructure and (b) contact-hour of faculty members for running the curricula and the research oriented activities should be examined and acted upon.

For Telecommunication Systems Engineering:

1. More emphasis should be given to publishing in top ranking journals like IEEE, IET, etc. and journals which are not well known internationally should be avoided.
2. The faculty load should be optimized in such a way that each faculty member gets sufficient productive time for doing research.
3. Faculty members should be encouraged to look for more distinctions, honors, awards, etc.

For Visual Information Processing and Embedded Systems Engineering:

1. The specialization title may be changed to "Image and Video Systems Engineering" to better reflect the contents of the program as well as for the better acceptability to the industry.
2. All PG courses to have same credit structure (say, 3-1-0 4 credits).

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

Faculty members of the department have subsequently met and discussed on the recommendations of the committee. Curriculum revisions based on these recommendations are underway and will be forwarded to the Institute soon.

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

STRENGTHS • Highly qualified faculty • Very high quality students • More than 60 years of reputation • Laboratories equipped with high quality instruments • Strong alumni network • Periodic updating of curriculum • Organizing international conferences and short-term courses on regular basis **WEAKNESSES** • Teacher-student ratio is low • Technical staff insufficiency	**OPPORTUNITIES** • To produce more PhDs • More industrial collaborations • Exploring possibilities for international collaborations • Organizing specialized summer and winter schools **THREATS** • Increasing the faculty strength is to be taken with utmost priority • More international collaborations and exposures for both the faculty and research students is another urgency

Important Highlights

Research Subdomains in the Department:

- **Microelectronics and VLSI Design:** *Analog, Mixed-Signal and RF IC Design, Digital IC Design and Test, Technology CAD, SiGe/Strained-Si Heterostructures MEMS and Microsystems, VLSI CAD, Nanoelectronics, Biomedical Instrumentation and Sensors*
- **Telecommunication Systems:** *Wireless Communication and Sensor Networks, Satellite Communication, Multimedia Coding and Communication, Computer Network, Network Coding and Information Theory, MIMO, OFDM, DSP, Adaptive Filters, VLSI Signal Processing, Compressive Sensing*
- **Fibre Optics and Lightwave Engineering:** *Photonics (Fiber optics, opto-electronics, Solar cells, plasmonics, metamaterials, optical interconnects, optical sensors), Optical network on chip, Optical Communication, Optical Wireless, Quantum optics*
- **RF and Microwave:** *Electromagnetics and Microwave Circuits, Antenna and EM Propagation*
- **Embedded Systems and Image Processing:** *Image and Video Processing, Pattern Recognition and Biomedical Signal Processing, Speech and Audio Signal Processing, Embedded Systems, Computer Architecture, Parallel and Distributed Processing, Neural Networks, Soft Computing Techniques, Artificial Intelligence*

Fellowship of Professional Bodies:

Name of the Professional body	Name of the fellow
The Institution of Electronics and Telecommunication Engineers	Kalyan Kumar Bandyopadhyay
IEEE	Ramesh Garg
Indian National Academy of Engineers	Mrityunjoy Chakraborty
Institution of Engineers	Swapna Banerjee
Institution of Engineers	Ajoy Chakraborty
West Bengal Academy of Sciences and Technology	Chinmay Kumar Maiti

National/International Recognition:

- 'New bio-memristor device using silk protein' news published in Nature India - *Prof. C. K. Maiti.*
- IBM Faculty Award in recognition of exceptional efforts in building leading research and innovation in the area of Wireless monitoring for a Smarter Planet – *Prof. T. K. Bhattacharyya.*
- Second prize in Healthcare Innovation World Cup-2013 held in New York for the development of novel non-invasive blood glucose monitoring system - *Prof. S. Banerjee.*
- ISSS best PhD thesis award (2013)
- ISSS best MTech thesis award (2012)
- INAE Best PhD thesis award (2011)
- DST Lockheed Martin India Innovation Growth Program – *Prof. G. Saha (2009)*
- Alexander Von Humboldt – *Prof. S.K. Varshney (2009), Prof. P.K. Biswas (2002)*

- ISTE Baroda Chapter National Award – *Prof. R.V. Rajakumar (2008)*
- INAE Best MTech thesis award (2007)
- ISA Techno shield award – *Microelectronics Laboratory (2007)*
- Gandhian Young Technological Innovation Awards – Prof. T.K. Bhattacharya (2014)

Member Editorial Board:

Name of the Journal	Name of the Faculty
IEEE Journal of Computing in Science and Engineering	Mrityunjay Chakraborty
Journal of ISSS	Tarun Kanti Bhattacharya
International Journal of Medical Engineering and Informatics	Prabir Kumar Biswas
IET Circuits, Devices and Systems	Santanu Chattopadhyay
IEEE Communication Surveys and Tutorial	Debasish Datta
International Journal of Embedded and Real-time Communication Systems	Raja Datta
International Journal of Biosciences and Technology	Raja Datta, Sudipta Mukhopadhyay
RF And Microwave Computer Aided Design	Ramesh Garg
IETE Journal of Education	Ramesh Garg
Journal of Microwave Engineering and Technologies	Bratin Ghosh
Guest Editor: Solid State Electronics	Chinmoy Kumar Maiti
International Journal of Electronics and Electrical Engineering Research	Sudipta Mukhopadhyay
International Journal of Wireless and Mobile Networks	Rajarshi Roy
International Journal of Computer Networks and Communications	Rajarshi Roy
International Journal of Distributed and Parallel Systems	Rajarshi Roy
Journal of Photonics	Shailendra Kumar Varshney

Laboratories in the Department:

- Anechoic Chamber
- Antenna Test Range
- Audio & Bio Signal Processing
- Basic Electronics
- CAD and VLSI
- Communication Systems
- Digital Communication
- Digital Signal Processing
- Electronic Circuits
- Fibre Optics and Systems
- General Computing Facility
- Image Processing
- Integrated Circuits
- Microelectronics & MEMs
- Microprocessor
- Microwave
- Microwave Measurement
- Process Simulation
- SMDP
- Telecom Networks
- VLSI Engineering