



Institute of Radio Physics and Electronics

PROGRESS REPORT
(April 2008 – March 2009)

Centre of Advanced Study
in
Radio Physics and Electronics, University of Calcutta,
92 Acharya Prafulla Chandra Road
Kolkata 700 009

Presented at the CAS Advisory Committee meeting held on March 02, 2009, at Institute of Radio Physics and Electronics, University of Calcutta

Institute of Radio Physics and Electronics, University of Calcutta

Status: Centre of Advanced Study

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Date of first approval: August, 1963.

Programme last reviewed: March, 2005.

1. Advisory Committee

| | | |
|------------------|--|---|
| Chairman | Professor Suranjan Das | Vice Chancellor, University of Calcutta |
| UGC Nominee | Prof. N. K. Dadhich | Director, Inter University Centre for Astronomy and Astrophysics (IUCAA), Pune |
| UGC Nominee | Prof. B. N. Basu | Institute of Technology, Banaras Hindu University/ currently Director, College of Engg & Tech, Lodhipur, Moradabad (UP) |
| Member | Prof. Goutam Ghosh | Head of the Department |
| Member Secretary | Prof. P. K. Basu | Programme Coordinator |
| Member | Prof. Susanta Sen | Deputy Programme Coordinator Professor from Thrust Area |
| Member | Vacant due to retirement of Prof. P. K. Saha | Professor from Thrust Area |
| Member | Vacant due to retirement of Prof. N. Purkait | Professor from non-thrust area |

**Proceedings of the meeting of the
CAS Advisory Committee of Radiophysics and Electronics,
University of Calcutta,
held on March 03, 2008**

Members present:

| | |
|--|--|
| Prof. Ashis Banerjee | Vice Chancellor, Chairman of Advisory Committee |
| Prof. B. N. Basu | UGC nominated expert |
| Prof. P. K. Basu | Coordinator, CAS in Radiophysics and Electronics |
| Prof. S. Sen | Dy. Coordinator and Head of the Department |
| Faculty members of the department | |
| Research Scholars of the department | by invitation |
| Prof. T. C. Goel, Director, BITS-Pilani (Goa Campus) | UGC nominated Expert; could not attend the meeting due to his illness. |

The meeting started with Prof. Ashis Banerjee, Vice Chancellor in the chair who started the proceeding.

Prof. S. Sen, Head of the Department welcomed the members. His report on the departmental activities during 2007-2008 touched upon the following matters.

- ❖ Establishment of the new Meeting Room, an addition to the infrastructure, following the recommendation of the last Advisory Committee meeting.
- ❖ Opening of the new auditorium, named after late Prof. B. R. Nag.
- ❖ Multi-media projection facilities added in all the class rooms as well as in auditoriums and the new meeting room.
- ❖ Digitisation of the Departmental Library databank.
- ❖ Conferences/symposia organized: VDAT-2007, IMT Advanced-Towards 4G, IEEE AEMC 2007.
- ❖ Collaborations with: Interra Systems, Aalborg University-Denmark, ADCOS-ISRO, Ecole Polytechnique-France.
- ❖ Nano Technology Centre Coming up in the new Technology Campus of the University.
- ❖ Granting of status of UGC Networking Centre to the Department with a budget of Rs.5 crores for 5 years.

Prof. P. K. Basu, CAS Coordinator, read out the proceedings of the previous Advisory Committee and the recommendations thereof, and the statement of expenditure of the year 2007-2008. The Proceedings was confirmed.

Comments made on the reports, comments from the faculties

Prof. B. N. Basu acknowledged the active role played by Prof. T. C. Goel in the earlier Advisory Committee meetings and sincerely hoped for his speedy recovery. He congratulated the Centre for excellent academic achievements. He also termed the Networking Programme a great achievement in view of the stiff competition the Centre went through. In connection with the UGC's proposal for different types of autonomy of the CAS department, Prof. Basu made the following suggestions: Reduction in the delay in the registration for and award of Ph. D.; special drive for filling up the vacant posts; extension of networking to those who cannot afford such training; inclusion of HoD and CAS Coordinator in Selection Committees (as is done in BHU). The present status of the CAS Department in relation to the spirit of the UGC letter on autonomy was discussed freely with participation of Vice-Chancellor and the UGC-nominated expert.

Prof. A. Maitra mentioned some details of the beneficial offers under the ISRO-ADCOS programme. Prof. D Guha pointed out the inconvenience caused by the discontinuation of the subscription for the on-line IEEE journals.

Vice Chancellor pointed out that the CAS department enjoys almost complete academic autonomy. As for the inclusion of the HoD and the Coordinator in Selection Committees, since it is restricted by the CU Act at present, Vice Chancellor suggested that the Departmental Committee discuss the matter further within the framework of the CU Act and report back to him. He also mentioned that the process of selection would be starting in March and that the date for the Radiophysics Department has been fixed.

(At this point Vice Chancellor took leave because of some pressing matters and Prof. Sen took over presiding over the matter.)

After introduction of the teachers to the UGC-nominated expert, Centre's activities were presented thrust-area-wise by the following faculty members.

| | | |
|------------------------------------|---|----------------------|
| Space Science | - | Ashik Paul |
| Microwave and Lightwave Technology | - | J. Y. Siddiqui |
| Solid State Electronics | - | P. K. Basu |
| Communication | - | A. Das Barman |
| System Science | - | Sumitra Mukhopadhyay |

Prof. B. N. Basu appreciated the way the young faculties have come up with excellent performance. He also lauded the standard and volume of works carried out within the limited infrastructure. At this point Prof. P. K. Basu referred to the warm admiration heaped upon the versatile expertise of the Department by the Empowered Committee for UGC Networking. Finally, two points were raised by Prof. B. N. Basu and discussed by the members: (i) Accommodation for the participants in the UGC Networking Programme, (ii) involvement of the B. Tech. students in research publications.

**Recommendations of the Advisory Committee
for
Centre of Advanced Study in Radiophysics and Electronics
University of Calcutta
Meeting of the Advisory Committee held on March 3, 2008**

1. The Committee scrutinized the progress made by the CAS-Department ((Institute of Radiophysics and Electronics) during the reported period (2007-2008) based on the presentations of the Head of the Department, CAS Coordinator and the concerned teachers, as well as on the deliberation following the presentations.
2. During the reported period, the Institute of Radiophysics and Electronics (CAS-Department) has carried out commendable academic and research work, as presented by the Department and as evidenced by the record of publication of papers in peer-reviewed national and international journals, publication of books, presentation of papers and invited lectures in national and international conferences, and a US patent.
3. The Department has established effective research collaboration with the different research organisations and universities in the country and abroad. The regional institutions have been benefited by the summer training programme as well as part-time doctoral programme of the Department. The IEEE- LEOS chapter of the Department has been adjudged the 'The Most Improved Chapter' of the Year 2006.
4. The Department has as many as 9 ongoing sponsored projects in the area of practical relevance. Thus, the CAS-Department has complied with the suggestion of the Advisory Committee in the previous meeting (2006-2007) to enhance R&D activities through sponsored research.

5. The Department has 27 teachers (P-12, R-8, L-07) on roll as against the sanctioned strength of 46. Therefore, the Department may take all steps to expedite the filling up of the vacant posts so that the academic and R&D activities of CAS could be further accelerated. The Hon'ble Vice-Chancellor has assured the Department of the cooperation of the University in this regard.
6. The CAS-Department is privileged to be one of the recipients of the UGC Networking Centre Programme (under the Physical Sciences category) with a budgetary provision of Rs. 5 crores. This has definitely strengthened the CAS-Department.
7. Following the suggestion made by the Committee in the previous meeting of the Advisory Committee (2006-2007), the Department has now built a separate committee room for technical/official meeting and discussion.
8. Further, the Internet and E-journal facilities have been extended to the students and teachers of the University.
9. As per decision of the earlier meeting of the Advisory Committee, a new M. Tech programme has been initiated in the area of VLSI Design with an intake of 12 students.
10. The Department may establishment an 'Industry-Institution Consultancy Cell' for the mutual benefit of the academia and the industries.
11. The Department may consider imparting education/vocational training to the underprivileged in such area as repair of TV, mobile phone set, computer hardware, computer software, information technology, diesel generator, refrigerators, inverter, etc.
12. The Department may continue to extend its facilities to other institutions for summer training/short-term courses, diploma courses, part-time doctoral research, etc.
13. The Advisory Committee gave serious consideration to Academic, Administrative, and Financial Autonomy to be awarded to CAS departments within university systems, as suggested in the letter of Dr. A. K. Parate, Joint Secretary, UGC addressed to Professor AK Banerjee, the Hon'ble Vice-Chancellor, University of Calcutta (DO 3-1/2008/SAP-I) dated 1 February 2008). The specific observations and the suggestions of the UGC Expert Committee in the light of this issue are as follows.

Academic Autonomy:

Syllabus:

It is noted that the Department already enjoys the autonomy as far as framing the syllabi of the teaching programmes/courses are concerned. For this purpose, the Departmental Committee (comprising the entire faculty) proposes the syllabi considering the present societal need and the national requirements. The various syllabi of the premier institutions in the country and abroad are also given due consideration. The syllabi are framed on the proposal by the Board of P. G. Studies of the Department. Subsequently, the syllabus gets approved by the Faculty Council and the Syndicate according to the framework of the University. The Committee appreciates this practice.

Academic calendar including the declaration of examination results:

It is observed that the Department decides the dates of the beginning and the end of the sessions as well as the dates of examinations, within the academic calendar of the University. The Board of Examiners (BOE) of the Department takes all efforts to consider and approve the examination results and then send at an early date its recommendation to the Controller of examination, which would then normally take two to three days for publishing the results.

As far as the doctoral programme is concerned, it is noted that the Departmental Ph. D Committee arranges the pre-Ph. D seminar of a candidate, proposes the panel of examiners of his or her thesis to the Vice-Chancellor. The Office of the Registrar of the University then takes the

responsibility of contacting the potential examiners for their consent; sending the thesis to the examiners for examination; and declaring the result on the award of the Ph. D degree to the candidate.

However, the Committee feels that the present practice of thesis examination is likely to delay the process of the declaration of the result in intermediate correspondences with the potential thesis examiners. Therefore, the Committee suggests that the CAS Department be allowed to contact the potential examiners of the thesis for their consent, and pursue them to submit on time the results of the examination of the thesis to the Registrar.

The Hon'ble Vice-Chancellor has assured of no objection to the above initiatives of the Department.

Financial Autonomy

According to the present University norms, the CAS-Department enjoys the freedom to utilize the grants under CAS, special grants from UGC as well as all grants in different sponsored projects sanctioned to the Department. In addition, the funds allocated by the University, after studying the budget proposal from all university departments, are freely utilized by the departments, adhering to the Government rules. Thus, the Department already is privileged with the financial autonomy within the University framework.

Administrative Autonomy

Filling up of vacant posts in the Department:

- (i) The Committee notes that the Department faces genuine difficulty in the matter of filling up of the existing vacancies of teaching posts in the Department and that there is scope for improvement in this regard by decentralizing the process by empowering the Departmental Committee of the CAS-Department to (a) advertise vacant posts as and when vacancy occurs, (b) short-list the candidates for interview, and (c) fix the date of the interview/selection of candidates in consultation with the Hon'ble Vice-Chancellor.
 - (ii) The University may include the Head of the CAS-Department as an invited member in the selection committee for interviewing and selecting the candidates for the teaching staff of the Department also for new appointments.
 - (iii) (a) Allotment of technical and administrative personnel to the CAS-Department may preferably be made in consultation with the Department to take care of the departmental requirements vis-à-vis the qualification and experience of the person. (b) Transfer of non-teaching staff from CAS-Department on promotion or otherwise may preferably be avoided without the express request from the Department.
14. The Department may approach the University authority for the grant of Academic, Administrative, and Financial Autonomy to the Department making a declaration to the effect that the Department is ready for accepting such Autonomy and is prepared for executing new and additional functions in the light of the Autonomy to the Department in the offing.

(Professor A. Banerjee)
(Chairman)
Vice Chancellor
University of Calcutta

Professor B. N. Basu
(Member)
UGC Nominee

3. Details of Sanctions and Expenditure

Grant sanctioned

| | |
|----------------------|--------------------|
| Non Recurring | 68.25 lakhs |
| Recurring | 31.65 lakhs |
| Total | 99.90 lakhs |

Statement of Expenditure

A. Expenditure during 1-4-2007 to 02-3-2008

| Equipment | Amount sanctioned in lakhs | Order placed | Bill submitted | Balance |
|---|----------------------------|-------------------------|---|-------------------|
| (i) Vector Network Analyser | 40.00 | USD-96,785.60 | 46,39,384.00 | -2,39,384.00 |
| (ii) Spectrum Analyser | 4.00 | | | |
| (iii) DSP tool Kit +10 Pentium | 4.50 | 1,80,498.00+USD3,300.00 | 3,37,423.00 | +1,12,577.00 |
| (iv) Zero-air and Nitrogen generator | 2.00 | 1,70,000.00 | 1,85,104.00 | +14,896.00 |
| (v) Receiving system for Schumann Resonance | 1.00 | 83,980.00 | 98,575.00 | +1,425.00 |
| (vi) Softwares (Mentor Graphics 5 user) | 10.00 | | 9,91,502.00 | +8,498.00 |
| (vii) Inkjet Printer for B.Tech students Project work (2) | 0.15 | 10,600.00 | 10,600.00 | +4,400.00 |
| 2.(a) Lecture auditorium with modern facilities including LCD projector | 5.00 | | Fully utilized with additional fund from CU | - |
| (b) Dust-free room (for pollution measurement) | 1.00 | | Estimate to be Submitted to UGC | - |
| (c) Reprographic facilities | 0.60 | | 58,500.00 | 1,500.00 |
| Total: | 68.25 | | 63,21,088.00 | -96,088.00 |

B. Recurring : 01.04.07 – 31.03.08

| | | | | |
|---|------|---|-----------|-----------|
| 1. Contingency @ Rs. 75,000/-p.a | 0.75 | | 74,976.00 | 24.00 |
| 2. Consumables/Chemicals etc. @Rs. 50,000/-p.a. | 0.50 | | 49,984.00 | 16.00 |
| 3. Travel @ Rs. 30,000/-p.a. | 0.30 | | 23,663.00 | 6,337.00 |
| 4. Visiting Fellows @ Rs. 40,000/-p.a. | 0.40 | | 31,400.00 | 8,600.00 |
| 5. Seminar @ Rs. 50,000/-p.a. (for two events) | 0.50 | - | 0 | 50,000.00 |
| 6. Hiring of | 0.30 | - | 29,942.00 | 58.00 |

| | | | | |
|---|-------------|---|-------------|----------------|
| secretarial/Technical services @ Rs. 30,000/-p.a. | | | | |
| 7. Advisory committee meetings @ Rs. 50,000/-p.a. | 0.50 | - | 24,847.00 | 25,154.00 |
| 8. Books and Journals @ Rs. 50,000/-p.a. | 0.50 | - | 49,959.00 | 41.00 |
| 9. Project Fellows (4Nos.) @ Rs. 6,000/-p.a. | 14.40 | | 20,129.00 | 13,4096.00 |
| | (5 yrs) | | | |
| | 66.00 | | 3,04,900.00 | 22,4326.00 |
| Interest accrued | 1,93,083.00 | | 1068 | Balance 88,500 |

Note: The excess expenditure for NR head has been met from the interest accrued, with the verbal consent of the External Experts and the expenditure has been approved by the UGC.

3. (B) Expenditure during 1-4-08 to 28-02-09 : Tentative statement to be placed on Table.

(C) New Grants Sanctioned under SAP

(i) Creation of 10 Research Fellowships in Science under Meritorious Students (RFSMS) @ Rs. 10,000/=

At present 5 Fellows are working under this scheme.

(ii) Sanction of additional grant of Rs. 20.00 lakhs for infrastructures like power and water supply, security equipment, classroom furnitures, equipment facilitating PG research etc.

An amount of Rs. 1,99,936/= only has been spent and further grant has been sought.

(iii) Sanction of additional grant of Rs. 30.00 lakhs for infrastructures like power and water supply, security equipment, classroom furnitures, equipment facilitating PG research etc.

An amount of Rs. 30.00 lakhs/only has been spent and further grant has been sought.

4. Thrust Areas

Present (New Phase) (a) Solid State Electronics & VLSI Design
(b) Space Science and Communication

Proposed New Areas In view of the recommendation by the Advisory Committee made last year the work conducted in diversified areas are grouped into the following three categories:

- (i) **Space and atmospheric science and communication,**
- (ii) **Microwave and lightwave technology) and**
- (iii) **Solid-state electronics and circuits (encompassing VLSI and nanotechnology).**

4. Major Achievements in Teaching and Research

- (a) Course Development Semester system in M. Tech level was introduced earlier. Semester system in the B. Tech. level, with summative and formative methods of evaluation has been introduced for both Radio Physics and Electronics and Information Technology from the academic session starting September 2006.
- In addition a new M. Tech course in VLSI Design has been introduced in September 2006.
- Structure for B. Tech. in RPE is given in Annexure I(A)
- Structure for B. Tech. in IT is given in Annexure I(B).
- Dual degree program with B. Tech (3 yrs) followed by M. Tech (1 yr) has been introduced. Details of regulation etc are given in Annexure III.
- (b) Student intake
- (i) B. Tech in RPE : 42 (32 general + 8 SC/ST + 2 outside CU)
 - (ii) B. Tech in IT : 20 (course fee @ Rs. 3000/= pm)
 - (iii) M. Tech : 40 (28 general + 2 outside CU + 8 SC/ST + 8 sponsored @ Rs. 3000/ pm)
 - (iv) M. Tech in VLSI Design : 20 (course fee @ Rs. 4000/= pm)
 - (v) M. Tech in VLSI Design (6 semester): proposed intake 08
- (c) New Academic/ Research Programs
- S. K. Mitra Centre for Research in Space Environment [Annexure IV(A)]
- UGC Networking Resource Centre in Physical Sciences [Annexure IV(B)]
- Centre for Research and Training in Microwaves and Millimeter waves [Annexure IV (C)]
- Centre fur TeleInFrastructur (CTIF)-India [Annexure IV(D)]
- Research Program in Space Science & Technology [Annexure IV(E)]
- (d) Teaching/Research Labs
- With the introduction of B. Tech in IT, new teaching laboratories have been introduced. The laboratories are renovated and shifted to new locations. Recently financial support from World Bank/MHRD supported TEQIP has been received. The teaching and research laboratories are being augmented.
- (e) Research Activities
- The Centre is well known for its research activities, both theoretical and experimental, in the thrust areas mentioned earlier. The achievements in the thrust areas during the period under review are highlighted in Annexure–V(A). Proposed research activities are discussed in Annexure –V(B). Research papers in Journals are listed in Annexure VI (A) Research papers in Conferences are listed in Annexure VI (B). Reports/Technical Notes published are given in Annexure VI (C). Ph.D. theses with titles are given in Annexure VI (D).

5. (a) Facilities Available

- (a) Equipment Over the years the Centre has generated important research facilities through grants received from the UGC, DOE, DST, MHRD, AICTE, DRDO and other Government and non-government agencies. A list of major equipment is given below:
Diffusion furnace
Mask Aligner
Vector Network Analyser
Spectrum Analyser
Gas Chromatograph
OTDR
EDA Suite
VLSI related Softwares
DSP tool kit
- (b) Library No of Books: 18,928 as on 28/02/2009
Journals: transferred to Central Library
CD/LRs : more than 300.
Computers: 16.
- (c) Internet All teachers have access to internet. Journals available in the e-library of CU can be accessed.
- (d) Website The centre has its own website : www.irpel.org, which is regularly updated

5. (b) New Facilities Available

| Sl. No. | Instrument | Price (Rupees in lacs) | Funded by | Area of Work |
|---------|--|------------------------|-----------|-------------------------|
| 1 | Agilent Vector Network Analyzer (50 MHz-22 GHz) | 44.00 | CAS | Microwaves/ Antennas |
| 2 | Agilent Spectrum Analyzer (3 GHz) | 4.00 | CAS | Communication |
| 3 | Agilent Power Meter with CW Power sensors 50 MHz - 26.5 GHz | 2.35 | TEQIP | Microwaves/ Antennas |
| 4 | Agilent Power Meter with Waveguide Power sensors 26.5 GHz – 40 GHz | 2.75 | TEQIP | Microwaves/ Antennas |
| 6 | Agilent PSG Signal Generator 250 KHz – 40 GHz | 15.00 | TEQIP | Microwaves/ Antennas |
| 7 | Agilent Spectrum Analyzer (26.5 GHz) | 14.00 | TEQIP | Communication |
| 8 | Agilent Lightwave Multimeter | 1.8 | TEQIP | Communication |
| 9 | Agilent Compact Tunable Laser S+C band | 11.50 | TEQIP | Communication |
| 10 | Agilent Compact Tunable Laser C+ L band | 8.00 | TEQIP | Communication |
| 11 | 20 GHz Optical to Electrical Converter | 5.50 | TEQIP | Communication |
| 12 | Microstrip fabrication Facility | 10.00 | TEQIP | Microwaves/ |

| | | | | |
|-----|-----------------------------|-------|-------|-----------------------------|
| 13. | Ionospheric Sounding System | 66.00 | TEQIP | Antennas Ionosphere, GPS |
| 14. | Mentor Graphics Software | 9.92 | CAS | VLSI Design |

6. Faculties and Other Research Staff : Annexure VII

- | | | |
|-----|---|------------------|
| (a) | List of Faculties with specialisation | Annexure VII (A) |
| (b) | List of Guest Lecturers/Retired Teachers | Annexure VII(B) |
| (c) | List of Scientific Workers | Annexure VII(C) |
| (d) | List of CAS Project Fellows | Annexure VII(D) |
| (e) | List of Other Workers working for Ph.D. under Faculties | Annexure VII(E) |

7. Achievements/activities of Faculties : Annexure VIII

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|-----|--|--------------------|
| (a) | Visits abroad under Visiting Professorship/Fellowship, Conferences etc | Annexure VIII(A) |
| (b) | Awards, Distinction, Editorship, Reviewerships, etc | Annexure VIII (B) |
| (c) | Invited talks/Chairmanship | Annexure VIII(C) |
| (d) | Collaboration with International/ National Institutions | Annexure VIII(D) |
| (e) | Conferences/Workshops arranged | Annexure VIII(E) |
| (f) | Visits and Lectures by Distinguished Visitors/ Other Lectures | Annexure VIII(F) |

8. On-going Projects

Details about the on-going projects are given in [Annexure–IX]

9. Collaboration with regional institutions

The faculties serve as experts and mentor to regional institutions, in particular, the institutions in North Eastern region of the country. Each year a few students from the Department of Electronic Science, Gauhati University, come to the Centre, to undertake their summer projects under the faculties of the Centre.

The University College of Technology- Calcutta University (UCT-CU) has been identified as one of the Lead Institutions under Technical Education Quality Improvement Program (TEQIP) of World Bank/MHRD. It is forming a network with Govt. College of Engg. & Ceramic Technology, Kolkata, and Haldia Institute of Technology, Haldia. As a department under UCT-CU, the Centre provides support to these Institutions in holding seminar/symposia. It is planned to guide faculties of these two institutions for Ph.D. work.

10. IEEE Activities

The LEOS Chapter and AP-MTT Chapters of IEEE, Calcutta Section, have their offices in the Centre. The faculty members belonging to these chapters organize regular seminars, workshops, lectures and social meets.

11. Encouragement of Student Activities

A Students Section of IEEE has been opened in the Campus, under the initiative of the faculties of the Centre, who are IEEE members.

The National Science Day (28.02.08) has been observed by arranging lectures by IEEE student members for B. Sc. (Hons) students of different colleges.

Activities are detailed in Annexure X

12. Alumni Association

The Radio Physics and Electronics Association hold lectures, reunion, and other technical and social events each year. It also maintains an Alumni Registrar.

13. Reports on Summer/Winter Schools

Given in Annexure XI.

The Glorious History of the Institute of Radio Physics & Electronics and the Centre of Advanced Study

The Institute of Radio Physics and Electronics was established as an independent post-graduate teaching and research department of the University of Calcutta in the year 1949. The late Professor S.K.Mitra, D.Sc, F.R.S., was the Head of the Institute until his retirement in 1955.

In retrospect, it was in the year 1925 that the University of Calcutta introduced “wireless” as an elective subject for special study in its post-graduate course in Pure Physics and started at the same time a wireless laboratory for teaching and research in the fields of electron tubes and radio wave propagation in the upper atmosphere. Ever increasing applications of radio waves, especially on the eve of and during the Second World War, and the rapid development of electronics as an important science by itself created a new situation. Inclusion of these developments was found impossible if the teaching and research activities in these subjects were to be confined within the necessarily limited scope allowed to them as a part of another post-graduate course. A large-scale expansion and re-organization became imperative. To meet this situation the university, in 1946, formulated a plan for the creation of a separate post-graduate department for Radio Physics and Electronics by pooling the then existing resources of the Wireless section of the Pure Physics department and the Communication Engineering section of the Applied Physics department. A visiting committee of the All India Council for Technical Education (A.I.C.T.E) approved this plan in 1947. Grants sanctioned by the Government of India on the recommendation of this committee enabled the creation in 1949 of the Institute of Radio Physics and Electronics—an independent post-graduate teaching and research department of the University of Calcutta.

The foundation stone of the Institute of Radio Physics and Electronics was laid on April 21, 1949, by the then Premier of West Bengal, Dr. B.C.Roy. The concluding remark of his address on the occasion of laying the foundation stone of the Institute was the following:

“Let me hope that in laying the foundation stone of the Institute of Radio Physics and Electronics today, I have planted a seed which will grow into a mighty tree, spreading its branches much beyond the borders of your present expectation. The Institute will become not only an all-India center of study and research but will also attract earnest seekers after truth from beyond the boundaries of India”.

A look at the Institute today should convince anybody that the expectations of Dr. Roy are well on the way to fulfillment almost to the word.

In the beginning, the Institute started its first session of 2-year M.Sc. course in Radio Physics and Electronics from July 1949. As the main building of the Institute (completed and occupied by end of 1951) was under construction at that time, classes were held in different places of the Science College campus—in the seminar rooms of Pure Physics and Applied Physics departments. Practical work was conducted in the Pure Physics and Applied Physics Laboratories and drawing classes were held in the Applied Chemistry building. The infant department had thus to struggle hard during the first two years of its existence. The first examination was held in November, 1951, exactly as scheduled.

Hardly had the department come into existence when plans for the expansion of the 2-year M.Sc. course to a 3-year course leading to the M.Sc. (Tech.) degree engaged the mind of its founder members. This was necessitated by two factors. First, the latest developments in Radio Physics and Electronics could no longer be given adequate coverage within the curriculum of a two- year course. Secondly, a 3-year course would be in conformity with the general pattern of technological education recommended by AICTE. The approval for the 3-year M.Sc. (Tech.) course in Radio Physics and Electronics came from University Grants Commission (U.G.C.) on recommendation of AICTE, in April 1957.

Soon after, came a major boost that further brightened the path of progress for the growing Institute. Early in 1962, UGC recommended the establishment of Centers of Advanced Study (CAS) in selected university departments known for their tradition and promise. The object the commission had in view was to encourage the pursuit of excellence and to accelerate the realization of international standards in the field of post-graduate education and research. In recognition of the tradition built here, this Institute was nominated as one of the five Centers of Advanced Study in 1962-63. This nomination, with promise of financial assistance to intensify teaching and research activities so as to achieve a high standard of excellence on the international level, fired the staff of the Institute from top to bottom. United as a team, the members set to work, each in his own sphere, with redoubled vigor.

In 1969, grants for the third stage of development of the Institute were received from the UGC which recommended drastic changes in the courses to be offered. In short, the approved scheme of development was: i) conversion of the 2-year B.Tech. Course to a 3-year graduate course leading to B.Tech. degree with an annual intake of 30 students, ii) conversion of the 1-year M.Tech. course to a 2-year post-graduate course leading to the M.Tech. degree with an annual intake of 25 students.

With the financial assistance allotted for the CAS, combined with the grants received for the third development stage, the facilities of the Institute began to develop as desired. A new multi storied building (known as the CAS – building) was constructed at a site adjacent to the Science College campus. Additions to staff, equipment and books paved the way for intensification of activities. The provisions for Visiting Professors, seminars and symposia, travel and personnel exchange facilities substantially accelerated the progress of the Institute.

Meanwhile, on the report of the Assessment committee appointed by the UGC (in 1973-74) to evaluate the performance of the Center during the first decade of its existence, the UGC classified it as “excellent” and offered to continue grants to the center under Special Assistance Program (S.A.P) of CAS in selected thrust areas of research. On the basis of its continuing tradition of high quality research the Institute is still getting grants from UGC under the SAP.

The Institute celebrated its Silver Jubilee in 1973. In late 1970's an academic link program ALIS was established between the Institute and a few UK Universities. The program encouraged bilateral exchange of scientists. A Liquid Phase Epitaxy (LPE) Reactor was received by the Centre as a gift with which work on growth of semiconductor heterojunction started. A Centre for Research and Training in Radar and Microwaves also started functioning in 1970's.

The University created a separate department named as the Department of Computer Science and Engineering in 1980. A number of teachers of the Centre were transferred and some of the facilities of the Centre were also made available to this new department. The activities related to computers in the Centre were somewhat reduced, but the work on semiconductor and space science scaled new heights. The Centre received in this decade substantial grant from the UGC under the Committee for Strengthening Infrastructure in Science and Technology (COSIST). Equipment related to Microelectronics, mm wave technology and characterization of semiconductors were procured out of the fund received. The Centre celebrated the birth centenary of its founder Prof. S. K. Mitra in 1989. Almost concurrently a new Department of Electronic Science was created by the University. The teachers of the Centre provided initial support to this new department in all sorts of activities.

In the decade of 1990s, UGC established the Eastern Centre for Radio Astronomy (ECRA) making INRAPHEL as its nodal point and identifying Haringhata Field station as the site for observation. Society for Applied Microwave Electronics Engineering Research (SAMEER), an organization funded by the then Department of Electronics, Government of India, opened a branch in Calcutta in this period. Two floors of the CAS building were rented to it to start with. New projects for fabrication of IMPATT diodes and characterization of mm wave devices were awarded to the Centre by different National Organizations.

The Institute started its golden jubilee celebration in 1998 by holding an International Conference Computers and Devices for Communication (CODEC). A two day Workshop Nanostructures, Applications and Goals (NAG) was held prior to CODEC to felicitate its illustrious teacher Prof. B. R. Nag. Next year an Indo-French Workshop Quantum Semiconductor Structures: Modern Developments (QUASEMOD) was also organized by the Institute. With continuation of CAS status, new areas of research, e.g., Atmospheric pollution and greenhouse gases, mm wave propagation, GPS, satellite communication, photonics, etc. were undertaken. With funding from the Indian Space Research Organization (ISRO) a Centre named as **S. K. Mitra Centre for Space Weather** was established in the Institute in 2002.

The Technical Education Quality Improvement Program (TEQIP): a joint venture of World Bank-MHRD, Govt. of India, was introduced in West Bengal in 2002. The University College of Technology (UCT-CU) was identified as one of the lead Institution. As a department of UCT-CU INRAPHEL received some equipment and other support under the program.

The CAS status has been extended to cover the years 2005-2010 on recommendation of a Review committee that visited the Centre in March 2005.

UGC was entrusted to identify 10 Networking Resource Centres, two each in Physical, Chemical, Biological, Mathematical and Materials Sciences in the country. In the first phase CAS in RPE has been given this status.

The Government of West Bengal decided to create a Centre for Research and Training in Microaves and Millimeter waves pooling the resources of the Training program in MM wave technology. The Centre starts its activities in 2008.

A new centre: Centre fur TeleInFrastructur : India (CTIF-India) has been established in the Institute on December 07, 2007.

ISRO has selected University of Calcutta for financial support under the programme of "Strengthening of Space Science Activities at Universities".

List of Former CAS Directors/ Coordinators

| No | Name | Period |
|----|--|-------------|
| 1. | Prof. J. N. Bhar | 1963-1976 |
| 2. | Prof. M. K. Das Gupta | 1976 – 1980 |
| 3. | Prof. B. R. Nag | 1980 – 1992 |
| 4. | Prof. S. K. Roy : Coordinator Prof. N. G. Nath: Deputy Coordinator | 1992 – 1997 |
| 5. | Prof. N. Purkait: Coordinator Prof. P. K. Saha : Deputy Coordinator | 1997 – 2005 |

ANNEXURE-I(A)

University of Calcutta

Structure of 3-year (6 semester) B.Tech. Course in RADIO PHYSICS AND ELECTRONICS

L : Lecture; T : Tutorial; P : Practical; C : Total Credits Earned;

Numbers under L, T, and P indicate contact hours/week

| | Title of Paper | L | T | P | C |
|---------------------|---|---|---|---|---|
| Semester I | | | | | |
| RP1.1.1 | Analytical and Numerical Methods | 3 | 2 | 0 | 5 |
| RP1.1.3 | Network Analysis | 3 | 1 | 0 | 4 |
| RP1.1.4 | Electromagnetic Fields and Waves | 3 | 0 | 0 | 3 |
| RP1.1.6 | Physics of Semiconductor Devices | 3 | 1 | 0 | 4 |
| RP1.1.7 | Analog Circuits | 3 | 0 | 0 | 3 |
| RP1.1.8 | Circuit Elements and Measurements | 0 | 0 | 3 | 2 |
| RP1.1.10 | Programming Language | 0 | 2 | 3 | 4 |
| RP1.1.11 | Engineering Drawing | 0 | 0 | 3 | 2 |
| RP1.1.12 | Workshop Practice | 0 | 0 | 3 | 2 |
| Semester II | | | | | |
| RP1.2.1 | Network Synthesis and Transmission Networks | 3 | 1 | 0 | 4 |
| RP1.2.3 | Logic and Switching Circuits | 3 | 1 | 3 | 6 |
| RP1.2.4 | Signals and Systems | 3 | 0 | 3 | 5 |
| RP1.2.5 | Microelectronics Materials and Technology | 3 | 0 | 0 | 3 |
| RP1.2.6 | Guided Wave Transmission | 3 | 1 | 0 | 4 |
| RP1.2.8 | Analog Electronics and Simulation | 0 | 1 | 3 | 3 |
| RP1.2.9 | Transmission Line and Antenna Experiments | 0 | 0 | 3 | 2 |
| Semester III | | | | | |
| RP2.1.1 | Digital Techniques | 3 | 1 | 0 | 4 |
| RP2.1.2 | Computer Organization and Architecture | 3 | 0 | 0 | 3 |
| RP2.1.3 | Analog Instrumentation and Measurements | 3 | 0 | 0 | 3 |
| RP2.1.5 | Communication Systems | 3 | 0 | 0 | 3 |
| RP2.1.6 | Electrical Machines and Power | 3 | 0 | 0 | 3 |

| | | | | | |
|------------------------|--|---|---|---|---|
| | Electronics | | | | |
| | Elective 1 (from) | 3 | 0 | 0 | 3 |
| | RP2.1.9 Computer Networking | | | | |
| | RP2.1.10 Space Climatology and Weather | | | | |
| | RP2.1.11 Control Systems | | | | |
| RP2.1.12 | Digital Technique Experiments | 0 | 0 | 3 | 2 |
| RP2.1.13 | Communication Techniques | 0 | 0 | 3 | 2 |
| RP2.1.14 | Solid State Device Measurements | 0 | 0 | 3 | 2 |
| RP2.1.17 | Experiments with Electrical Machines | 0 | 0 | 3 | 2 |
| Semester IV | | | | | |
| RP2.2.1 | Heterostructure Devices | 3 | 1 | 0 | 4 |
| RP2.2.3 | Digital Communication | 3 | 0 | 0 | 3 |
| RP2.2.4 | Microprocessor and Interfacing | 3 | 1 | 3 | 6 |
| RP2.2.5 | Digital Signal Processing | 3 | 0 | 3 | 5 |
| RP2.2.6 | Digital Instrumentation and Measurements | 3 | 0 | 0 | 3 |
| | Elective 2 (from) | 3 | 0 | 0 | 3 |
| | RP2.2.2 Telecommunications | | | | |
| | RP2.2.7 Video and Multimedia Techniques | | | | |
| | RP2.2.8 Mobile and Satellite Communications | | | | |
| RP2.2.12 | Digital Communication Experiments | 0 | 0 | 3 | 2 |
| RP2.2.14 | Microwave Circuits Experiments | 0 | 0 | 3 | 2 |
| RP2.2.15 | Instrumentation and Measurements | 0 | 0 | 3 | 2 |
| Semester V | | | | | |
| RP3.1.1 | Microwave and mm-wave Engineering | 3 | 1 | 0 | 4 |
| RP3.1.3 | VLSI Design | 3 | 0 | 0 | 3 |
| RP3.1.4 | Optical Communication and Networking | 3 | 0 | 0 | 3 |
| RP3.1.5 | Economics and Management | 3 | 0 | 0 | 3 |
| | Elective 3 | 3 | 0 | 0 | 3 |
| | Elective 4 | 3 | 0 | 0 | 3 |
| Elective 3 & 4 from | RP3.1.6 Microwave and Wireless Components | | | | |

| | | | | | | |
|--------------------|----------|-------------------------------------|---|---|---|---|
| | RP3.1.7 | Microwave Antenna | | | | |
| | RP3.1.8 | Radar and Navigational Electronics | | | | |
| | RP3.1.9 | High Frequency Devices and Circuits | | | | |
| | RP4.1.4 | Advanced Communication Systems | | | | |
| | RP3.1.10 | Quantum Effect Devices | | | | |
| RP3.1.16 | | VLSI Design Methodology | 0 | 0 | 3 | 2 |
| RP3.1.17 | | Optical Communication Experiments | 0 | 0 | 3 | 2 |
| RP3.1.18 | | Electronic Design and Simulation | 0 | 0 | 3 | 2 |
| RP3.1.19 | | Foundation of Project Work | 0 | 0 | 3 | 2 |
| Semester VI | | | | | | |
| RP3.2.1 | | General Viva Voce | 0 | 0 | 0 | 4 |
| RP3.2.2 | | Project Work: Final | 0 | 0 | 9 | 6 |

ANNEXURE-I(B)

University of Calcutta

Structure of 3-year (6 semester) B.Tech. Course in INFORMATION TECHNOLOGY

L : Lecture; T : Tutorial; P : Practical; C : Total Credits Earned;

Numbers under L, T, and P indicate contact hours/week

| | Title of Paper | L | T | P | C |
|---------------------|---|---|---|---|---|
| Semester I | | | | | |
| RP1.1.2 | Discrete Mathematics | 3 | 2 | 0 | 5 |
| RP1.1.3 | Network Analysis | 3 | 1 | 0 | 4 |
| RP1.1.5 | Transmission Engineering | 3 | 0 | 0 | 3 |
| RP1.1.6 | Physics of Semiconductor Devices | 3 | 1 | 0 | 4 |
| RP1.1.7 | Analog Circuits | 3 | 0 | 0 | 3 |
| RP1.1.9 | Web Design | 0 | 0 | 3 | 2 |
| RP1.1.10 | Programming Language | 0 | 2 | 3 | 4 |
| RP1.1.11 | Engineering Drawing | 0 | 0 | 3 | 2 |
| RP1.1.12 | Workshop Practice | 0 | 0 | 3 | 2 |
| Semester II | | | | | |
| RP1.2.2 | Data Structures I | 3 | 1 | 0 | 4 |
| RP1.2.3 | Logic and Switching Circuits | 3 | 1 | 3 | 6 |
| RP1.2.4 | Signals and Systems | 3 | 0 | 3 | 5 |
| RP1.2.5 | Microelectronics Materials and Technology | 3 | 0 | 0 | 3 |
| RP1.2.7 | Operating Systems | 3 | 0 | 0 | 3 |
| RP1.2.8 | Analog Electronics and Simulation | 0 | 1 | 3 | 3 |
| RP1.2.10 | System Administration | 0 | 0 | 3 | 2 |
| Semester III | | | | | |
| RP2.1.1 | Digital Techniques | 3 | 1 | 0 | 4 |
| RP2.1.2 | Computer Organization and Architecture | 3 | 0 | 0 | 3 |
| RP2.1.4 | RDBMS | 3 | 0 | 0 | 3 |
| RP2.1.7 | Data Structures II | 3 | 1 | 0 | 4 |
| RP2.1.8 | Algorithms | 3 | 1 | 0 | 4 |
| RP2.1.9 | Computer Networking | 3 | 0 | 0 | 3 |

| | | | | | |
|------------------------|--------------------------------------|--------------------------------------|---|---|---|
| RP2.1.12 | Digital Techniques Experiments | 0 | 0 | 3 | 2 |
| RP2.1.13 | Communication Techniques | 0 | 0 | 3 | 2 |
| RP2.1.15 | Computer Networking Experiments | 0 | 0 | 3 | 2 |
| RP2.1.16 | RDBMS Design | 0 | 0 | 3 | 2 |
| Semester IV | | | | | |
| RP2.2.2 | Telecommunications | 3 | 0 | 0 | 3 |
| RP2.2.3 | Digital Communication | 3 | 0 | 0 | 3 |
| RP2.2.4 | Microprocessor and Interfacing | 3 | 1 | 3 | 6 |
| RP2.2.5 | Digital Signal Processing | 3 | 0 | 3 | 5 |
| | Electives 1 | 3 | 0 | 0 | 3 |
| | Elective 2 | 3 | 0 | 0 | 3 |
| Electives 1 and 2 from | RP2.2.7 | Video and Multimedia Techniques | | | |
| | RP2.2.8 | Mobile and Satellite Communications | | | |
| | RP2.2.9 | Computer Graphics | | | |
| | RP2.2.10 | Instrumentation and Control | | | |
| | RP2.2.11 | Pattern Recognition | | | |
| RP2.2.12 | Digital Communication Experiments | 0 | 0 | 3 | 2 |
| RP2.2.13 | Object Oriented Programming | 0 | 0 | 3 | 4 |
| Semester V | | | | | |
| RP3.1.2 | Software Engineering | 3 | 1 | 0 | 4 |
| RP3.1.3 | VLSI Design | 3 | 0 | 0 | 3 |
| RP3.1.4 | Optical Communication and Networking | 3 | 0 | 0 | 3 |
| RP3.1.5 | Economics and Management | 3 | 0 | 0 | 3 |
| | Elective 3 | 3 | 0 | 0 | 3 |
| | Elective 4 | 3 | 0 | 0 | 3 |
| Elective 3 & 4 from | RP3.1.11 | Parallel and Distributed Computing | | | |
| | RP3.1.12 | Data Mining | | | |
| | RP3.1.13 | Mobile Computing | | | |
| | RP3.1.14 | Image Processing and Computer Vision | | | |
| | RP4.1.4 | Advanced Communication Systems | | | |

| | | | | | | |
|--------------------|----------|--------------------------------------|---|---|---|---|
| | Rp3.1.15 | Artificial Intelligence and Robotics | | | | |
| RP3.1.16 | | VLSI Design Methodology | 0 | 0 | 3 | 2 |
| RP3.1.17 | | Optical Communication Experiments | 0 | 0 | 3 | 2 |
| RP3.1.18 | | Electronic Design and Simulation | 0 | 0 | 3 | 2 |
| RP3.1.19 | | Foundation of Project Work | 0 | 0 | 3 | 2 |
| Semester VI | | | | | | |
| RP3.2.1 | | General Viva Voce | 0 | 0 | 0 | 4 |
| RP3.2.2 | | Project Work: Final | 0 | 0 | 9 | 6 |

ANNEXURE-II (A)

Structure of 2-year M.Tech. Course in

Radiophysics and Electronics

(With effect from academic session 2007-2008)
(Semester-wise distribution of papers and Credits)

2 YEAR / 4 SEMESTER 'FULL TIME' COURSE

L : No. of Lecture Hours per week
T: No. of Tutorial hours per week
P : No.of hrs/week for a Practical paper;
C = C_L+C_T+C_P = Total CREDITS assigned to the paper

CT : Compulsory Theoretical Paper
ET : Elective Theoretical Paper
TW : Compulsory Thesis Work

C_L: Credits assigned to Lecture Course
C_T : Credits assigned to Tutorial
C_P: Credits assigned to Practical paper

CL : Compulsory Laboratory Paper
EL: Elective Laboratory paper
GVV:General Viva Voce

| PAPER | TITLE | L | T | P | C _L | C _T | C _P | C |
|--------------------|---|---|---|---|----------------|----------------|----------------|-----------|
| Semester I | | | | | | | | |
| CT1 | Mathematical Methods in Engineering | 3 | 2 | 0 | 3 | 2 | 0 | 5 |
| | OR | | | | | | | |
| | Discrete Mathematics | | | | | | | |
| CT2 | Engineering Electromagnetics | 3 | 2 | 0 | 3 | 2 | 0 | 5 |
| CT3 | Advanced Communication Principles | 3 | 2 | 0 | 3 | 2 | 0 | 5 |
| CT4 | Physics of Semiconductor Devices | 3 | 2 | 0 | 3 | 2 | 0 | 5 |
| CL1 | Lab Work: CAD Lab | 0 | 0 | 3 | 0 | 0 | 2 | 2 |
| CL2 | Computational Techniques | 0 | 0 | 3 | 0 | 0 | 2 | 2 |
| ET1 | Elective Theoretical paper-1 | 3 | 0 | 0 | 3 | 0 | 0 | 3 |
| ET2 | Elective Theoretical paper-2 | 3 | 0 | 0 | 3 | 0 | 0 | 3 |
| | Total Credits of Semester I | | | | | | | 30 |
| Semester II | | | | | | | | |
| CT5 | Electronic & Optoelectronic Technologies | 3 | 0 | 0 | 3 | 0 | 0 | 3 |
| CT6 | Advanced Electronic Materials and Devices | 3 | 2 | 0 | 3 | 2 | 0 | 5 |
| CT7 | Space Science and Technology | 3 | 2 | 0 | 3 | 2 | 0 | 5 |
| CT8 | Java Programming | 3 | 0 | 3 | 3 | 0 | 2 | 5 |
| EL1 | Advanced Measurement Lab | 0 | 0 | 3 | 0 | 0 | 2 | 2 |
| EL2 | Design Paper | 0 | 0 | 6 | 0 | 0 | 4 | 4 |
| ET3 | Elective Theoretical paper-3 | 3 | 0 | 0 | 3 | 0 | 0 | 3 |
| ET4 | Elective Theoretical paper-4 | 3 | 0 | 0 | 3 | 0 | 0 | 3 |

| | | | | | | | |
|-----|---|---|---|----|---|---|------------|
| | TOTAL CREDITs of Semester II | | | | | | 30 |
| | Semester III | | | | | | |
| TW1 | Compulsory THESIS Work (Foundation) | | | | | | |
| | Sessional Work | 0 | 0 | 21 | 0 | 0 | 14 |
| | VivaVoce | | | | | | 6 |
| GVV | General Viva Voce | | | | | | 10 |
| | TOTAL CREDITs of Semester III | | | | | | 30 |
| | Semester IV | | | | | | |
| TW2 | Compulsory THESIS Work (Final) | | | | | | |
| | Sessional Work | 0 | 0 | 21 | 0 | 0 | 14 |
| | Dissertation | | | | | | 6 |
| | Viva voce | | | | | | 10 |
| | TOTAL CREDITs of Semester IV | | | | | | 30 |
| | TOTAL CREDITs OF FULL TIME M.TECH COURSE | | | | | | 120 |

List of Elective Papers

- | | |
|---|---|
| 1. Advanced Semiconductor Theory | 2. Quantum Electronics |
| 3. Nanoelectronics | 4. Nanophotonics |
| 5. Modeling of Semiconductor Process Technology | 6. Modeling of Microwave Semiconductor Devices |
| 7. Microelectronics Technology | 8. VLSI Circuits and Systems |
| 9. Design Verification and Testing | 10. Low Power CMOS Design |
| 11. RF, Analog and Mixed Signal Design | 12. Processor Organization and Architecture |
| 13. Embedded Systems | 14. Design of VLSI CAD Tools |
| 15. ASIC/Memory Design | |
| 1. Microwave & mm Wave Devices and Circuits | 2. RADAR Engineering Systems |
| 3. Fibre Optic Links and Networks | 4. Photonics |
| 5. Microwave & mm Wave Antenna | 6. Modeling of Microwave Semiconductor Devices* |
| 7. Computational Electromagnetics | 8. Digital Signal Processing * |
| 1. Radio Wave Propagation | 2. Space Science |
| 3. Microwave & mm Wave Communication Systems | 4. Remote Sensing |
| 5. Radio Astronomy Techniques | 6. Internet Technology and Applications |
| 7. Navigational Electronics | 8. Information Theory and Coding |
| 9. Channel and Speech Coding | 10. EMI and EMC |
| 11. Advanced Communication Techniques | 12. Computer Communication |
| 13. Wireless Sensor Networks | |

ANNEXURE-II (B)

COURSE STRUCTURE OF M. TECH. IN “VLSI DESIGN” (Semester-wise distribution of papers and Credits) 2 YEAR / 4 SEMESTER ‘FULL TIME’ COURSE

L : No. of Lecture Hours per week
 T: No. of Tutorial hours per week
 P : No.of hrs/week for a Practical paper;
 C = C_L+C_T+C_P = Total CREDITs assigned to the paper
 CT : Compulsory Theoretical Paper
 ET : Elective Theoretical Paper
 TW : Compulsory Thesis Work

C_L: Credits assigned to Lecture Course
 C_T : Credits assigned to Tutorial
 C_P: Credits assigned to Practical paper
 CL : Compulsory Laboratory Paper
 EL: Elective Laboratory paper
 GVV:General Viva Voce

| PAPER | TITLE | L | T | P | C _L | C _T | C _P | C |
|---------------------------------------|--|---|---|---|----------------|----------------|----------------|-----------|
| Semester I | | | | | | | | |
| CT1 | Discrete Mathematics: Graph Theory and Combinatorics | 3 | 2 | 0 | 3 | 2 | 0 | 5 |
| CT2 | Data Structures and Algorithms | 3 | 2 | 0 | 3 | 2 | 0 | 5 |
| CT3 | Physics of VLSI Devices | 3 | 0 | 0 | 3 | 0 | 0 | 3 |
| CT4 | Microelectronics Technology | 3 | 0 | 0 | 3 | 0 | 0 | 3 |
| CT5 | VLSI Circuits and Systems | 3 | 0 | 0 | 3 | 0 | 2 | 3 |
| CL1 | CAD Techniques | 0 | 0 | 9 | 0 | 0 | 6 | 6 |
| ET1 | Elective Theoretical paper-1 | 3 | 2 | 0 | 3 | 2 | 0 | 5 |
| TOTAL CREDITS of Semester I | | | | | | | | 30 |
| Semester II | | | | | | | | |
| CT6 | Design Verification & Testing | 3 | 2 | 0 | 3 | 2 | 0 | 5 |
| CT7 | Low Power Design | 3 | 2 | 0 | 3 | 2 | 0 | 5 |
| CT8 | RF, Analog and Mixed Signal Design | 3 | 2 | 0 | 3 | 2 | 0 | 5 |
| CT8 | Java Programming | 3 | 0 | 3 | 3 | 0 | 2 | 5 |
| CL2 | CAD Techniques II | 1 | 0 | 6 | 1 | 0 | 4 | 5 |
| ET2 | Elective Theoretical paper-2 | 3 | 2 | 0 | 3 | 2 | 0 | 5 |
| ET3 | Elective Theoretical paper-3 | 3 | 2 | 0 | 3 | 2 | 0 | 5 |
| TOTAL CREDITS of Semester II | | | | | | | | 30 |
| Semester III A (3 months) | | | | | | | | |
| CL3 | FPGA Laboratory | 0 | 0 | 6 | 0 | 0 | 4 | 4 |
| CS1 | Seminar | 0 | 0 | 6 | 0 | 0 | 4 | 4 |
| GVV | General Viva Voce | | | | | | | 10 |
| TOTAL CREDITS of Semester IIIA | | | | | | | | 18 |

| | | | | | | | |
|----------------------------------|---|---|---|----|---|---|------------|
| Semester III B (3 months) | | | | | | | |
| TW1 | Compulsory THESIS Work (Foundation) | | | | | | |
| | Sessional Work | 0 | 0 | 12 | 0 | 0 | 8 |
| | VivaVoce | | | | | | 4 |
| | TOTAL CREDITs of Semester IIIB | | | | | | 12 |
| | TOTAL CREDITs of Semester III | | | | | | 30 |
| Semester IV | | | | | | | |
| TW2 | Compulsory THESIS Work (Final) | | | | | | |
| | Sessional Work | 0 | 0 | 21 | 0 | 0 | 14 |
| | Dissertation | | | | | | 6 |
| | Viva Voce | | | | | | 10 |
| | TOTAL CREDITs of Semester IV | | | | | | 30 |
| | TOTAL CREDITs OF FULL TIME M.TECH COURSE | | | | | | 120 |

NOTE: Choice of Elective Papers

ET1: Elective Theoretical paper – I is to be chosen from:

- (i) OOProgramming & Language Translation
- (ii) Physics of Semiconductor

ET2 & ET3: Elective Theoretical papers II & III are to be chosen from:

- (iii) Processor Organization and Architecture
- (iv) Digital Signal Processing
- (v) Embedded Systems
- (vi) Design of VLSI CAD Tools
- (vii) ASIC/Memory Design
- (viii) Nano-electronics
- (ix) Nano-photonics

ANNEXURE III (A)
Course Structure of M. Tech in Radio Physics and Electronics
under Dual Degree Program

Semester I to IV will be the same as in B. Tech Curriculum

Semester – V will be the same as in B. Tech Curriculum except RP3.1.19 – Foundation of Project Work being replaced by RP 4.2.9 – Seminar

| | | | L | T | P | C |
|---|--|---|----------|----------|----------|------------|
| | RP 4.2.9 | Seminar | 0 | 0 | 3 | 2 |
| | Total Credit of Semester I to V (B. Tech) | | | | | 140 |
| | Semester VI | | | | | |
| In addition to the Project and General Viva voce, the student is required to take the following courses | | | | | | |
| 1. | RP4.2.1 | Advanced Electronic Materials and Devices | 3 | 0 | 0 | 3 |
| 2. | RP 4.2.2 | Space Science & Technology | 3 | 0 | 0 | 3 |
| 3. | RP4.2.6 | Java Programming | 3 | 1 | 3 | 6 |
| 4. | Elective 3 | | 3 | 2 | 0 | 5 |
| 5. | Elective 4 | | 3 | 2 | 0 | 5 |
| | Semester Credit (B. Tech) | | | | | 10 |
| | Semester Credit (M. Tech) | | | | | 22 |
| | Semester VII A | | | | | |
| 1. | RP5.1.2 | Advanced Electronic Measurements | 0 | 0 | 6 | 4 |
| 2. | RP5.1.3 | Comprehensive Viva Voce | 0 | 0 | 0 | 12 |
| | Semester VII B | | | | | |
| 1. | RP 5.1.4 | Compulsory THESIS Work: (Foundation) | | | | |
| | | Sessional Work | 0 | 0 | 12 | 8 |
| | | Viva Voce | 0 | 0 | 0 | 4 |
| | Semester Credit (M. Tech) | | | | | 28 |
| | Semester VIII | | | | | |
| 1. | RP5.2.1 | Compulsory THESIS Work (Final) | | | | |
| | | Sessional Work | 0 | 0 | 21 | 14 |
| | | Dissertation | 0 | 0 | 9 | 6 |
| | | Viva Voce | 0 | 0 | 0 | 10 |
| | Semester Credit (M. Tech) | | | | | 30 |
| | Total Course Credit (M. Tech) | | | | | 150 |
| | Total Course Credit (B. Tech) | | | | | 80 |
| | | | | | | 230 |

* Electives should be selected from RP 4.1.3, RP 4.1.6, RP 4.2.3, RP 4.2.4, RP 4.2.5, RP6.0.1 through RP 6.0.31

ANNEXURE II(D)
Course Structure of M. Tech in VLSI Design
under Dual Degree Program

Semester I to IV will be the same as in B. Tech Curriculum

Semester – V will be the same as in B. Tech Curriculum except RP3.1.19 – Foundation of Project Work being replaced by RP 4.2.9 – Seminar

| | | | L | T | P | C |
|---|------------|--------------------------------------|----------|----------|----------|------------|
| 1. | RP 4.2.9 | Seminar | 0 | 0 | 3 | 2 |
| Total Credit of Semester I to V (B. Tech) | | | | | | 140 |
| Semester VI | | | | | | |
| In addition to the Project and General Viva voce, the student is required to take the following courses | | | | | | |
| 1. | RP4.2.3 | Design Verification and Testing | 3 | 2 | 0 | 5 |
| 2. | RP4.2.4 | Low Power Design | 3 | 2 | 0 | 5 |
| 3. | RP4.2.5 | RF, Analog and Mixed Signal Design | 3 | 2 | 0 | 5 |
| 4. | Elective 1 | | 3 | 2 | 0 | 5 |
| Semester Credit (B. Tech) | | | | | | 10 |
| Semester Credit (M. Tech) | | | | | | 20 |
| Semester VII A | | | | | | |
| 1. | RP5.1.1 | CAD Techniques – II | 0 | 2 | 6 | 6 |
| 2. | RP5.1.2 | Comprehensive Viva Voce | 0 | 0 | 0 | 12 |
| Semester VII B | | | | | | |
| 1. | RP5.1.3 | Compulsory THESIS Work: (Foundation) | | | | |
| | | Sessional Work | 0 | 0 | 12 | 8 |
| | | Viva Voce | 0 | 0 | 0 | 4 |
| Semester Credit (M. Tech) | | | | | | 30 |
| Semester VIII | | | | | | |
| 1. | RP5.2.1 | Compulsory THESIS Work (Final) | | | | |
| | | Sessional Work | 0 | 0 | 21 | 14 |
| | | Dissertation | 0 | 0 | 9 | 6 |
| | | Viva Voce | 0 | 0 | 0 | 10 |
| Semester Credit (M. Tech) | | | | | | 30 |
| Total Course Credit (B. Tech) | | | | | | 150 |
| Total Course Credit (M. Tech) | | | | | | 80 |
| Grand Total | | | | | | 230 |

* Electives should be selected from RP2.2.6, RP6.0.1 through RP6.0.7 and RP6.0.26 through RP6.0.31

ANNEXURE – IV(A)

A Report on the Activities of S.K. MITRA CENTRE FOR RESEARCH IN SPACE ENVIRONMENT

Late Professor Sisir Kumar Mitra, FRS, is the pioneer of radio and space researches in this part of the globe. He established the Institute of Radio Physics and Electronics of this University in 1949 with his school of space physicists as its core group. The activities of this Institute were subsequently expanded to cover areas like Solid State Electronics, Computer and System Science, in addition to the Ionosphere and Wave Propagation. In recent years, however, the research interest of the Ionosphere and Wave Propagation Group was limited to some selected areas due to lack of funds and manpower. However, the scientific contributions in those limited areas have been significant and internationally recognized. The University, with the support of Indian Space Research Organization (ISRO), proposed to establish a Centre in memory of Late Professor Sisir Kumar Mitra to undertake research in the existing as well as new fields, extending from troposphere to upper atmosphere. Professor R.N.Basu, former Vice Chancellor and Professor A.K.Banerjee, the Honorable Vice Chancellor, formally approached the Chairman, ISRO for providing financial support to the Centre. After prolonged interactions with Advisory Committee on Space Research (ADCOS) of ISRO four research proposals on the following topics with a total budget of Rs. 75.2 lakhs were sanctioned by ISRO Headquarters under the umbrella of the proposed Centre:

- (1) Atmospheric Electricity
- (2) Space Weather
- (3) Lower Atmospheric Chemistry
- (4) Radio Remote Sensing of the Atmosphere

Late Dr. A.P. Mitra, FRS, played the key role in formulating the scientific programme of the Centre and extended his support as the then Chairman of ADCOS, ISRO. The Centre was formally inaugurated on 12 March 2002. The Institute of Radio Physics and Electronics was chosen as the nodal department to organize the Centre which will be inter-departmental in nature, involving the University departments like Radio Physics and Electronics, Physics, Chemistry, Atmospheric Sciences and Marine Science.

The first phase of the ISRO funded projects ended in March 2007. A set of proposals was submitted to ISRO HQ for the second phase and four projects were approved with the funds totaling Rs. 95.48 lakhs for the period 2007-2010. Apart from the projects approved directly by ISRO HQ, four other projects sanctioned by SAC, ISRO and CAWSES India, ISRO, have been carried out at the Centre. Through the implementation of these projects, the Centre participated in a number of ISRO supported national programmes such as, GAGAN, CAWSES, Megha Tropiques Mission, Ka-band Satellite Propagation, and the international programmes namely, SCINDA and COSMIC Satellite.

The following projects are presently being carried out at the Centre.

1. Radio Remote Sensing of the tropical atmosphere (phase II): Studies on Radio Environment and Climatic parameters in the tropical region

Name of the P.I : Prof. Animesh Maitra, Institute of Radio Physics & Electronics
Total Amount Sanctioned (2007-2010) :Rs 14.83 Lakhs

2. Ionosphere Space Weather in relation to satellite-based systems

Name of the P.I : Prof.Ashish Dasgupta, Institute of Radio Physics & Electronics

Name of the Co P.I : Sri Ashik Pal
Total Amount Sanctioned (2007-2010) :Rs 33.05 Lakhs

3. Monitoring Global Electricity Parameters

Name of the P.I : Prof. S.S.De, Institute of Radio Physics & Electronics
Name of the Co P.I : Dr. B.Bandopadhyay
Total Amount Sanctioned (2007-2010) : Rs 27.38 Lakhs

4. Aerosol formation and role of its chemical transformation and transport in the boundary layer at the land-ocean boundary condition of NE coast of Bay of Bengal

Name of the P.I : Prof. Subha Sen, Department of Chemistry
Name of the Co P.I : Prof. T.K.Jana, Department of Marine Science
Total Amount Sanctioned (2007-2010) : Rs 27.38 Lakhs

5. Studies on tropical rain and atmospheric water content using ground based measurements and satellite data related to Megha Tropiques Mission

Name of the P.I : Prof. Animesh Maitra, Institute of Radio Physics & Electronics
Total Amount Sanctioned (2007-2010) : Rs 29.34 Lakhs

ANNEXURE – IV(B)

UGC NETWORKING RESOURCE CENTRE IN PHYSICAL SCIENCES

The recommendation of the MHRD task force for Basic Scientific research in Universities as approved by the Government of India stated that “ There is a need to create 10 networking centres in basic sciences (two centres each in Physical Science, Chemical Science, Life Science, Materials Science and Mathematical Science) in leading departments of Universities in different parts of the country to promote collaborative research, access to advanced facilities and imparting training in frontier areas. These centres should be supported on a long term basis in a substantial manner to enable them to realize internationally competitive status. The system of both Winter and Summer Schools must be supported. Each subject area of basic sciences may offer up to ten programs a year. There should be provision for Visiting Fellowships for faculties within the country.”

The University Grants Commission accepted the guidelines proposed by the Empowered Committee for establishing the UGC Networking Centres. It was decided to identify three UGC networking Centres during the year 2007-2008, one each in Life Sciences, Physical Sciences and Chemical Sciences.

Accordingly, proposals were invited from SAP departments indicating the areas of Summer/Winter schools, types of training, available infrastructure, laboratories, equipment etc as well as expertise of faculties, and awards and honours received by them. The proposals were considered by the Empowered Committee and after their scrutiny Centre of Advanced Study in Radio Physics and Electronics (CASRPE), University of Calcutta, was invited to make a presentation at the UGC office, New Delhi, on November 20, 2007. The Empowered Committee advised the CASRPE to submit a revised proposal specifying the number of intakes in each type of training, proposed plan of work, etc.

The revised proposal submitted by CASRPE was given careful examination by the Empowered Committee, who decided to invite the representatives once again to meet them for further discussions. The date of the meeting was February 5, 2008. In the meeting the Empowered Committee informed that the Department of RPE has been selected as the Networking Centre. It is to be noted that this department is the sole Centre in Physical Science in the country.

The Centre will receive a fund of Rs. 5.00 crores for a period of 5 years.

Apart from holding summer/winter schools (~ 10 in 5 years) on well defined topics for faculties and researchers, the Centre will impart short term training to Ph.D and postdoctoral workers from other institutions of the country and allow them to share the expertise, equipment, internet, library and other facilities available in the department. The Faculties in the department will also advise fresh Ph.D. holders to initiate research programmes in emerging areas and help them train new Ph.D. workers. Students pursuing M.Sc., B. Tech and M. Tech courses will be given summer and vacation training. The Centre also plans to hold workshops in north eastern regions.

A website and a photobrochure are to be developed giving details of faculties, equipment and other facilities available, areas of training, topics of summer/winter schools, application formats for interested persons, etc.

A Summer School SemiNano and a Winter School MiSCom have been arranged, details for which are given in Annexure XI. The next Summer School entitled “Physics and Simulation Techniques for Nanoscale Electronic Devices” (NanoDev 09) will be held during June 1-19, 2009,

A few Ph.D. workers also visited the Centre and discussed their problems with the mentors.

ANNEXURE – IV(C)

Centre for Research and Training in Microwaves & Millimetrewaves

Microwaves and Millimeter waves are radio waves of wavelength in the range of 100 mm to 1mm. These waves were first put into practical use during World War II. Rapid development in various fields of Electronic Engineering thereafter has led to many new applications, in recent years, in the field of Communication, Information-highways, Instrumentation, Remote Sensing and Weather forecasting etc.

Keeping these application potentials in view, Department of Electronics, Govt. of India, under the Technology Development Programme of National Radar Council had initiated projects of R & D nature at the Institute of Radiophysics and Electronics, University of Calcutta, in the area of Microwaves and Millimeterwaves during 1980s. These covered studies related to wave propagation and remote sensing as part of the technology development programme of DOE. Subsequently with further financial support from other funding agencies, which include AICTE, MHRD, DST, DRDO, ADA, UGC and TISCO, different activities were undertaken in the form of delivering electronic hardware, system fabrication and installation at the user's premises and feasibility studies of various propagation impairments related to communication, radar, radiometry and remote sensing.

To sustain and propagate all these R&D activities in millimeterwave/microwave technology in the country, the need for creating scientific and technical manpower in the field was felt. In view of this, DOE, Govt. of India, offered Institute of Radiophysics and Electronics, University of Calcutta, to undertake a Training Programme in Millimeterwave Technology, for a five year period commencing from 1988. Undertaking the programme was possible because an infrastructure worth about Rs. 3 crores had already been developed with funds from various agencies. It is important to note that the programme of this type was the first of its kind in Eastern India.

Under this Programme, expert manpower and a resource group in this area have been developed and a number of consultancy jobs have been extended to the Defence Sectors, Department of Telecommunication, Department of Space, Department of Science and Technology. Further, a number of products developed through this Programme are used in Atmospheric Science.

During the last five years, Institute of Radiophysics and Electronics has organized several Refresher Courses and a Workshop, mainly on Microwave, Millimetrewave and Optical Communication, under the Training Programme. A one-year PG Diploma course on Microwave and Millimeterwave Technology has been launched but had to be held in abeyance after one batch of students passed out due to some administrative problems. The University of Calcutta with the concurrence from the Govt. of West Bengal, has decided to convert the Training Programme to a permanent centre. The Govt. of W.B. has decided to continue funding the Programme so that the Diploma Course is set to be revived. It is also being planned to upgrade the Diploma Course to full-fledged 4-semester M. Tech. in Microwave and Millimeterwave Engineering.

In consideration of the importance of microwaves and millimetrewaves and the expertise and infrastructure available in the department, the Government of west Bengal made a decision to create a permanent centre entitled **Centre for Research and Training in Microwaves and Millimetre waves** in the Institute. At present two existing Scientists working in the Training Programme are absorbed as faculties in the department. The Centre has One Research Fellow, one technical assistant and one Office Assistant.

The Centre started its activity in July 2008. A one day workshop entitled **Horizons of Microwave & Millimetrewave Engineering & Research (HOMMER)** was held on August 22, 2008 [see list of speakers and topics in Annexure VIII]. The Centre is planning to introduce an M. Tech programme in Radio Physics and Electronics with specialization in **Microwaves and Lightwaves**.

ANNEXURE IV (D)

Activities of CTIF-India

On December 7, 2007, a Memorandum of Agreement (MoA) was signed between the Institute of Radiophysics and Electronics, University of Calcutta, India and **Center for TeleInFrastuktur, CTIF, University of Aalborg, Denmark**, in the area of Wireless Communication Technology. The occasion saw the launching of **Center for TeleInFrastuktur (India), or CTIF-India**. Besides the parent body, this is the second CTIF established after the CTIF (Italy) in the University of Rome.

ANNEXURE – IV(E)

ISRO Programme on “Strengthening of Space Science Activities at Universities”

ISRO has selected University of Calcutta for financial support under the programme of "Strengthening of Space Science Activities at Universities". The selection was based on the past and present activities in the area of space science mainly pursued at the Institute of Radio Physics and Electronics. Mainly two areas, namely, space weather and radio remote sensing, in which already major research programmes are ongoing with funding from ISRO and which are parts of a number of National Programmes, are identified as the thrust areas in space science. The funding comprises of (i) one-time grant for equipment, (ii) support for two faculty positions for five years, and (iii) three M. Tech. Fellowships for five years. The programme has been approved by the Syndicate of the University and necessary actions are already taken to implement programme at this Institute as early as possible. The programme is expected to boost the space science activities, both teaching and research, in a major way at this institute.

ANNEXURE – V(A)

RESEARCH ACTIVITIES (EXECUTED)

Solid State Electronics & Circuits **(including VLSI & Nanoelectronics)**

Transport and Magnetotransport of Low Dimensional Systems

Mobility and magnetoresistance of two-dimensional electrons in CdSe single quantum wells (SQWs) are calculated in the temperature range of 4.2K- 30K incorporating deformation potential acoustic, piezoelectric, and background and remote ionized impurity scatterings using Fermi – Dirac statistics. The mobility agrees with the available experimental result at 4.2K, and is found to be limited mainly by the ionized impurity scattering in the temperature range considered. The magnetoresistance coefficient is found to be more sensitive than the mobility to the changes in the channel width, the background impurity concentration and the magnetic field.

Diffusion thermopower of the 2D electron gas in CdSe SQWs is calculated in the temperature range 1.4K–12K. The negative of the quantity is found to increase with temperature and the 2D electron concentration, and is mainly limited by ionized impurity scattering.

Longitudinal magnetoresistivity and Hall mobility of 2D electron gas in GaN quantum wells are calculated in the temperature range 3K-18K incorporating all relevant lattice scattering mechanisms. The variations of longitudinal magnetoresistivity with magnetic field and temperature agree with the available experimental results at temperature $T = 1.38\text{K}$.

Subband Structures of Quantum Ring

Tuning of intersubband transition in semiconductor Quantum Ring by electric field,

Physics and Simulation of Nano scale MOS

Analytical modeling for nanoscale MOSFETs has been developed and the devices have been simulated using the numerical device simulator ATLAS. MOS devices utilizing strained materials, high-k dielectrics together with innovative architectures such as dual gate MOSFETs have been employed in our studies. Different performance metrics pertaining to MOS devices have been evaluated using analytical and numerical approaches and the results have been compared with reported experimental results.

Silicon Photonics

The possibility of having direct band gap in tensile strained Ge layers grown on suitable pseudo substrates was examined. It has been found that when Ge layers are grown on a ternary alloy GeSiSn, the direct conduction band in Ge occurs at a lower energy than the usual conduction band minima at L point. The band line-up is also type I. However, the band gap is around 0.5-0.6 eV. To have a structure emitting at communication wavelength of 1550 nm, addition of slight amount of C in Ge layer becomes necessary. It was shown that SiGe alloy grown on GeSiSn can also lead to direct gap type I structure.

VLSI Devices and Circuits

An optimization-based algorithm to tackle the task of analog high-level design has been developed. Performance models of nano CMOS analog integrated circuits have been developed using least squares support vector machine. An automated topology generation procedure for sigma delta modulator system has been developed using state space concept and similarity transformation technique. A genetic algorithm-based optimization technique has been developed for high-level specification translation.

Microwave and Lightwave Technology

Conducting polymers at microwave frequencies

The method for determining the dielectric constant of rectangular samples of Teflon and Perspex at X-band reported earlier [IEEE-AEMC 2007] has been adapted to determine the same for cylindrically shaped samples. The results are in good agreement which indicate that the method may be applied for the determination of the complex permittivity of unknown samples.

The method has now been applied for the measurement of the permittivity and conductivity at X-band of medium loss samples like bakelite, ethylene vinyl acetate(EVA) and ethylene propylene diene M-class rubber(EPDM – a rubber composite) both doped with carbon nano particles. Results have been obtained for the dielectric constant and conductivity at different frequencies and also with sample thickness.

Printed Antennas

Microstrip antennas with rectangular and triangular geometries have been studied with different substrate and superstrate combinations. These studies were based on both theoretical and experimental investigations. The results are just published in several International journals.

A novel design using composite substrate for rectangular patch has been proposed very recently. This configuration shows very interesting results indicating considerably high gain over a wide beamwidth. This is under revision at IEEE AP Transactions.

Dielectric Resonator Antennas

Different geometries and aspects of dielectric resonator antennas (DRA) have been studied. One major issue is the mutual coupling between two adjacent DRA elements placed on the same ground plane. We have developed a novel technique employing a compact defected ground structure (DGS) and have experimentally demonstrated about 5-6 dB suppression of the mutual coupling between two cylindrical DRAs. The DRAs have been fabricated by our collaborator in the National Institute of Interdisciplinary Science & Technology NIIST, Trivandrum. This result was reported in Electronics Letters July 2008 issue.

Several hybrid and composite DRA structures previously examined and reported by our group are now known to the DRA community for different wideband applications. Recently, we have investigated a couple of ring DRAs using conical and hemispherical shapes. Each of them, fed by electric monopole, can provide much improved matched bandwidth over at least 25% additional frequency band compared to its earlier versions. The theoretical design and verified data using commercial simulator have been reported. Further experimental studies with two sets of prototypes will be executed shortly.

Left-Handed (LH) materials

Extensive studies have been carried out at microwave frequency (both analytical and computer-aided modeling) to characterize the LH materials to understand the negative refraction and anomalous transmission properties of electromagnetic waves propagating through periodic LH material structures (Strip-wire and SRR combination type). Properties of Multiple inclusion magnetic structures like MSRR, SR and LR has also been investigated to tailor the resonant frequency, bandwidth and effective negative permeability realizable with such LH material structures and their suitability for millimeter-wave application has been explored.

Optical Communication

Work in this area involves the study of Travelling Wave Semiconductor Optical Amplifiers (TW-SOA). The following studies have been made:

- a) Crosstalk analysis in an all optical cross-connect (OXC);
- b) Ultrafast SOA-based all optical flip-flop for photonic switching without bit loss;
- c) Development of Photonic Simulation Tools;
- d) Application of the SOA model in photonic processing in all optical flip flop and photonic comparator;
- e) Development of a circuit model of SOA to include the electrical and chip parasites.

Si Photonic Devices

Recently Si/Ge MQWs have shown strong quantum confined Stark effect due to direct excitonic absorption in Ge layers. The experimental electroabsorption spectra in such structure has been fitted by two Gaussian curves and an exponential distribution. From the change of absorption induced by electric field the change in refractive index has been calculated by Kramers-Kronig relation, and several figures-of-merit for electroabsorption modulators, direction couplers and short pulse generators have been calculated and methods for optimization of these FOMs have been examined.

Photonic Devices in Communication

Studies have been made to estimate the responsivity of Resonant Cavity Enhanced (RCE) SiGe MQW pin photodetectors. Also work has been continuing on the characteristics of Translasers, QDIPs, Type-II Superlattice photodetectors, etc.

Component crosstalk in WDM system has also been examined.

Space and Atmospheric Science and Communication

Propagation effects on Ku-band Satellite Signal:

Depolarization

The phenomenon of depolarization of a Ku band satellite signal caused by rain has been studied with a simple experimental system in which the attenuation of the co-polar component and the enhancement of the cross-polar component signal have been measured at a tropical location. The depolarization effect at Ku-band has been assessed in terms of the degradation of XPD. The presence of large raindrops causes an increased depolarization for identical co-polar attenuations during a rain event. The XPD degradations obtained with the present data are comparable to that obtained from the ITU-R model on the basis of whole year's data, although the model somewhat overestimates the experimental data at the higher values of co-polar attenuation. The monsoon months, compared to other months of the year, show an enhancement in the occurrence of depolarization effect at the present tropical location.

Scintillations

Scintillations of a Ku-band satellite signal are observed in association with rain attenuation at Kolkata, India. The wavelet analysis of signal fluctuations, due to simultaneous occurrence of scintillations and attenuation, reveals the relative impact of different scales of refractivity structures on the signal at different instants of time. A positive relationship exists between the peaks in the global wavelet spectrum due to attenuation and scintillations. The power-law relationship between the standard deviation of high-pass filtered fast fluctuations and the attenuation value during rain events indicates that scintillations can be caused by both thin and thick layer of turbulence during rain.

Climatic Parameter Studies

Rain Dropsize Distribution

The DSD variation of rain in tropical region can show the characteristic features of different types of rain, namely, stratiform, transitional and convective. The distinctive features can also be noticed by the rain decay parameter, indicative of horizontal extent, which can be obtained from the rain attenuation measurement over an earth-space path. The convective rain has small and highly varying spatial coverage and associated with high rain rates whereas the stratiform type has large spatial extent with relative smaller rain rates. The modeling of rain decay parameter for different types of rain enables rain attenuation prediction over an earth-space path from ground based rain rate measurement with reasonable success. Long term data are required to have a reliable model of decay parameter for more consistent prediction of rain attenuation, particularly at high rain rates.

Liquid Water Content

The profile of cloud liquid water density and the total liquid water content (LWC) are obtained from the radiosonde data using the Salonen model at Kolkata, India, a tropical location. The cumulative distribution LWC shows a departure from the ITU-R model at this location, exhibiting a significantly enhanced occurrence during the monsoon months. The cloud attenuation, derived by integrating the profile of specific attenuation obtained from the radiosonde data, is related to LWC at different frequencies in the range 10-100 GHz. A comparison indicates that the cloud attenuation at frequencies below 50 GHz is somewhat overestimated by the ITU-R model generated values and significantly underestimated by the ITU-R model at frequencies above 70 GHz at the present location.

Effects of magnetic storms on equatorial ionospheric scintillations

The response of equatorial scintillations to the prompt penetration of magnetospheric electric field to equatorial latitudes has been studied by combining L-band and VHF scintillations near the northern crest of the equatorial anomaly and global ion density plots of DMSP over nearly one solar cycle (1996-2005). It is suggested that the penetration of the magnetospheric electric field to the equatorial latitudes is dependent on the local time; subsequent to a large reversal of the interplanetary magnetic field with $B_z \geq 10\text{nT}$ at the magnetopause to the southward direction, ESF is generated in a narrow longitude sector corresponding to the local dusk time only due to an enhanced eastward electric field. ESF is rather inhibited at other longitudes with non-dusk local time. ESF activity within 3 hours of southward B_z maximum may be attributed to the prompt penetration of the magnetospheric electric field. The effect of region 1 current dominates over the shielding region 2 current and is confined to a narrow longitude sector where the local time is near dusk. As it takes a finite time for the solar wind to propagate from the satellite ACE to the magnetopause, the large B_z southward turning may be used for forecasting of equatorial spread F , which causes system outages

GPS TEC and Phase Fluctuations

A software-based dual-frequency high-resolution GPS receiver is operational at the Institute of Radio Physics and Electronics for precision measurements of ionospheric Total Electron Content (TEC) and phase. This institute is also a part of the international SCINDA (**SC**Intillation **N**etwork **D**ecision **A**id) program of the US Air Force where an ionospheric TEC monitor provides data which is continuously uploaded to the SCINDA website. Scintillations are usually not observed at L-band from Calcutta during the present low sunspot number years except for some isolated cases of field-alignment of equatorial plasma bubbles. On those days, data from the software-based GPS receiver recorded at 50Hz have been combined with the SCINDA measurements to detect phase perturbations at GPS L1 frequency associated with TEC bite-outs and fluctuations in carrier-to-noise (CNO) ratios on GPS links in the post-sunset hours. These are perhaps the first GPS phase scintillation studies from India.

Development of Ionospheric Scintillation Models

The Earth's ionized upper atmosphere often becomes turbulent and develops electron density irregularities. In the presence of a relative motion between the satellite, the ionosphere and the receiver,

the different parameters of the signals like amplitude, phase and polarization may be severely affected. The irregularities cause scintillation of the above parameters, for which the performance of communication and navigation is degraded. The amplitude of the two geostationary satellite signal (FLEETSATCOM (73⁰ E) (350 km subionospheric point: 21.10⁰ N, 87.25⁰ E geographic; 28.65⁰ N magnetic dip, 15.28⁰ N dip latitude) and INMARSAT (65⁰E) (350 km subionospheric point: 21.09⁰ N, 86.59⁰ E geographic; 28.74⁰ N magnetic dip, 15.33⁰ N dip latitude)) is recorded at Kolkata over one solar cycle. The data are analyzed to find out the Scintillation Index (S. I.) of the amplitude from 1996 to 2006. The long term analysis helps to know about the dependency of scintillation activity on local time, season and solar cycle. Using the data of percentage occurrence of scintillation for magnetically quiet day (Dst \geq -50 nT) a scintillation occurrence model is developed for the rising phase of the solar cycle 1996-2001 from Neural Network.

Mobile Communication

Investigations were made on a CDMA based audio watermarking Scheme for wireless and Mobile Telecommunications

Systems Science

Expert Systems

Work has been carried out in the domain of expert system design, system identification, prediction and control system design. A doctoral dissertation entitled “Extraction of Optimal Fuzzy Rules for Identification, Prediction and Control of Nonlinear Systems” was submitted on October, 2008 in Jadavpur University.

Medical Imaging Technique

Computer-Aided Diagnosis techniques are developed for AI based decision making system to assist the clinicians for therapeutic procedures. Presently multiresolution based automated segmentation methodologies are proposed for early detection of tumors.

Medical image acquisition using different modalities like X-ray, CT, MR, PET, SPECT, US are increasingly being used by the clinicians for therapy planning. Therefore a need exists to bring different modality images in a common platform for the purpose of information processing. Keeping this in view, the present research is based on the analysis of multimodal medical images to identify and recognize the tumor lesions more accurately.

Radiological images are used as an important tool in medical diagnosis and evaluations. This motivates us to derive different image fusion algorithms to combine the useful complementary information from multi-modal images into a single composite image that is more informative and is more suitable for visual perception or computer processing.

Mechatronics

An intelligent approach of assembling gear box components using Mechatronic Principles was studied.

Computational Geometry

Research work was done on Proximity problems, Covering Problems, and Visibility Problems.

ANNEXURE – V(B)

RESEARCH ACTIVITIES (PROPOSED)

Solid State Electronics and Circuits

Quantum Nanostructures

Subband structures and the effect of electric field on them will be continued. The properties of Carbon Nanotube FETs will be investigated.

Nano-MOS

Performance optimization of nano MOS devices with respect to higher speed coupled with lower power will be investigated. Devices constructed using high-k dielectrics, strained channel materials and employing different structures will be included in our analysis. Technology characterization will be carried out with a view to making the devices suitable for analog circuit applications.

Si Photonics

The search for direct gap type I heterostructures on Si platform will be continued. In addition, the characteristics of lasers made of the heterostructures and QWs, e.g., gain spectra, loss, threshold current, etc will be estimated.

VLSI Devices and Circuits

Performance modeling of nano CMOS analog systems: The earlier work will be extended for complete analog systems. Use of artificial neural network will also be studied for performance modeling purpose.
Statistical design and optimization of analog circuits: The effect of variation of process parameters on circuit performances will be studied. Accordingly an optimization framework will be formulated to make the circuits robust.

Microwave and Lightwave Technology

Conducting Polymers

The studies will be extended to the measurement of these parameters for liquid samples of conducting polymers.

Printed Antenna & DRA

Some new aspects evolved through our course of studies and experience will be pursued in the near future. Composite substrates with different compositions will be studied where we intend to incorporate square and circular shapes of the radiating elements. Defect in ground plane is another topic to be investigated. This is mainly to explore techniques to suppress cross-polarized radiation. After the pioneering work in this particular area done by our group in 2006, we have been trying to explore new defects and techniques. Indeed, the particular aspect is impossible to address theoretically and as such, a long and rigorous process is needed through a series of experimental investigations. We do hope to complete this investigation within next couple of years, which may usher new lights to the physical insight in to the cross-polar radiation from microstrips.

Limited ground plane is a big problem to microstrip people. Truncation leads to radiation hazards. We, therefore, have taken up a plan to explore this aspect using shaped ground planes for microstrips which can alleviate the shortcomings.

The DRA is known as a radiating structure although its excitation is not very simple. We intend to address this issue with twofold objectives: (i) where a DRA will act simply as a DR, but modifying the resonance and radiation of another radiating element and (ii) where a DRA will act as a secondary radiator, but modifying the resonance of the primary radiator significantly. This, we believe, will make the use of DRA more versatile.

Left-Handed (LH) material based IMPATT Oscillator and Multiplier

We have already started extensive studies on the properties of Composite Right Left Handed (CRLH) materials which can be used as zeroth-order resonator. Dispersion characteristics of such structures and their impedance characterization are under progress. We would use this information along with the Large-signal and Small-signal model developed by us for IMPATT diode to study the device-circuit interaction which will help us to design zeroth-order resonator based IMPATT oscillator, which our analysis shows to have the potential for design of very low phase noise (-140 dBc/Hz for frequency offset from carrier of 100KHz) IMPATT oscillator. Further, the Large-signal model developed for harmonic operation of IMPATT diode will help us to develop design methodology for IMPATT multipliers which can be useful for the development of higher millimeter-wave (140 GHz, 220GHz) sources using microwave IMPATT diode. These are the scheme of research we are looking forward to pursue in the coming year.

CPW-SRR based LH Filters

The Coplanar Waveguide (CPW) structure with multiple Split Ring Resonators (SRR) imprinted on the dielectric substrate of CPW is under investigation for possible use as miniaturized LH material based stop-band filter. The dispersion characteristics of such structure have been studied and parametric variation of SRR for suitable coupling to realize a broad stop-band with sharp roll-off is under study. We also plan to fabricate such LH filters with sophisticated printed circuit technology and to validate our modeling results with actual experimentation.

Optical Communication

It is proposed to analyze the critical parameters such as node configuration, maximum number of nodes, filter widths, channel spacing, signal input power, inter-node link loss and its variability, tapping ratio, and SOA small-signal gain in an optically amplified SOA based WDM ring network.

There have been substantial research and development efforts placed on implementing Fiber-To-The-Home (FTTH) networks to accommodate upcoming demands for various multimedia services in near future. Among the various options to the FTTH realization, the wavelength-division-multiplexed passive optical network (WDM-PON) has been considered as an ultimate solution. For a successful deployment of the WDM-PON, the optical network terminal (ONT) placed in the subscriber premises should be wavelength-independent. Use of SOA and (Reflective SOA) RSOA in a re-modulation scheme, where downstream optical signal is reused for upstream transmission, appears to be the most effective technique for implementation of optical network terminal. Work in this area has already been initiated.

Photonic Devices for Communication

Work will be continued to study the noise performance in Ge Schottky photodetectors, Crosstalk in WDM systems, characteristics of Translaser, QDIPs, Type-II Superlattice photodetectors (e.g. APDs).

Space and Environment Science and Communication

Collaboration with SAC, ISRO, Ahmedabad

The Ka and Ku-band propagation studies will be carried out in collaboration with SAC, ISRO, Ahmedabad. This is a part of the national programme on Ka-band propagation campaign undertaken by SAC/ISRO and will be carried out with the Ka-band beacon signals from the Indian geostationary satellite GSAT-4. The multistation data from the Indian region on rain DSD, MRR, rainguages, radiometers, and propagation measurements will be utilized for developing the propagation models for the Indian region. Already, this effort has resulted joint publications and some more are in offing.

Megha Tropiques Mission of ISRO

A Micro Rain Radar (MRR), very recently acquired under the Megha Tropiques project, are now in operation after successful testing. This will provide the vertical structures of rain which are crucial in identifying the types of tropical rain that are associated with different atmospheric processes. Also, a humidity and temperature profiler will be acquired soon under the ISRO sponsored "Strengthening of Space Science Activities" programme. Data acquired with multitechnique observations on rain, cloud, water vapour and temperature will be utilized to provide the ground truth for the sensors MADRAS and SAPHIR on board MT satellite for atmospheric remote sensing.

Ionospheric Space Weather

The ensuing moderate-to-high sunspot number period 2010-2011 will result in extensive occurrence of intense amplitude and phase scintillation events. Power spectra of GPS phase scintillations, in addition to that of amplitude scintillations, will facilitate in understanding the ionospheric F region irregularity hierarchy. This information may be used in selection of receiver PLL and DLL bandwidths.

Systems Science

Image Processing

In the next phase of study, few image processing algorithms will be implemented into FPGAs. It implies a special purpose dedicated system rather than a general purpose computer and is ideally suited for less hardware complexity as well as low cost of production.

Fuzzy Systems

Work will be continued on Expert system design, prediction in the domain of Finance engineering, multi-objective parameter and system identification, target tracking using Kalman filter in fuzzy domain.

Computational Geometry:

In future, studies on Covering Problems, In Place Algorithms for Sensor Networks, etc. will be undertaken.

ANNEXURE – VI(A)

Research Publications in Journals

| No | Name of Teacher | Title, journal, vol, page, year |
|-----|---|---|
| 1. | P.K.Ghosh, A.Ghosal, D.Chattopadhyay | <i>Magneto-electronic transport of the two-dimensional electron gas in CdSe single quantum wells</i> Accepted for publication in Pramana Journal of Physics (2008). |
| 2. | A.Ghosal and K.Sarkar | <i>Longitudinal magnetoresistivity and Hall mobility of two-dimensional electron gas in GaN quantum wells</i> , Revised manuscript communicated for publication in Indian Journal of Physics (December 2008). |
| 3. | S. Mukhopadhyay and A.K. Mandal | <i>Design of Lyapunov based adaptive controller for nonlinear MIMO system</i> , IET Control Theory and Application (communicated). |
| 4. | Soma Barman (Mondal) | <i>An intelligent approach of assembling gear box components using Mechatronic Principles</i> , IETE Journal of Research (communicated) |
| 5. | A. Malacarne, Jing Wang, Y. Zhang, Abhirup Das Barman, G. Berrettini, L. Poti, and A. Bogoni, | <i>20 ps-Transition Time All-Optical SOA-based Flip-Flop used for Photonic 10 Gb/s Switching Operation without any Bit Loss</i> , IEEE Journal of Selected Topics in Quantum Electronics , Vol.14, N0-3, pp. 808-815 (June 2008). |
| 6. | Abhirup Das Barman, and P. K. Basu | <i>Incoherent In-band Crosstalk Induced Power Penalty in Amplified Wavelength Division Multiplexed Networks: a Comparative Study using Gaussian and Chi-squared Probability Distribution Functions</i> , Journal IET, Circuits, Devices and Syst. (UK), 2, (1), pp.139-143 (2008). |
| 7. | N. Andriolli, M. Scaffardi, A. Das Barman, P. Castoldi, L. Poti, A. Bogoni | <i>Optical Packet Switched Interconnection Network based on Modular Photonic Digital Processing</i> , Journal IET Communications, UK , (Accepted for publication, Mar. 2008). |
| 8. | Bratati Mukhopadhyay, Abhijit Biswas, P. K. Basu, G. Eneman, P Verheyen, E Simoen and C Claeys | <i>Modelling of threshold voltage and subthreshold slope of strained Si MOSFETs including quantum effects</i> , Semicond. Sc. Technol. , 23 , 095017 (8 pp) (2008). |
| 9. | Swagata Bhattacharjee and Abhijit Biswas | <i>Modeling of threshold voltage and subthreshold slope of nanoscale DG MOSFETs</i> , Semiconductor Science and Technology (U. K) , vol. 23, p. 015010 (8 pp.), 2008 |
| 10. | S. Bhattacharjee and | <i>Estimation of threshold voltage and subthreshold slope of extremely scaled DG</i> |

- A. Biswas** *MOSFETs*
IETECH Journal of Information Systems, vol. 2, no. 3, pp 127-132, (2008).
11. Moumita Basak,
Abhijit Biswas and P K Basu *Performance analysis of a δ -doped AllInAs-GaInAs HEMT and design optimization of radio frequency MSM-HEMT transimpedance amplifier*
IETECH Journal of Communication Techniques, vol. 2, no. 2, p. 152-156, (2008).
 12. P. Chakraborty,
S. S. Mahato, T. K. Maiti, M. K. Bera,
C. Mahata,
S. K. Samanta,
A. Biswas and
C. K. Maiti *Charge trapping in memory devices using high-k dielectrics*
International Journal of Computers, Information Technology and Engineering, vol. 2, no. 2, pp. 71-76, (2008).
 13. P. Chakraborty,
S. S. Mahato, T. K. Maiti, M. K. Bera,
C. Mahata,
S. K. Samanta,
A. Biswas and
C. K. Maiti *Performance improvement of flash memory using AIN as charge-trapping layer*
Microelectronics Engineering, (in press).
 14. Swapan
Bhattacharyya,
N. R. Das and
Susmita Sen *Electrical Tuning of Intersubband Transition in a Semiconductor Quantum Ring*,
Journal of Applied Physics (accepted for publication, January 2009).
 15. **N. R. Das** and
Susmita Sen *Threshold for Photoelectric Emission from a Quantum Ring of Narrow-gap Semiconductor*, **Physica B: Condensed Matter**, Vol. 403, pp.3734–3739, (2008).
 16. Himadri Sekhar
Dutta, **N. R. Das**
and Mukul K. Das *Investigating the Effect of Hetero-interface Trapping on the Performance of a RCE Ge-on-Si Schottky Photodiode at 1.55 μ m*, **Semiconductor Science & Technology**, **23**, 085012 (7pp), (2008).
 17. Himadri Sekhar
Dutta, **N. R. Das**
and Mukul K. Das *Frequency Response of a Resonant Cavity Encapsulated Germanium-on-Silicon Schottky Photodiode*,
IET Circuits, Devices and Systems, Vol. 2, p. 128-132, (2008).
 18. **Arpita Das** and M.
Bhattacharya *Identification and classification of tumor / cancer lesion appearing in brain using CT and MR images: study on adaptive neuro fuzzy systems*
Int. Journal of Advanced Research in Computer Engineering, ISSN:0974-4320 (Accepted in Feb. 2009).
 19. **A. Das** and M.
Bhattacharya, *Identification of Microcalcifications and Grading of Masses using Digital Mammogram*, **Int. Journal of Medical Engineering and Informatics**, (Accepted in Jan 2009).
 20. Sujit Chattopadhyay
and **Pradip Kumar Saha** *Study of Bound Surface Plasmon Modes on Subwavelength Structures of Rectangular Cross-section using Simple Analytical Technique*,
J. Opt. A: Pure Appl. Opt. (UK) 10, 096201(2008).
 21. **A. Maitra** and
S. Chakrabarty *Cloud liquid water content and cloud attenuation studies with radiosonde data at a tropical location*, **Journal of Infrared, Millimeter, and Terahertz Waves**, Vol. 30, No. 4, pp. 367-373, (2009).

- 22 **A. Maitra** and K. Chakravarty *Rain depolarization measurements on low margin Ku-band satellite signal at a tropical location* **IEEE Antennas and Wireless Propagation Letters**, (2009, in press).
- 23 **A. DasGupta**, **A. Paul**, S. Ray, A. Das, and S. Ananthkrishnan *A study of precursors to equatorial spread F using the Giant Meterwave Radio Telescope*, **Radio Sci.**, 43, RS5002, doi:10.1029/2007RS003667 (2008).
- 24 S. K. Chakraborty, R. Hajra and **A. Paul** *Ionosphere near the anomaly crest in Indian zone during magnetic storm on 13-14 March 1989*, **Ind. J. Radio Space Phys.**, 37, 396-407 (2008).
- 25 Sandip Das, **Partha P. Goswami** and Subhas C. Nandy *Smallest color-spanning object revisited* **International Journal of Computational Geometry and Applications (IJCGA)** (accepted).
- 26 S. K. Midya and H. Sarkar *Study of interrelating between stratospheric O₃ and monsoon rainfall over India*, **Ind J Radio Space Phy.** (revised Ms to be submitted).
- 27 **Soumya Pandit**, S.K.Bhattacharya, C.R.Mandal and A.Patra *A Fast Exploration Procedure for Analog High-Level Specification Translation*, **IEEE Transactions on CAD**, Vol.8 Issue 27, pp 1493-1497 (August 2008).
- 28 **D. Guha**, Y. Antar, P. Beland, and M. Roper *A Small Size High Gain Printed Antenna for Wireless Base Station Booster/Repeater Applications (MWJ-7059)* **Microwave Journal** (2009 to appear).
- 29 S. Chattopadhyay, M. Biswas, **J. Y. Siddiqui** and **D. Guha** *Input impedance of rectangular microstrip with variable air gap and varying aspect ratio*, **IET Microwaves, Antennas and Propagations**, (2009 to appear).
- 30 M. Biswas and **D. Guha** *Input Impedance and Resonance Characteristics of Superstrate Loaded Triangular Microstrip Patch*, **IET Microwaves, Antennas and Propagations**, Vol. 3, No.1, pp. 92-98, (Feb. 2009).
- 31 S. Chattopadhyay, M. Biswas, **J. Y. Siddiqui** and **D. Guha** *On the Resonance of Rectangular Microstrip Patches with Variable Air Gap and Varying Aspect Ratio* **Microwave Opt. Technology Letters**, Vol. 51, No. 1, pp. 169-173, (Jan. 2009).
- 32 **D. Guha**, S. Biswas, T. Joseph and M. T. Sebastian *Defected ground structure to reduce mutual coupling between cylindrical dielectric resonator antennas*, **Electronics Letters**, Vol. 44, No. 14, pp. 836 – 837, (3rd July 2008).
- 33 L. C. Chu, **D. Guha**, and Y. M. M. Antar *Conformal Strip-Fed Shaped Cylindrical Dielectric Resonator: Improved Design of a Wideband Wireless Antenna* **IEEE Antennas and Wireless Propagation Letters**, Vol. 5. 2009 (to appear)
- 34 **Dipankar Biswas**, Tapas Das, Sanjib Kabi and Subindu Kumar, *Conspicuous Presence of Higher Order Transitions in the Photoluminescence of In_xGa_{1-x}N/GaN Quantum Wells* **Advanced Materials Research** Vol. 31, Page:62-64 (2008)

- 35 **Dipankar Biswas** ,
Subindu Kumar,
Tapas Das *Dependence of the Absorption Spectra of III-V Semiconductor Quantum Dots on the Size Distribution*
Advanced Materials Research Vol. 31, Page:59-61 (2008)
- 36 Subindu
Kumar, Sanjib Kabi,
and **Dipankar
Biswas** *Dependence of the photoluminescence of annealed III-V semiconductor quantum dots on their shape and dimension*
Journal of Applied Physics, Vol: 104, Page:086102 (2008)
- 37 Tapas Das , Sanjib
Kabi and **Dipankar
Biswas** *Calculations for the band line-up of strained $In_xGa_{1-x}N/GaN$ quantum wells: Effects of strain on the band offsets*
Journal of Applied Physics (Accepted for publication) (2008).
- 38 **N. N. Purkait**,
S. De, **S. Sen**, and
D. K. Chakrabarty *Surface O_3 and its precursors at two cities in the northeast coast of India*
Indian J Radio and Space Physics (accepted).

ANNEXURE – VI(B)

Research Publications in Seminars/ Symposia/ Conferences

| Authors | Title, Symposium, Conference , Organizer, venue, dates |
|--|---|
| 1 Subal Kar, (Invited) | <i>Some Studies on Left Handed Metamaterials (LHM): May be Useful for Beam Diagnostics Related to Accelerator and Fusion Research</i> Homi Bhabha Centenary DAE-BRNS Symposium on Atomic, Molecular and Optical Physics , Inter University Accelerator Centre, New Delhi, February 9 – 13, 2009. IX th International Workshop on Fibre Optics and Photonics, Photonics 2008 , December 15-17, 2008 at Habitat World Centre, Delhi, organized by IIT-Delhi |
| 2 P. K. Basu, Bratati Mukhopadhyay, Sumitra Ghosh and Gopa Sen (Invited) | <i>Quest for direct band gap in indirect gap group IV semiconductors for photonic device applications,</i> |
| 3 S. Debnath, A Das Barman, R Gangopadhyay, A Bogoni and L Poti | <i>An augmented reservoir model for a reflective SOA</i> |
| 4 Abhirup Das Barman, Ipsita Sengupta and P K Basu | <i>Circuit model for static and dynamic analysis of SOA</i> |
| 5 S Dasgupta and Abhirup Das Barman | <i>Design of narrow band DWDM channel de-multiplexer for fibre Bragg grating</i> |
| 6 Santu Sarkar, N R Das, and M K Das | <i>Analysis of component cross-talk and obtaining bit-error-rate in a WDM receiver</i> |
| 7 Gopa Sen, Bratati Mukhopadhyay and P K Basu | <i>Modeling electroabsorption and electro refraction in Ge/SiGe multiple quantum wells for application as modulators</i> |
| 8 Sumitra Ghosh and P K Basu | <i>Calculated composition of $Ge_{1-z}C_z/Ge_{1-x}Si_xSn_y$ heterostructures grown on Si for direct gap emission from $Ge_{1-z}C_z$ at $1.55 \mu m$.</i> |
| 9 Subindu Kumar, Sanjib Kabi, Tapas Das and Dipankar Biswas | <i>Curious changes in the photoluminescence of InGaN/GaN Quantum Wells explained</i> 2nd National Conf. Advanced Optoelectronic Materials & Devices (AOMD) , IT-BHU, December 22-24, 2008. |
| 10 P. K. Basu, S. Ghosh, Bratati Mukhopadhyay and Gopa Sen | <i>Ge/SiGeSn multiple quantum well photonic devices, Proc. AOMD, Eds. S. Jit & P Chakraverti, McMillan , pp. 141-155.</i> |
| 11 Gopa Sen, Bratati Mukhopadhyay and P K Basu | <i>Performance optimization of Ge/SiGe MQW-electroabsorption modulator for short optical pulse generation,(as above) pp. 94-101.</i> |

- 12 Tapas Das, **Dipankar Biswas** and Sanjib Kabi *A First Report on the Utility of the Full Width at Half Maximum of the Photoluminescence Spectrum From $In_xGa_{1-x}N$ / GaN Quantum Wells*
- 13 Sanjib Kabi, Subindu Kumar, **Dipankar Biswas** and Tapas Das *Further Support to the Large Band Gap 1.95 eV of InN*
- XXIX URSI-GA-2008, Chicago, USA, 7-16 August 2008**
- 14 M. Bhattacharya and **A. Das** *A Study on Seeded Region Based Improved Watershed Transformation for Brain Tumor segmentation*
15. K. Chakravarty and **A. Maitra** *Depolarization of Ku-band satellite signal in relation to rain attenuation for the tropical region, presented orally, [Paper No. F05.7]*
16. **A.Maitra** and A.Adhikari *Scintillations of Ku band satellite signal related to rain attenuation at a tropical location, presented orally [Paper No. F04.2]*
- 17 **A.Maitra** and D.Das *Time series predictor of Ku-band rain attenuation over an earth space path at a tropical locations, presented orally [Paper No. F03.5]*
18. Mukul K Das, and **N. R. Das** *On the Performance Analysis and Optimum Design of $Si_{1-y}Ge_y/Si$ Multiple Quantum Well Resonant Cavity Enhanced p-i-n photodetectors (paper D05.7),*
19. **D. Guha**, Bidisha Gupta, and Y. M. M. Antar *Quarter of a Hemispherical Dielectric Resonator: New Geometry Explored to Design a Wideband Monopole -Type Antenna*
- Other International/National Conferences**
- 20 **A. Das** and M. Bhattacharya *Registration of Multimodality Medical Imaging of Brain using Particle Swarm Optimization **Proc. of Int. Conf. on Intelligent Human Computer Interaction (IHCI-09)**, 20-23 Jan. 2009 in Allahabad, India by Springer Link.*
- 21 **A. Das** and M. Bhattacharya *GA based Neuro Fuzzy Techniques for Breast Cancer Identification **Proc. of Int. Machine Vision and Image Processing Conference (IMVIP-08)**, pp. 136-141, 3-5 Sept. 2008 in Northern Ireland, UK by IEEE Computer Society*
- 22 **J. P. Banerjee**, S. Banerjee, I. Ali and **S. K. Ray** *Large signal model to simulate the high frequency properties of optically controlled IMPATT devices, **Proc. of National Symposium**, held in Jodhpur, India*
- 23 S. Banerjee and **J. P. Banerjee** *Effect of punch through on the breakdown characteristics of 4H-SiC IMPATT Diode **Proc. of International Symposium Microwave 2008**, held in Jaipur, India*
- 24 A. Das, M. Mukherjee, P. Bhattacharyya, N. C. Mondal, M. K. Pandit, **J. P. Banerjee** and **S. K. Roy** *Direct optical injection locking of a Ka-band Si SDR IMPATT diode for low phase noise **Proc. of International symposium ISM 2008**, held in Bangalore, India*
- 25 M. Mukherjee, N. C. Mondal, P. Bhattacharyya, **J. P. Banerjee** and

S. K. Roy

- 26 M. Mukherjee, J. Mukherjee, **J. P. Banerjee and S. K. Roy** *Effect of photo-illumination on Millimeterwave properties of InP based IMPATT diodes at elevated temperature* **Proc. of International Symposium ICMMT 2008**, held in Nanjing, China.
- 27 **Soma Barman (Mondal)** *CDMA based audio watermarking Scheme* **National seminar on Recent advances in wireless and Mobile Telecommunications** held on Oct18-19,08, organized by The Institute of Engineers
- 28 Rikmantra Basu, **Abhirup Das Barman** and **P. K. Basu** *Modeling of Semiconductor Optical Amplifier using a Simple Asymmetrical Multiple Quantum-Well Structure*, **Intl Conf on Topics in Optoelectronics and Photonics (IConTOP)**; Dept of AOP-CU, March 1-4, 2009 at SINP.
- 29 F Fresi, G. Berrettini **A Das Barman** S. Debnath, L. Potì, and A. Bogoni. *Single RSOA Based ONU for RZ Symmetrical WDM PONs at 2.5 Gb/s*, **International conference on Photonics in Switching 2008, Hokkaido, Japan, Proceedings S-06-2, 4-7 August 2008.**
- 30 **A. Biswas**, M. Bargallo Gonzalez, A. De Keersgieter, E. Simoen, G. Eneman, P. Verheyen and C. Claeys *Stress simulation of embedded $Si_{1-y}C_y$ source/drain n-MOSFETs* **Semiconductor Technology- ISTC 2008**, Ed, M. Yang, *The Electro Chem. Soc.* Ser. PV 2008-01, pp. 88-92, 2008, China.
- 31 Sujit Chattopadhyay, **P. K. Saha**, F. Causa and J. Sarma. *Modified Wave-vector of Surface Plasmon Modes in the presence of Auxiliary Three-Layer Dielectric Waveguide* **International Conference on Transport and Optical Properties of Nanomaterials, (ICTOPN)** January 5-8, 2009, Allahabad, India
- 32 Ahmed Al Balushi, Sujit Chattopadhyay, **P.K.Saha**, F. Causa and J. Sarma *Comparison of Approximate and Formal Methods of Analysis of Surface Plasmon Waves in Rectangular Cross-section (nano-wire/hole) Waveguides* **ICTOPN**, January 5-8, 2009, Allahabad,
- 33 **A. Maitra** (Invited) *Earth-Space Propagation Effects Related to Satellite Communications at Frequencies above 10 GHz at a Tropical Location*, Invited Talk and Session Chairman, **International Conference on Electronics, Computer and Communication**, 27 - 29 June 2008, Rajsahi University, Bangladesh.
- 34 **A. Maitra** (Invited) *Radio propagation studies at frequencies above 10 GHz related to satellite communications*, **Tutorial on Radio Science**, 30 June 2008, Rajsahi University, Rajsahi, Bangladesh, organized by Regional Facility on Radio Science (RFRS), NPL, New Delhi.
- 35 **A. Maitra**, D. Das, A Adhikari *Rain Attenuation Prediction over an Earth-Space Path from Rain Rate Measurements at a Tropical Location*, paper accepted for presentation, **3rd European Conference on Antennas and Propagation (Eucap 2009)**, Berlin, Germany, 23 - 27 March 2009
- 36 Subir Ghosh, **Partha Goswami**, Anil Maheshwari, Subhas *Algorithms for computing diffuse reflection paths in polygons*, **Proc. of the Third Annual Workshop on Algorithms and Computation** to be held during February 18-20, 2009 (accepted).

- Nandy, Sudebkumar
Pal and Swami
Sarvattomananda
- 37 Priya Ranjan Sinha Mahapatra,
Partha P. Goswami,
and Sandip Das *Maximal covering by two isothetic unit squares*
Proc. Canadian Conf. on Computational Geometry (CCCG 2008)
- 38 **Soumya Pandit**,
C.R.Mandal and
A.Patra *Systematic Methodology for High-Level Performance Modeling of Analog Systems”* **IEEE Int. Conf. VLSI Design 2009**
- 39 M. Biswas and
D. Guha *Experimental investigation of a equilateral triangular microstrip antenna with a dielectric radome,”* **Intl. Conf. on Recent Advances in Microwave Theory and Techniques Microwave-2008**, p.356-358, Jaipur, India, Nov. 2008.
- 40 **Gopa Sen, Bratati Mukhopadhyay** and
P. K. Basu *Ge/SiGe Quantum Wells on Si for Electro-optical Intensity Modulators* Proceedings of National Conference on Device, Intelligent System and Communication & Networking, Aug 1-2, 2008, pp 72 – 75.
- 41 **Gopa Sen, Bratati Mukhopadhyay**, and
P. K. Basu *Design of Ge/SiGe MQW Directional Coupler* **Accepted for publication** in the Proceedings of International Conference on Computer, Communication, Control and Information Technology (C³IT-2009), 6-7 February, 2009.
- 42 **N. R. Das** and
Kasturi Mukherjee *Electric Field Assisted Tunneling In Asymmetric Barrier Quantum Wells For Switch Applications* accepted for presentation in **International Conference Computers, Communication and Control**, Academy of Technology, Hooghly, February 6-7, 2009
- 43 **A. Paul** and
A. DasGupta *Control of Equatorial Electrojet over the Development of the Equatorial Ionization Anomaly around the Post Sunset Period, ,* DST Sponsored Workshop on **Electrodynamical Coupling of Atmospheric Regions (ECAR)**, Indian Institute of Geomagnetism, Navi Mumbai, November 25-26, 2008.
- 44 **A. DasGupta**
and S. Ray *Storm time Dependence of Equatorial F region Irregularities,* DST Sponsored Workshop on **Electrodynamical Coupling of Atmospheric Regions (ECAR)**, Indian Institute of Geomagnetism, Navi Mumbai, November 25-26, 2008.
- 45 **A. Maitra** *Earth-Space Propagation Studies Related to Satellite Communications in the Tropical Region,*
International Conference on Recent Advances in Microwave Theory and Applications (Microwave - 08), 21- 24 November 2008, University of Rajasthan, Jaipur.
- 46 **A. Maitra** *Propagation Studies Related to Satellite Communications at Ku/Ka Bands in Tropical Regions”,* **7th Indian Conference on Microwaves, Antenna, Propagation & Remote Sensing (InCMARS-2008)**, 9 - 11 December 2008.
- 47 **Sumitra Mukhopadhyay**
and A.K. Mandal *Fuzzy rule based classification using evolutionary algorithm,”* in **Proc. of CSI-RDHS**, pp.33-36, 2008.
- 48 C. Saha, **J. Y. Siddiqui, D. Guha**, *Accurate Modelling of The Resonant Frequency Of Square Split Ring Resonators,*
Proc. Nat. Symp. Antennas and Propagation, Kochi, India, Dec. 2008

- Y.M.M. Antar
- 49 M. Biswas, **J. Y. Siddiqui** and **D. Guha** *Experimental Studies Of Circular Microstrip Radiator Backed By a Cylindrical Cavity*, **Proc. Nat. Symp. Antennas and Propagation, Kochi**, India, Dec. 2008
- 50 **D. Guha** (Invited) *Broadband Dielectric Resonator Antennas*, **Inv. Paper in Proc. Nat. Symp. Antennas and Propagation, Kochi**, India, Dec. 2008
- 51 Prasun Banerjee, **Gautam Ghosh** and Salil Kumar Biswas *Measurement of the Dielectric Constant of Medium Loss Cylindrical Shaped Samples using Cavity Perturbation Method.* IEEE Xplore, Release 2.5, [**International Conference on Recent Advances in Microwave Theory and Application, Microwave 2008**, Jaipur] Page(s): 124-125
- 52 Prasun Banerjee, **Gautam Ghosh** and Salil Kumar Biswas *Measurement of Dielectric Loss of p-Type Silicon at X-Band Frequency* **International Symposium on Microwaves and Millimeterwaves: Basics & Technology (ISoMM-09)**, 2009, Kolkata.

ANNEXURE – VI(C)

List of Ph.D. Theses Submitted/Awarded / Pre Doctoral Seminar Read

| Name | Supervisor | Title | Status |
|-----------------------------|----------------------------------|--|---------------------------|
| 1. Sri Mukul K Das | Prof. N. R. Das | Some studies on the design of Si-Ge photodetectors and HBTs for optical communication | Awarded in 2008 |
| 2. Sri Amlan Chakrabarti | Prof. S. Sur Koley, ISI, Kolkata | Algorithms for Quantum Computing | Seminar read in 2007 |
| 3. Sri Manotosh Biswas | Prof. D. Guha | Computer aided design and experimental studies of some microstrip antennas with conventional and modified ground structure | Awarded |
| 4. Ms. Sumitra Mukhopadhyay | Prof. A K Mondal (JU) | Extraction of Optimal Fuzzy Rules for Identification, Prediction and Control of Nonlinear Systems | Submitted in October 2008 |
| 5. Sri Subindu Kumar | Prof. D. Biswas | Studies on Some Important Properties of III-V Nanostructures. | Seminar given |
| 6. Sri Abhirup Das Barman | Prof. P. K. Basu | Experiments and Modeling of Photonic Devices for Wavelength Division Multiplexed Optical Links. | Viva Voce to be conducted |
| 7. Shri Asik Pal | Prof. A. Dasgupta | Ionospheric Scintillation and its Effects on the Global Positioning System (GPS) | Awarded in December 2008 |
| 8. Ms Sarbani Ray | Prof. A. Dasgupta | Equatorial Anomaly Gradient Effects on GPS | Awarded in December 2007 |

ANNEXURE – VI(D)

List of Ph.D. registration in 2008-09

Names not included in Report for 2007-08

| Name | Supervisor | Title | Status |
|---------------------|---------------------------|---|-----------------------------------|
| 1. Sri Santu Sarkar | Dr. Nikhil Ranjan Das | Performance Analysis and Optimisation of a Dense Wavelength Division Multiplexed System | Registration approved on 21.01.08 |
| 2. Sri Sourabh Das | Prof. Animesh. Maitra | Study on effects of Rain On Signal Propagation and related rain parameter for the different zones of Indian region. | Do |
| 3. Sri Chinmoy Saha | Dr. Jawad Yaseen Siddiqui | On Some Studies with Split Ring Resonators(SRR) Of Different Shapes for Metamaterial Applications | Do |

| | | | | |
|----|-----------------|--------------------------|---|----|
| 4. | Sri Sanjib Kabi | Prof. Dipankar.Biswas | Some Studies on the Optoelectronic Properties of III-V Semiconductor Nanostructures | do |
|----|-----------------|--------------------------|---|----|

New Registrations

| | | | | |
|-----|-----------------------------|---|---|-----------------------------------|
| 1. | Miss Bidisha Gupta | Dr Debatosh Guha | On Some Novel Broadband Dielectric Resonator Antennas | Registration approved on 21.05.08 |
| 2. | Sri Rajkumar Hajra | Dr.Shyamal Kumar Chakraborty, Reader in Physics, Raja Peary Mohan College, Uttarpara | A Study on the Variability of Total Electron Content Near the Crest of the Equatorial Anomaly in the Indian Zone. | do |
| 3. | Sri Sujit Chattopadhyay for | Prof. P.K.Saha | Theoretical Studies on Waveguides for Surface Plasmon Polariton and Some Related Problems | 21.05.08 |
| 4. | Sri Koushik Pal | Dr. Mahua Bhattacharya, Associate Professor of IIITM, Gwalior & Professor Goutam Ghosh | Security Aspects of Medical Image Analysis: Study on Digital Watermarking Techniques | 24.07.08 |
| 5. | Ms Susmita Sen | Dr. N.R. Das, Reader | On Certain Aspects of Optical Interaction in a Semiconductor Quantum Ring | 24.07.08 |
| 6. | Ms Paulami Rakshit | Dr. N.R.Das, Reader | On the Performance Analysis and Design of Silicon CMOS Photoreceiver Components | 24.07.08 |
| 7. | Sri Koushik Dutta | Dr. D. Guha, Reader | Design and Characterizations of some Novel Negative Permeability / Permittivity Structures for Metamaterials | 24.07.08 |
| 8. | Sri Sujoy Biswas | Dr. D. Guha, Reader | On Some Novel Defected Ground Structures for Planar Antenna Applications. | 24.07.08 |
| 9. | Sri Chandrakanta Kumar | Prof.Debatosh Guha & Dr. S. Pal distinguished scientist, ISRO satellite Centre, Department of Space, Bangalore, | On Some Studies of the Radiation Characteristics Of Microstrip Antennas | 12.11.08 |
| 10. | Mr. J K M Sadique Uz Zaman | Dr. Ranjan Ghosh, Reader | Studies on Incorporating Randomness in Cryptographic Algorithms and Related Cryptanalytic Modeling | 12.11.08 |
| 11. | Sri Swapan Bhattacharyya | Prof. N.R.Das | On Certain Aspects Of Electron Confinement in Quasi Zero Dimensional Semiconductor | 12.11.08 |

| | | | Nanostructures | |
|-----|-----------------------|---|---|------------|
| 12. | Ms. Kasturi Mukherjee | Prof. N.R.Das | On Some Electronic and Optoelectronic Properties of Semiconductor Quantum Nanostructures in Presence of Electric Field | 12.11.08 |
| 13 | Ms. Sayantani Mitra | Dr. Jawad Y. Siddiqui, Lecturer | On some Novel Printed Antennas for Ultra Wide Band and Radio Frequency Identification Applications | 12.11.08 |
| 14 | Ms. Archita Banerjee | Prof. Debatosh Guha | On Some Novel Broadband Planar Antennas using Dielectric Resonators | 27.01.2009 |
| 15. | Sri Abhijit Banerjee | Prof. N. R. Das and Dr. B. N. Biswas, Academy of Technology, Hoogly | Optical Phase Locked Loop and its Application for Remote Carrier Signal Generation | 27.01.2009 |
| 16. | Sri Arindum Mukherjee | Prof. N. R. Das and Dr. B. N. Biswas | On Some Aspects of Remote Carrier Generation for Mobile Communication | 27.01.2009 |
| 17. | Ms. Ipshita Sengupta | Sri. Abhirup Das Barman, Reader | Some Studies on Physics-Based and Equivalent Circuit Models of Semiconductor Optical Amplifiers for Application in Optical Links and Networks | 27.01.2009 |
| 18 | Sri Siddhartha Panda | Prof. Dipankar Biswas | Studies on some Salient Properties of Annealed and Non-Annealed III-V Nanostructures | 27.01.2009 |
| 19. | Sri Manabendra Maiti | Dr. P .K. Karmakar, Senior Lecturer | Studies on Water Vapour Distribution and the Propagation Characteristics at Microwaves/Millimeter waves | 27.01.2009 |
| 20. | Ms Moumita Mukherjee | Prof. D. N. Bose of U.S.I.C | (due to sudden demise of Prof. S.K.Roy) | 27.01.2009 |
| 21. | Ms Isani Roychaudhuri | Prof. P.K. Basu and Prof. S. Sen | Some Analysis On The Growth and Development of Electronic Research in India Over the Period 1925-1960”. | 27.01.2009 |
| 22. | Sri Koulik Sarkar | Dr. A. Ghoshal | Electron-phonon interactions in Superlattice and Nanostructured semiconductors | 2008 |

ANNEXURE – VII

List of Faculties and Other Teaching/ Research Staff

(A). Names and Specialisation of the Faculty in the Centre

Professors

1. Prof. G. Ghosh
M.Tech., Ph.D.
Head of the Department Solid State and Microwave Electronics, Digital Electronics
2. Prof. B. Bandyopadhyay
M.Tech., Ph.D. Microwave Electronics, Computer Software
3. Prof. J.P.Bandyopadhyay,
M.Sc., Ph.D. SMIEEEE Semiconductor Devices, Microelectronics.
4. Prof. P.K.Basu,
M.Tech., Ph.D., FAST (WB) ,
FIETE, SMIEEEE
CAS Program Coordinator Semiconductor Physics, Material Science, Solid State and
Optoelectronic Devices, VLSI Design, Optical
Communication, Nanoelectronics
5. Prof. D. Biswas
M.Tech, Ph.D. Solid State Electronics and Devices,
Electronic Circuit Design and Instrumentation
6. Prof. D. Chattopadhyay,
M.Tech., Ph.D., D.Sc. Semiconductor Physics and Devices, Circuit Theory, Material
Science
7. Prof. N. R. Das
M. Tech., Ph.D., SMIEEEE Optoelectronic and Photonic Devices, Semiconductor
Nanostructures
8. Prof. P. K. Goswamy
M.Tech, Ph.D. Microwave Semiconductor Devices and
Circuits, Digital Techniques, Control Systems, Numerical
Analysis, Electronic Engineering Design
9. Prof. D. Guha
M.Tech., Ph.D., SMIEEEE Antenna Engineering, Microwaves,
Broadcast Engineering
10. Prof. S. Kar,
M.Tech, Ph.D., FIETE, SMIEEEE,
Fulbright Fellow Microwave and mm-wave Electronics, Computer Aided
Design and Optimization, High Energy Physics and
Technology and Femto second Technology, Left-Handed
(LH) materials
11. Prof. A. Maitra
M.Sc., Ph.D. FIETE, SMIEEEE Communication, Wave Propagation, Remote Sensing
12. Prof. P. C. Rakshit,
M.Tech, Ph.D. Circuit Theory, Microwave Solid State Devices and Circuits

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|-----|---|--|
| 13. | Prof. J. B. Roy, M.Tech., Ph.D., MIEEE | Solid State and Quantum Electronics, Optoelectronics, Microprocessor |
| 14. | Prof. P. K. Saha M.Tech, Ph.D.(Leeds), FIETE, SMIEEE (retired on July 31, 2008) | Electromagnetic Boundary Value Problems, Microwave Engineering, Optoelectronics, Fibre Optic Communication. |
| 15. | Prof. S. Sen , M. Tech, Ph.D., FIE Deputy Program Coordinator | Quantum and Optoelectronic Devices, OEIC, Instrumentation, VLSI Design |

Readers

- | | | |
|----|---|--|
| 1. | Dr. Abhijit Biswas M.Tech, Ph.D., | Semiconductor Device Modeling, Circuit and Device Simulation with SPICE, VLSI, optoelectronics, Control Theory, Semiconductor Physics and Devices, TCAD, Analog circuits. |
| 2. | Sri A. Das Barman, M. Tech. | Optical communication, DSP |
| 3. | Dr. S. K. De M.Tech, Ph.D | Solid State and Microwave Electronics Pulse and Digital Technique. |
| 4. | Dr. A. Ghosal M.Tech., Ph.D. | Solid State Electronics, Communication Circuits and Systems, Electron transport in Nanostructures and Superlattices |
| 5. | Dr. R. Ghosh M.Tech, Ph.D. | Solid State Electronics, Microelectronics, Microwave, Educational Technology. |
| 6. | Dr. Partha Goswamy M. Tech, Ph.D. | Computational Geometry, Graph Algorithm, Data Structure & Design and Analysis of Algorithm |
| 7. | Dr. Ashik Paul M. Tech., Ph.D. | Space Science, Communication Engg. |
| 8. | Dr. (Mrs) G. Sen (Guha Mazumdar) M.Tech., Ph.D., MIEEE | Microwave Engineering, TV Engineering, Optoelectronics. |
| 9. | Dr. B. Saha M.Tech., Ph.D. | Active Circuits, Radio wave propagation |

Senior Lecturers and Lecturers

- | | | |
|----|---|--|
| 1. | Dr. (Mrs) Soma Barman Mandal, M. Tech., Ph.D., MIEEE | Mechatronics, Digital Signal Processing |
| 2. | Dr. Subrata Chattopadhyay, M. Tech, Ph.D. | Millimeter wave propagation, Electric Machines |
| 3. | Ms. Arpita Das, M. Tech | Medical Image Processing, Artificial Intelligence, Pattern Recognition and VLSI Design. |
| 4. | Dr. Pranab Karmakar, M. Sc, Ph.D. | Millimeter wave Propagation, Remote Sensing |

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|----|--|--|
| 5. | Sri Anjan Kundu, M. Tech. | Microwave Engineering |
| 6. | Dr. Bratati Mukhopadhyay, M. Tech, Ph.D., MIEEE | Physics of Semiconductor Nanostructures, Semiconductor Devices and Modeling, VLSI circuits, Photonics |
| 7. | Smt. Sumitra Mukhopadhyay, M.E.Tel.E. | Control Systems Engineering. |
| 8. | Sri Soumya Pandit, M. Tech. | VLSI Circuits and Systems, Analog Design Automation |
| 9. | Dr. J. Y. Siddiqui, M. Tech., Ph.D. | Microwave antenna, Computational Electromagnetics |

(B) Guest Lecturers/Retired Professors working as Teachers

| Name | Affiliation |
|--|--|
| 1. Prof. N. N. Purkait, M. Tech, M. Sc (Wales), Ph.D. | Ex-IRPE |
| 2. Prof. A. K. Dasgupta, M. Tech, Ph.D. | Space Science, Radio Wave Propagation Analog Circuits, Antennas |
| 3. Dr. B. C. Roy, M. Sc., Ph.D. | Ex-BKC College; part time in IRPE |
| 4. Sri Himadri Sekhar Dutta | A K Choudhury School of IT, CU |
| 5. Prof. Amitabha Chanda | ISI (retd) |
| 6. Prof. Ranjan Dasgupta | National Inst. For Technical Teachers' Training & Research, Kolkata |
| 7. Dr. Partha Pratim Das | Interra Systems, Salt Lake, Kolkata |
| 8. Sri J. N. Roy | Interra Systems, Salt Lake, Kolkata |
| 9. Smt. Himadri Bhattacharyya | Surendra Nath College, Kolkata |
| 10. Sri Anirban Sarkar | Serampore College, Hoogly, WB |
| 11. Smt. Nayana Guha Mazumdar | BKC College, Kolkata |
| 12. Sri Mukul K. Das (till April 08) | AK Chowdhury School of IT, CU |
| 13. Dr. Partha Sarathy Goswamy (joined INRAPHEL) | Kalyani University, Kalyani, Nadia, WB |
| 14. Dr. Sumitra Ghosh | RPE, Research Assistant |
| 15. Prof. Partha Sarathy Dasgupta | IIM-Kolkata |
| 16. Prof. Sudakshina Kundu Mookerjee | WBUT, Kolkata |
| 17. Dr. Abhijit Mallik | Dept. Electronic Sc., CU |

18. Dr. Bratati Mukhopadhyay (joined Research Associate, DST project, RPE
INRAPHEL)
19. Sri Surajendra Krishna Deb BSNL, Calcutta Telephones

(C) List of Full time Scientific/Research Workers

| Name | Designation / status | Supervisor/group leader | Sponsoring authority |
|--|--|-------------------------------------|--|
| 1. Dr. Sumitra Ghosh | Research Assistant /permanent | Prof. P. K. Basu | University of Calcutta |
| 2. Dr. Birendra Singh (retired) | Research Assistant/permanent | HoD | Do |
| 3. Dr. Pranab Karmakar (joined as Sr. Lecturer) | Scientist C | Prof. P. K. Saha | Govt. of West Bengal |
| 4. Dr. Subrata Chattopadhyay (joined as Sr. Lecturer) | Do | do | As above |
| 5. Sri Himangshu Sarkar | JRF | Prof. P. K. Basu | As above |
| 6. Dr. Sukla Datta Gupta | Woman Sc. | | DST |
| 7. Smt. Bratati Mukhopadhyay (joined as Lecturer) | Research Associate | Prof. P. K. Basu | DST Project |
| 8. Smt. Swagata Bhattacharyya | Research Fellow in Science under Meritorious Student | Dr. A. Biswas/ Prof. P. K. Basu | CAS |
| 9. Dr. Manatosh Biswas (joined WBSU) | Research Associate: DST Fast Track Scientist Scheme; now Reader, WB State Univ. | | DST Project: |
| 10. Smt. Aditi Das | Senior Research Fellow | Prof. A. K. Dasgupta | Under CSIR support in S. K. Mitra Centre |
| 11. Dr. Sarbani Ray | Research Associate | do | SKM Centre |
| 12. Sri Tanmay Das | JRF | Do | SKM Centre |
| 13. Sri Sanjib Kabi | CAS: RFSMS | Prof. D. Biswas | CAS |
| 14. Smt. Arpita Das (joined as a Lecturer) | Research Fellow | Prof. S. Sen | TEQIP |
| 15. Sri Kaustav Chakrabarty | JRF | Prof. A. Maitra | ISRO |
| 16. Smt. Arpita Adhikary | JRF | Prof. A. Maitra | ISRO |
| 17. Sri Aniruddha Bhattacharyya | JRF | Prof. A. Maitra | SAC/ISRO |
| 18. Sri Rakesh Roy | JRF | Prof. S. S. De/ B. Bandyopadhyay | ISRO |

| | | | | |
|-----|----------------------------|------------|------------------|-------------------------|
| 19. | Sri Dilip Kumar Halder | JRF | Do | ISRO |
| 20. | Sri Gopal Bhabak | JRF | do | ISRO |
| 21. | Smt. Poulami Rakshit | JRF:RFSMS | Prof. N. R. Das | UGC |
| 22. | Smt Kasturi Mukherjee | JRF:RFSMS | Prof. N. R. Das | UGC |
| 23. | Md. J K M Sadique-Uz-Zaman | JRF: RFSMS | Dr. Ranjan Ghosh | CU-UPE Scheme/UGC-RFSMS |

(D) CAS RFSMS/Project Fellows joining the Institute in 2005

| No | Name | Supervisor |
|----|----------------------------|-------------------------------------|
| 1. | Smt. Swagata Bhattacharjee | Dr. Abhijit Biswas/Prof. P. K. Basu |
| 2. | Sri Sanjib Kabi | Prof. D. Biswas |
| 3. | Smt. Poulami Rakshit | Prof. N. R. Das |
| 4. | Smt Kasturi Mukherjee | Prof. N. R. Das |
| 5. | Md. J K M Sadique-Uz-Zaman | Dr. Ranjan Ghosh |

(E) List of Faculties in INRAPHEL/Other Institutions working for Ph.D. in the Centre

| | Name | Designation | Institution | Supervisor |
|-----|-----------------------------|-----------------|---|----------------------|
| 1. | Sri A. Kundu | Lecturer | INRAPHEL, CU | Dr. B. Bandyopadhyay |
| 2. | Sri Subindu Kumar | Lecturer | Siliguri Inst. Technology | Prof. D. Biswas |
| 3. | Sri Tapas Das | | INRAPHEL, CU | Prof. D. Biswas |
| 4. | Sri Himadri Dutta | Lecturer | AKCSIT, CU | Dr. N. R. Das |
| 5. | Smt. Susmita Sen | Lecturer | Birla Institute of Technology | Dr. N. R. Das |
| 6. | Sri Santu Sarkar | Sr. Lecturer | Academy of Technology, Adisaptagram, WB | Dr. N. R. Das |
| 7. | Sri Swapan Bhattacharya | Asst. Professor | Assansol Engg. College | Dr. N. R. Das |
| 8. | Smt. Madhumita Pal | Asst. Professor | NIT, Silchar | Dr. N. R. Das |
| 9. | Smt. Sriparna Bhattacharyya | Sr. Lecturer | Heritage Inst. Technology, Kolkata | Dr. N. R. Das |
| 10. | Sri Sudipta Chattopadhyay | Sr. Lecturer. | Siliguri Institute of Technology | Dr. D. Guha |

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|-----|---------------------------|-----------------|---|------------------------|
| 11. | Sri Sujoy Biswas | Sr. Lecturer. | VXL Technologies | Dr. D. Guha |
| 12. | Sri Chandra Kanta Kumar | Scientist 'D' | Satellite Centre, ISRO, Bangalore | Dr. D. Guha |
| 13. | Sri Kaushik Datta | Sr. Lecturer. | Academy of Technology, Adisaptagram, WB | Dr. D. Guha |
| 14. | Smt. Bidisha Gupta | Lecturer | Techno India, Kolkata | Dr. D. Guha |
| 15. | Sri Chinmoy Saha | Lecturer | Heritage Inst. Of Tech. | Dr. J. Y. Siddiqui |
| 16. | Sri. Anirban Mandal | Lecturer | Netaji Subhas Engg. College | Dr. J. Y. Siddiqui |
| 17. | Smt. Sayantani Mitra | Lecturer | | Dr. J. Y. Siddiqui |
| 18. | Sri Sujit Chattopadhyay | DGM | BSNL, Calcutta Telephones | Prof. P. K. Saha |
| 19. | Smt. Swastika Chakraborty | Asstt Professor | JIS College of Engineering, Kalyani | Prof. A. Maitra |
| 20. | Sri S. Bhattacharya | Lecturer | ITME, Kolkata | Prof. A. Maitra |
| 21. | Smt Dalia Das | Lecturer | Meghnad Saha Institute of Technology | Prof. A. Maitra |
| 22. | Sri Saurabh Das | Research Fellow | Space Application Technology, ISRO, Ahmedabad | Prof. A. Maitra |
| 23. | Smt. Moumita Basak | Lecturer | Techno India, Kolkata | Dr. Abhijit Biswas |
| 24. | Smt. Ipsita Sengupta | Lecturer | MCKV College of Engg, Liluah, Howrah | Sri Abhirup Das Barman |
| 25. | Sri Koulik Sarkar | Teacher | | Dr. A. Ghoshal |

ANNEXURE-VIII

Other Details about the Faculty

(A) Administrative Positions Held by Faculties

| | Name | Position | Centre |
|----|---------------------------|-----------------------------|--|
| 1. | Prof. J. P. Bandyopadhyay | Director | Centre of Millimeter wave Semiconductor Devices and Systems (CMSDS), a joint venture of DRDO and University of Calcutta. |
| 2. | Prof. P. K. Basu | Director | CRTMMW, UGC-NRC (proposed) |
| 3. | Prof. Animesh Maitra | Director | S K Mitra Centre |
| 4. | Prof. P. K. Saha | Director | CTIF-India |
| 5. | Prof. N. Purkait | Principal Consultant | TEQIP of UCTCU |
| 6. | Prof. Susanta Sen | Dean, Faculty of Technology | CU |

(B) Visits Abroad

| Name | Function | Institution | Period |
|------------------------|--------------------|--|----------------------------|
| Prof. P. K. Basu | Visiting Scientist | ECE Dept, McMaster University, Hamilton, Canada | Sept- October 08 |
| Prof. Animesh Maitra | Conference | International Conference on Electronics, Computer and Communication, Rajsahi University Bangladesh. | 27 - 29 June 2008. |
| | URSI-GA 08 | Kaustav Chkrabarty, Research Fellow under A. Maitra, attended and orally presented three research papers at XXXIX URSI General Assembly, Chicago | Chicago, 7-16 August 2008 |
| Prof. Debatosh Guha | Visiting Professor | Royal Military College of Canada, Kingston, Ontario | |
| | Conference | URSI-GA, Chicago | Chicago, 7-16 August 2008 |
| Dr. J. Y. Siddiqui | Visiting Scientist | Royal Military College, Kingston, Canada | November 2008 |
| Sri Abhirup Das Barman | Visiting Scientist | CNIT, Pisa, Italy | Jan-Feb 09 |
| Prof. N. R. Das | Visiting Scientist | Department of Electrical and Electronic Engineering, University of Sheffield. | Aug./Sept., 2008 |
| | URSI YS 2008 | Sri Mukul Das, Lecturer, A K Choudhury School of IT, CU, working under Prof. | Chicago, 7-16 August 2008. |

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|------------------------|--------------------|---|-----------------------|
| | | Das was awarded URSI-GA Young Scientist Award to present a paper at URSI-GA meeting at Chicago. | |
| Prof. Susanta Sen | Visit to Japan | 1) IWAI Lab on Nanoelectronics, in Tokyo Inst. Tech., Tokyo 2) Inaugural ceremony of CTIF-Japan, Tokyo & Yokosuka Research Park, Yokosuka, Japan | Japan, Oct. 2-3, 2008 |
| Dr. Pranab K. Karmakar | Visiting Scientist | Instituto Nacional de Pesquisas Espaciais, Brazil | February-March 2009 |

(C) Awards, Distinctions, Editorship, Review work, Fellowship/Membership of Societies etc.

| Name | Distinction |
|---------------------------|--|
| Prof. Susanta Sen | Dean, Faculty of Technology & Chairman – LIPMU of TEQIP – UCT-CU; FIE; Fellow CSI, Organizing Chair: VDAT 07; Member of the Governing Council: Saha Institute of Nuclear Physics, Kolkata. |
| Prof. B. Bandyopadhyay | Website Manager: EPMDS 6; Editor of Centres website : www.irpel.org Webmaster: CODEC 06: Guest Editor, IEE –CDS (special Issue) |
| Prof. A. K. Dasgupta | Member of Editorial Board, IJRSP, Member – URSI GA 06 |
| Prof. P. K. Saha | Fellow IETE (FIETE), Senior Member IEEE (SMIEEE), (past) Chairman, AP-MTT Chapter, IEEE – Kolkata; Member of Editorial Board of IEEE Trans. MTT Chairman – CODEC 06. Guest Editor – IET-CDS (special Issue) |
| Prof. P. K. Basu, | Fellow WAST, FIETE, SMIEEE, (past) Chairman, LEOS Chapter, IEEE Kolkata Member, EPSRC College, UK; Member OSA (USA) Reviewer : APS, AIP Journals, IEEE –EDS, IEE-CDS |
| Prof. G. Ghosh | Reviewer in AEMC, 2007 and National Conference on Recent Trends in Information Systems (ReTIS-08), February 2008 |
| Prof. J. P. Bandyopadhyay | FIETE, SMIEEE, Member, IEEE (LEOS) Member, Calcutta Chapter of IEEE (LEOS) Member, local organizing committee of EPMDS-2006, Dept. of Electronic Science, C.U. Member, local organizing committee for international Conference on Laser and Nanomaterials (ICLAN) October 2006 Dept. of Physics. Member of Board of Research studies of Physics of Burdwan University Reviewer of IEEE ED, JIETE, Indian Journal of Pure & Applied Physics, Indian Journal of Physics, Journal of Institution of Engineers. |
| Prof. S. Kar | Fulbright Fellow, FIETE, SMIEEE, Listed in Marquis Who's Who in Science and Engineering, Marquis Publication, U.S.A, Collaborative research with Berkeley Lab U.S.A has appeared as news page in State Alumni News (Fulbright) of the U.S. State Dept., Reviewer of JIETE and Journal of Physics, Selection Committee Expert of Gauhati University, External Expert of the P.G Council of North Eastern Hill University |
| Prof. A. Maitra | FIETE, MIEEE, General Chair, IEEE AEMC, Kolkata, 19-20 December 2008; Member of Editorial Board, Indian Journal of Radio & Space Physics, NISCAIR, CSIR, New Delhi Referee of the Journals- Indian Journal of Radio and Space Physics, CSIR Indian Journal of Physics, IACS, Calcutta, Journal of Institution of Engineers, Calcutta, Radio Science, USA, IEEE Transactions on Vehicular Technology, USA. |
| Prof. J. B. Roy | MIEEE, Program Chair: EPMDS 06; Secretary: IEEE-LEOS, Calcutta Chapter. |
| Prof. N. R. Das | FIETE, SMIEEE, Vice Chairman: LEOS, IEEE Kolkata, Reviewer of IEEE PTL, IEEE-JQE |

Organizing Chair of the IEEE Lasers and Electro-Optic Society (LEOS)
 Chapter of the IEEE Calcutta Section for the year 2004, Secretary 2005
 Program Chair : CODEC 06; Guest Editor : IJCITE (Special Issue)
*Editor of an International journal IJCITAE, Reviewer of IEEE Transactions on
 Instrumentation and Measurement, IEEE J. of Quantum Electronics, IET
 Circuits, Devices and Systems.*

| | |
|------------------------|---|
| Prof. D. Guha | SMIEEE, Reviewer of IEEE Trans MTT, IEEE Trans. Antennas and Propagation, IEEE Antennas and Wireless Propagation Letters, IET Microwave, Antennas and Propagation, IET Electronics Letters, International Journal of RF and Microwave Computer-Aided Engineering, International Journal of Antennas and Propagation, Journal of Microwaves and Optoelectronics, IETE Technical Review , Indian Journal of Physics |
| Dr. A. Biswas | Reviewer :IEEE Trans. on Electron Devices, Optical and Quantum Electronics |
| Dr. J. Siddiqui | MIEEE, Reviewer of IEEE Antenna & Wireless Propagation Letters, Reviewer of IET Microwaves, Antennas & Propagation. |
| Dr. B. Bandyopadhyay | Guest Editor: IET-CDS (special Issue) |
| Sri Abhirup Das Barman | Reviewer, IEEE/OSA J Lightwave Technol. |
| Dr. A. Ghoshal | Reviewer, Ind J Physics |
| Dr. P. P. Goswami | Reviewer, papers for the Third Annual Workshop on Algorithms and Computation (WALCOM 2009) to be held during February 18-20, 2009. |
| Sri Soumya Pandit | MIEEE, Reviewer, IEEE/ACM Conf. 2008, VDAT 2008 |

(D) Invited Talks / Session Chairs in Conferences and Symposia

| | Name | Function | Event/Title of Talk | Organizers/dates |
|----|--------------|-----------------|---|--|
| 1. | J P Banerjee | Session Chair | International Symposium on Microwaves | University of Rajasthan, 2008 |
| 2. | P.K. Basu | Invited talk | <i>From Morse code to radio-on-fibre</i> IEEE-WIE Seminar Next Generation Wireless Communication :Concepts & Technology, World Telecomm Day, | May 17, 08, at IEM, Kolkata.IEM, May 17 |
| 3. | P.K. Basu | Invited talk | <i>THz Electronics and Communication</i> WIE-CUSB Workshop EDCC | Meghnad Saha Audit., June 20, 2008June 20 |
| 4. | P.K. Basu | Invited talk | <i>Photonic devices</i> Invited Tutorial at Nanotechnology: Science, Engineering and Applications organized by IIT-Kgp, July 8, 9, 08 | IIT-Kharagpur, July 7-8, 08 AICTE-SDP |
| 5. | P.K. Basu | Invited talk | <i>Traditional low dimensional structures;</i> Invited Tutorial (as above) | Do |
| 6. | P.K. Basu | Invited talk | <i>Optical Fibre Communication, IETE</i> Foundation Day Seminar | Nov. 2, 2008, Kolkata |
| 7. | P.K. Basu | Invited talk | <i>Si Nanophotonic devices for VLSI and communication</i> | SINP-IRPE, Nov. 27,08 |

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|-----|-----------|--|---|--|
| 8. | P.K. Basu | Invited talk | Seminar Challenges in Nanoelectronics <i>Quest for direct band gap/ Photonics 08</i> | IIT-D,OSA,LEOS Dec 15-17,08 |
| 9. | P.K. Basu | Invited talk | AOMD 08 | IT-BHU, Dec. 22-24 |
| 10. | P.K. Basu | Invited talk | <i>Semiconductor Nanoelectronics and Nanophotonic</i> One Day Seminar on Nanotechnology organized by BIT-Kolkata | IACS, Jan 30 |
| 11. | P.K. Basu | Invited talk | <i>Broadband Communication over fibres</i> | MiSCom, UGC-NRC, Feb 09 |
| 12. | P.K. Basu | Session Chairman, | Photonics 2008 | December 14-17, 2008 |
| 13. | P.K. Basu | Member of NAC & Technical Program & Session Chairman | Photonics 2008 | December 14-17, 2008 |
| 14. | P.K. Basu | Program Chair | CODEC 2009 | IRPE, Hyatt, Dec. 14-16, 09 |
| 15. | P.K. Basu | Judge for selection of best poster paper | Photonics 2008 | do |
| 16. | A. Maitra | Invited talk | <i>Earth-Space Propagation Effects Related to Satellite Communications at Frequencies above 10 GHz at a Tropical Location</i> International Conference on Electronics, Computer and Communication, | 27 - 29 June 2008, Rajsahi University, Bangladesh |
| 17. | A. Maitra | Invited talk | <i>Radio propagation studies at frequencies above 10 GHz related to satellite communications</i> Tutorial on Radio Science, organized by Regional Facility on Radio Science (RFRS), NPL, New Delhi. | 30 June 2008, Rajsahi University, Bangladesh, |
| 18. | A. Maitra | Invited talk | <i>GPS Sounding: An Emerging Tool for Space Based Remote Sensing of Atmosphere</i> One Day Seminar on GPS and its Applications, Sisir Mitra Bhavan, Kolkata. | 5 November 2008, INRAPHEL & TEQIP-UCTCU,Kolkata |
| 19. | A. Maitra | Invited talk | <i>Earth-Space Propagation Studies Related to Satellite Communications in the Tropical Region</i> International Conference on Recent Advances in Microwave Theory and Applications (Microwave-08) | 21- 24 November 2008, University of Rajasthan, Jaipur |
| 20. | A. Maitra | Invited talk | <i>Propagation Studies Related to Satellite Communications at Ku/Ka Bands in Tropical Regions</i> , 7th Indian Conference on Microwaves, Antenna, Propagation & Remote Sensing (InCMARS-2008),. | 9 - 11 December 2008 |
| 21. | A. Maitra | Invited talk | <i>Jagadish Chandra and Wireless Research (Jagadish Chandra ebong Betar Gabeshana)</i> , National Seminar on J C Bose on the occasion of 150th Birth | organized by Bangiya Sahitya Parishad, Kolkata, 20 Dec 2008. |

Anniversary of J C Bose,

| | | | | |
|-----|------------|---------------------------------------|--|--|
| 22. | A. Maitra | Invited talk | <i>Broadband microwave communications</i> Winter School on Broadband Microwave Systems and Communications” Centre, Institute of Radio Physics and Electronics, University of Calcutta, 9-17 February 2009. | (MisCom-09), 9-17 February 2009, UGC NRC |
| 23. | A. Maitra | Session Chairman | International Conference on Electronics, Computer and Communication, | 27 – 29 June 2. |
| 24. | A. Maitra | Chairman-Sub Committee | on the topic of "Satellite Communications", APMC 2008, | Hong Kong (Dec. 16-19, 2008) and Macau (Dec. 19-20, 2008). |
| 25. | A. Maitra | Member, National Organising Committee | Microwave Conference 2008, | Jaipur, 21-24 Nov 2008. |
| 26. | A. Maitra | Member, Organising Committee | International Symposium on Microwaves and Millimeterwaves: Basics and Technology (ISoMM-09). | Bose Institute, Kolkata, 14 - 16 January 2009 |
| 27. | S. Kar | Session Organizer and Session Chair | session entitled “Microwave and Millimeter-wave Devices and Circuits with CAD” Progress in Electromagnetic Research Symposium (PIERS) 2009 | Moscow, Russia during August 18 – 21, 2009. |
| 28. | S. Kar | Invited talk | <i>Some Studies on Left Handed Metamaterials (LHM): May be Useful for Beam Diagnostics Related to Accelerator and Fusion Research</i> Homi Bhabha Centenary DAE-BRNS Symposium on Atomic, Molecular and Optical Physics | Inter University Accelerator Centre, New Delhi, February 9 – 13, 2009. |
| 29. | N. R. Das | Invited talk | <i>Advances in Avalanche Photodiode for Optical Detection</i> , LEOS Technical Lecture organized by <i>IEEE LEOS Calcutta Chapter</i> , | January 7, 2009. |
| 30. | N. R. Das | Invited talk | <i>Avalanche Photodiode in a WDM Receiver System</i> , Short Course on “Recent Trends in Wired and Wireless Communication” held | NIT Silchar, Dec.24-28, 2008. |
| 31. | N. R. Das | Invited talk | <i>Component Crosstalk in WDM Optical Network</i> , Short Course on “Recent Trends in Wired and Wireless Communication” | NIT Silchar, Dec.24-28, 2008. |
| 32. | N. R. Das | Invited talk | <i>Quantum Dot for Seeing in the Dark</i> , National Conference on Creativity in Engineering Education | AOT, Hooghly, West Bengal, Feb.9-10, 2008 |
| 33. | N. R. Das | Program chair | CODEC 2009 | Dec 14-16, 09 |
| 34. | P. K. Saha | Invited Talk | <i>Half a Century of Research in Microwaves at INRAPHEL</i> , HOMMER 08 | CU, Aug 22, 2008 |
| 35. | P. K. Saha | Invited Talk | <i>Sensing with Microwaves</i> , | Jadavpur |

| | | | | |
|-----|------------------|---|--|--|
| | | | Fifth Forum of Japan-Indo Collaboration Project on Infrastructural Communication Technologies supporting Fully Ubiquitous Information Society, | University 19 December, 2008. |
| 36. | P. K. Saha | Co-Chair, Scientific Program Committee | ISoMM 09 | Bose Institute, Jan 14-16, 2009 |
| 37. | P. K. Saha | Keynote address | MiSCom, Winter School of UGC-NRC | Feb. 9. 2009 |
| 38. | P. K. Saha | Invited talks | MiSCom, Winter School of UGC-NRC | Feb. 9-11. 2009 |
| 39. | P. P. Goswami | Invited Talk | TIFR-BITS Workshop on “Introduction to Graphs and Geometric Algorithms”, Birla Institute of Technology & Science | BITS-Pilani, January 22 – 24, 2009. |
| 40. | P. P. Goswami | Invited Talk | Silver Jubilee Workshop on “Introduction to Geometric Algorithm”, Indian Institute of Technology, Kharagpur | IIT-Kharagpur, Oct.31- Nov. 02, 2008 |
| 41. | P. P. Goswami | Invited Talk | TIFR-CRCE Workshop on “Introduction to Geometric Algorithms”, Fr. Conceicao Rodrigues College of Engineering Mumbai. | July 22-23, 2008. |
| 42. | D. Guha | Representation | Represented India in Comm. B in the 2008 URSI GA, Chicago, | August 7-16, 2008 |
| 43. | D. Guha | Invited Talk | <i>New Generation Wireless Antennas</i> Siliguri Institute of Technology, Siliguri, Darjeeling | March 24, 2008 |
| 44. | D. Guha | Invited Talk | <i>Broadband Dielectric Resonator Antennas</i> Antennas and Propagation Symposium APSYM 2008 | Cochin, Dec. 31 2008 |
| 45. | D. Guha | Session Chair | APSYM 2008 | Cochin, Dec. 31 2008 |
| 46. | D. Guha | Half day Tutorial | <i>Planar Antennas for Modern Wireless Communications</i> Fifteenth National Conference on Communications NCC 2009 | IIT Guwahati, Jan. 16-17, 2009 |
| 47. | D. Guha | Invited Talk | <i>Fundamentals of Antenna Engineering and Techniques</i> National WORKSHOP ON Microwave Communication Systems, | Purushottam Institute of Engineering & Technology, Rourkela March 7-8, 2009 |
| 48. | D. Guha | Invited Talk | <i>Advances in Printed Antenna Technology</i> Heritage Institute of Technology, Kolkata | |
| 49. | A. DasGupta | Invited talk | <i>Scintillation Effects on GPS</i> , IEEE One Day workshop: Microwave in Space | Jadavpur University, Kolkata, September 2008. |
| 50. | A. | Invited talk | <i>F Region Irregularities</i> , | Andhra |

| | | | | |
|-----|-----------------|----------------------------|--|------------------------------------|
| | DasGupta | | DST Sponsored Science and Engineering Council (SERC) School | University, September 22-23, 2008. |
| 51. | A. DasGupta | Invited talk | <i>GPS and Propagation Effects</i> , IETE Foundation Day | Nov 2, 2008, Kolkata |
| 52. | A. DasGupta | Invited talk | <i>An Introduction to GPS and Propagation Effects</i> , One Day Seminar on Global Positioning System (GPS) and Its Applications | INRAPHEL, Nov 5, 2008. |
| 53. | Susanta Sen | Invited talk | <i>CMOS Circuits</i> , in SemiNano 08, Summer School of UGC-NRC | June 2-20, 2008 |
| 54. | Susanta Sen | Invited talk | <i>CMOS and Beyond: From Micro to Nano Electronics</i> | November 27, 2008 |
| 55. | Susanta Sen | Invited Talk | Challenges in Nanoelectronics, SINP <i>Nanotechnology and its challenges in Electronics</i> , One day Seminar on Nanotechnology, BIT-Kolkata | IACS, Jan. 30, 2009 |
| 56. | Dipankar Biswas | Invited Seminar | <i>Explanation of strange PL observed on annealing III-V nanostructures</i> | INRAPHEL, June 9, 2008 |
| 57. | J. B. Roy | Invited talk | <i>Microprocessor-a versatile chip</i> | March 18-19, 2008 |
| 58. | J. B. Roy | Invited talk | State level workshop on “Undergraduate Science Education: An interdisciplinary approach” organized by Vidyasagar college <i>Microprocessors</i> | September 1 – 20, 2008. |
| 59. | J. B. Roy | Session Chairman | 16 th Refresher Course in Physics, UGC-ASC, Dept Physics, CU <i>Technological aid in teaching and learning</i> | December 19-20, 2008 |
| 60. | P. K. Karmakar | Invited series of lectures | UGC sponsored National Workshop on “Undergraduate Physics Education: March towards Quality and Excellence in Higher Education”, Physics Dept., Vidyasagar College <i>Mcrowave propagation and remote sensing</i> | February-March, 2009 |
| | | | Instituto Nacional de Pesquisas Espaciais, Brazil | |

(E) Collaboration with National/International Institutes

| | Name | Name of the Collaborating Scientist/Institution | Nature of collaboration |
|----|----------------------|--|---------------------------------|
| 1. | Prof. A. K. Dasgupta | NPL, GMRT, NMRF-Tirupati, Andhra U, SAC, Boston U, Boston College, USA, ICTP-Trieste | Joint research |
| 2. | Prof. N. Purkait | NPL, PRL | Joint research |
| 3. | Prof. P. K. Saha | RMC, Kingston, Canada, SAMEER-Kolkata | Joint research and book writing |
| 4. | Prof. P. K. Basu | McMaster Univ, Canada | As above |

| | | | |
|-----|--------------------|---|---|
| 5. | Prof. S. Sen | TIFR | Joint research |
| 6. | Prof. D. Biswas | U Valencia, Spain | Joint research |
| 7. | Prof. Subal Kar | Lawrence Berkeley National Laboratory, University of California at Berkeley, U.S.A | Laser based Ultrafast X-ray source (LUX) for ultrafast studies in human cells. Nano structures etc. |
| 8. | Prof. A. Maitra | i) Bose Institute, Kolkata ii) Satellite Application Centre, ISRO, Ahmedabad iii) Rutherford Appleton Laboratory, UK iv) Strathclyde University, UK Microwave Laboratory, University vi) Catholique de Louvain, Belgium | Joint research, collaboration in sponsored projects |
| 9. | Dr. D. Guha | Royal Military College of Canada, Kingston, Ontario. | Joint works on developing new Planar Antennas |
| 10. | Dr. D. Guha | CSIR Regional Research Laboratory (RRL), Trivandrum | Dielectric Resonators for wideband Wireless Antennas |
| 11. | Dr. D. Guha | Spotwave Wireless Inc., a North American Wireless Industry | Design of dual band high gain wireless antenna. |
| 12. | Dr. N. R. Das | McMaster University | Joint research |
| 13. | Dr. Abhijit Biswas | IMEC-Belgium, IIT-Kharagpur | Joint research |

(F) Conferences/Workshops arranged/supported by Faculties of INRAPHEL

| Title | Date/venue | Collaboration/support |
|--|--------------------|---|
| 1. Summer School “ Physics of Semiconductor Nanostructures” (SemiNano) | June 2-20, 2008 | UGC Networking Resource Centre |
| 2. Conference “Nanotechnology: Fabrication & Characterisation Techniques” (NanoFACT) | June 13-14, 2008 | TEQIP |
| 3. One day Seminar on “ Electronics, Devices, Computers and Communication” (EDCC) | June 20, 2008 | IEEE-WIE & IEEE-CUSB |
| 4. Workshop on Air Interface Design for Broadband Wireless Systems | August 4-6, 2008 | CTIF-India, TEQIP of UCTCU & NIT-Durgapur |
| 5. Horizons on Microwave & Millimeterwave Engineering Research (HOMMER) | August 22, 2008 | CRTMMW, TEQIP |
| 6. One day Seminar on Global Positioning Systems (GPS) and Its Applications | November 5, 2008 | TEQIP |
| 7. One day Seminar on “Challenges in Nanoelectronics” | November 27, 2008 | INRAPHEL +SINP |
| 8. High Speed Wireless : Third Generation (3G) Mobile Communication | December 7-9, 2008 | CTIF-India |
| 9. ISoMM | Jan. 14-16, 2009 | Bose Institute : cosponsored by INRAPHEL |

| | | | |
|----|------------------------|-------------------|--------------------|
| 10 | Winter School “MiSCom” | February 9-27, 09 | UGC-NRC |
| 11 | Science Day | February 28, 2009 | LEOS, CUSB of IEEE |

(G) Visits, Lectures by Distinguished Scientists and Other Lectures arranged

| | | | |
|-----|--|--|------------------------------------|
| 1. | J. Sarma Dept E&EE, Univ. Bath, UK | Surfing the Surface Plasmon Waves | UGC-UPE April 1, 2008 |
| 2. | Dr. Koushik Maharatna School of ECEngg University of Southampton | Bio-inspired reconfigurable array for implantable neuro-therapeutics (BRAIN): a mission | RPEA |
| 3. | Chandrakanta Kumar Scientist E ISRO-Bangalore | Antenna technology used in Chandrayaan mission by ISRO | RPEA |
| 4. | Dr. Subhasish Chakrabarti Dept E& EE, Univ. of Manchester, UK | Photonic Engineering of THz Quantum Cascade Lasers with Aperiodic Lattices | UGC-NRC, LEOS, CUSB |
| 5. | Prof. Dipankar Biswas, INRAPHEL, CU | Explanation of strange PL observed on annealing of III-V semiconductor nanostructures | UGC-NRC, LEOS, CUSB |
| 6. | Prof. Subir Sarkar, E&TCE, JU | Single electronics- a prospective substitute beyond CMOS for VLSI circuits | UGC-NRC |
| 7. | Prof. Bhargab Bhattacharya, ISI, Kolkata | Nanofluidics and biochips | UGC-NRC, LEOS, CUSB |
| 8. | Dr. Kuntal Chakrabarti, SNBNCBS, Kolkata | Carbon Nanotubes | UGC-NRC, LEOS |
| 9. | Prof. P. K. Basu INRAPHEL | Terahertz electronics and communication | IEEE-WIE, CUSB June 20, 2008 |
| 10. | Prof. N. R. Das INRAPHEL | Advances in Photodiodes for optical detection | LEOS Jan 07, 09 |
| 11. | Dr. Sanatan Chattopadhyay Dept. electronic Sc., CU | CMOS: challenges | LEOS |

**Speakers and title of talks in Three Day Workshop on
Wireless Communication :**

**Air Interface Design for Broadband Wireless Systems: WiMAX, 3GPP LTE, IMT - Advanced
August 4- 06, 2008**

| | Name | Organization | Title of Talk |
|----|------------------------|---|--|
| 1. | Prof. Debesh Das | Minister-in-Charge, IT, Govt WB | Keynote address |
| 2. | Prof. Ramjee Prasad | Director, CTIF, Aalborg University (AAU), Denmark | Visions of Future Wireless Systems (4G) Conclusions |
| 3. | Prof. Flemming Bjerger | CTIF/RATE Section, | A more flexible usage of the “scarce” |

| | | | |
|----|----------------------------|--|--|
| | Frederiksen | Department of Electronics Systems, AAU. Denmark | spectrum ? |
| 4. | Dr. Muhammad Imadur Rahman | Research Engineer, Ericsson Research, Sweden | Transceiver issues from PHY point of view (part I) Uplink Issues (part II) MAC: Link Adaptation (part I) MAC: Resource Allocation (part II) |
| 5 | Dr. Suvra Sekhar Das | Senior Scientist, Tata Consultancy Services, India | Wireless channel propagation and cellular concept (part I) Downlink Issues (part II) MAC: Link Adaptation (part II) MAC: Resource Allocation (part I) |
| 6 | Dr. Nicola Marchetti | Assistant Professor, CTIF/RATE Section, Department of Electronics Systems, AAU, Denmark | Transceiver issues from PHY point of view (part II) Downlink Issues (part I) Uplink Issues (part I) Technological Comparisons |
| 7 | Mr. Michael Jensen | Head of Network Planning WIP Labs/ CTIF-NetSec Section, Department Electronics Systems, AAU. Denmark | WIP Labs' Network Planning: an Overview |

Speakers and title of talks in One Day Seminar HOMMER-2008
on August 22, 2008

| | Name | Organization | Title of Talk |
|----|----------------------------|----------------------|--|
| 1. | Prof. P. K. Saha | INRAPHEL | Half a Century of Research in Microwaves at INRAPHEL |
| 2. | Dr. S. S. Rana | SAC, ISRO, Ahmedabad | Microwave and Laser Remote Sensing |
| 3. | Prof. S. K. Koul | CARE, IIT-Delhi | Recent Trends in Millimeterwave Circuit Design and Technology |
| 4. | Prof. Sudeep Bhattacharjee | IIT-Kanpur | New Frontiers in Nanoscience and Technology using Microwaves for |

Generation of Multielement Focused Ion Beams.

Speakers and titles of talks in One Day Seminar on Global Positioning Systems (GPS) and Its Applications on November 5, 2008

| | Name | Organization | Title of Talk |
|----|----------------------|---|--|
| 1. | Prof. A. DasGupta | S.K. Mitra Center for Research in Space Environment, CU | An Introduction to GPS and Propagation Effects |
| 2. | Dr. A. Sengupta | National Physical Laboratory | An Introduction to GPS Signal Characteristics, Reception and its Use in Time Dissemination |
| 3. | Dr. K.N.S. Rao | Indian Space Research Organization | Indian Satellite Based Augmentation System – GAGAN and IRNSS |
| 4. | Prof. A. Maitra | INRAPHEL | GPS Sounding: An Emerging Tool for Space Based Remote Sensing of Atmosphere |
| 5. | Dr. S. Bandyopadhyay | Department of Geography, CU | GPS in Geomorphic Change Detection: Case Studies from West Bengal |

Speakers and titles of talks in Challenges in Nanoelectronics: Nov. 27, 2009

| | Name | Organization | Title of Talk |
|----|---------------------------|-------------------------------|---|
| 1. | Prof. M. Pepper | Cavendish Lab, Cambridge Univ | Keynote Address |
| 2. | Prof. Susanta Sen | INRAPHEL-CU | CMOS and Beyond: From Micro to Nano Electronics |
| 3. | Prof. M. K. Sanyal | SINP | Organic Electronics |
| 4. | Prof. S. Yarlagadda | SINP | Spintronics |
| 5. | Prof. P. K. Basu | INRAPHEL-CU | Si Nanophotonics for VLSI circuits and communications |
| 6. | Prof. S. Banerjee | SINP | |
| 7. | Dr. Sanatan Chattopadhyay | Dept. Electronic Sc. CU | CMOS: Challenges |

Speakers and titles of talks in Workshop *High Speed Wireless Third Generation (3G) Mobile Communication*

Organized by CTIF-India & INRAPHEL (7th -9th December 2008)

| | | | |
|---|-------------------|---|---------------------|
| 1 | Prof. Susanta Sen | Dean, Faculty of Engineering and Technology, CU | Welcome Speech |
| 2 | Dr. Samar Kumar | Chief General | Introduction Speech |

| | | | |
|----|------------------------------|---|---|
| | Chakravarty | Manager, BSNL, Kolkata | |
| 3 | Mr. K. Sridhara | Member Technology, Telecom Commission, Government of India | Keynote address, “Role of Cognitive Radio for Future Communications” |
| 4 | Dr. Debes Das | Honourable ICT Minister, West Bengal | Inaugural Speech |
| 5 | Prof. Ramjee Prasad | Director, CTIF, Aalborg University, Denmark | Concluding Remarks |
| 6 | Dr. Ashok Chandra | Joint Wireless Advisor, Government of India | PANEL DISCUSSION on “Global ICT Standardisation Forum for India” |
| | Mr. T.R. Dua | Cellular Operator Association of India | |
| | Prof. Ole Brun Madsen | Co-Director, CTIF, Aalborg University, Denmark | |
| | Mr. Rajeev Ranjan Prasad | Managing Director, WIP Labs, India | |
| | Mr. Debasis Bandyopadhyay | Vice President, TCS | |
| | Dr. S.S. Inamdar | Principal, SIT, Lonavala, India | |
| 7 | Mr. T.R. Dua | Cellular Operator Association of India. | <i>3G Scenario in India</i> |
| 8 | Prof. Knud Erik Skouby | Director, CTIF- Copenhagen, Aalborg University, Denmark | <i>A Broad Overview of Future Internet</i> |
| 9 | Mr. Gautam K. Audhya | General Manager (Sales and Marketing), BSNL, India | <i>3G Evolution and WiMAX</i> |
| 10 | Dr. Jaydip Sen | Consultant, TCS, India. | <i>Challenges for the Future Wireless Communication</i> |
| 11 | Dr. Ashok Chandra | Joint Wireless Advisor, Government of India. | <i>Challenges for Spectrum Management</i> |
| 12 | Dr. Suvra Sekhar Das | Department of E & ECE, IIT Kharagpur, India | <i>Physical Layer Aspects of 3G Mobile Communication</i> |
| 13 | Ms. Soma Bandyopadhyay | Consultant, TCS. | <i>Physical Layer Challenges</i> |
| 14 | Prof. Ole Brun Madsen | Co-Director, CTIF – AAU, Denmark. | <i>The Future Global Network Planning</i> |

ANNEXURE-IX

New Projects Sanctioned

| <u>Name</u> | Project Title | Funding agency/amount in lakhs/period |
|--|--|--|
| 1. P. K. Basu & N. R. Das | Physics and modeling of Si nanophotonic devices | DST, ~ 12 lakhs 2007-2010 |
| 2. Prof. S. S.De/ Dr. Bijay Bandyopadhyay | Monitoring Global Electricity Parameters | Indian Space Research Organization Rs. 35, 06,558 01.04.2007 (3 yrs) |
| 3. Prof. A. Maitra | Radio Remote Sensing of the Tropical Atmosphere (Phase II) | ISRO, Department of Space, Government of India, Bangalore Rs. 14.83 lakhs 2007 -2010 |
| 4. Prof. A. Maitra | Studies on tropical rain and atmospheric water content using ground based measurements and satellite data related to Megha Tropiques Mission | SAC, ISRO Rs. 29.34 lakhs 2007-2010 |
| 5. Prof. A. Maitra | Studies on Water Vapour and Cloud Liquid Water using Radiometers and Related Rain/Fog Environment at High Altitude Station at Darjeeling | DST, Government of India, under IRHPA Scheme through Bose Institute, Kolkata, 2005- 2010. |
| 6. Sri Ashik Paul | A study on the variability of total electron content near the crest of the equatorial anomaly in the Indian zone | ISRO, 7 lakhs Feb. 2006 – 3 years |
| 7. A. Dasgupta | Operation of SCINDA Receiver at the University of Calcutta | Department of the Air Force, Asian Office of Aerospace Research and Development (AOARD), Japan US\$6900.00 (~Rs. 2.95 lacs) (2008-2009) |
| 8. A. Dasgupta | Ionospheric Space Weather in relation to Satellite Based Systems | ISRO Rs. 33.05 lacs 2007-2010 |
| 9. Prof. S.S. De (PI) and Dr. B. Bandyopadhyay (Co-I) | Monitoring Global Electricity Parameters | ISRO Rs: 27.48 lakhs Duration : 3 years |

ANNEXURE X

Activities of Student Organizations in 2008-09

University of Calcutta Student Branch, IEEE; Student Branch Code: 28561

School Code: 2528593; Email Address: sb.cu@ieee.org

| TECHNICAL LECTURES | |
|---|--|
| Edge effects on Integral Quantum Hall Effect <i>March 20, 2008</i> | Professor B. M. Arora, Condensed Matter Physics & Material Science Division, Tata Institute of Fundamental Research, Mumbai. |
| III-V Compound Semiconductors: destined for Light <i>March 24, 2008</i> | Professor B. M. Arora, |
| The GMRT and its Subsystems- <i>March 28, 2008</i> | Prof. S. Ananthkrishnan, Adjunct Professor, Pune University. |
| The Square Kilometer Array: The Exciting New Radio Array of 2020 <i>March 31, 2008</i> | Prof. S. Ananthkrishnan, |

| COMMUNITY EVENT / EDUCATIONAL PROGRAM |
|---|
| <ul style="list-style-type: none"> • National Science Day (India) (February 28, 2008) was celebrated as an educational program where some school and college students were invited. College students participated in an interactive session on <i>Recent Development on Communication and Information Technology</i>. There were presentations on different topics related to present socio-economic problems and their solutions by the students of Department of Radio Physics and Electronics, University of Calcutta. The students enjoyed the program very much. Everyone including participating teachers highly appreciated the activities and requested for similar events in future also. The program was organized jointly with the LEOS Chapter (Calcutta Section). • Some of the Student members participated in an One Day Out-Reach Program on “Recent Trends in Information and Communication Technology” on 11th April, 2008 at Birbhum Institute of Engineering and Technology, Suri, West Bengal, India. There was a student presentation regarding the <i>IEEE Student Activity</i> to motivate the college students to become IEEE member. The program was jointly organized with IEEE Calcutta Section and IEEE WIE Affinity Group, Calcutta Section. • A one day workshop cum student paper and design model contest was organized on Electronic Devices Computers and Communication (EDCC-08) on 20th June, 2008. Students of various institutions of the state joined to compete for the presentations. The program was jointly organized by IEEE Calcutta University Student Branch and IEEE Women in Engineering Affinity (WIEA) Group, Calcutta Section in patronage and partial sponsorship from IEEE Calcutta Section. • A dinner party and one day outing was arranged to refresh the student members before their annual semester in the month of February, 2008. Students have enjoyed quite a lot through this excursion/visit. • Science Day, February 28, 2009 will be celebrated as in previous years. |

ANNEXURE XI

(A) A Report on the Summer School on Physics of Semiconductor Nanostructures SemiNano 2008 (June 2-20)

Organized by UGC Networking Resource Centre

Genesis of UGC Networking Resource Centre

Ministry of Human Resource Development set up a committee to examine the current status of research and education in India. Following the recommendation of the committee to set up ten Centres, two each in Physical, Chemical, Life, Mathematical and Materials Science, the UGC invited proposals from University Departments under UGC's Special Assistance Program. After scrutiny of the proposals by an Empowered committee, shortlisted departments were invited for further discussion and revision of the proposals. The Institute of Radio Physics and Electronics, a Centre of Advanced Study since 1963, was finally selected as a UGC Networking Resource Centre in Physical Science in 2007-08.

About the Summer School

As a UGC-NRC, the Centre is to conduct 10 Summer/Winter Schools in 5 years, and to give training to UG,PG students, researchers, postdoctoral workers and faculties of Universities and college to conduct research, develop learning resources, allowing the participants to share the infrastructure, equipment, library, internet and all other facilities.

INRAPHEL decided to initiate the program under UGC-NRC by holding a 3 week summer school entitled "Physics of Semiconductor Nanostructures" (SemiNano 2008) to give an in depth training on Semiconductor Materials, Devices and Nanostructures. The targeted participants are University/College teachers, researchers and M. Tech students.

The aim and scope of the Summer School was detailed in a poster displayed in the Institute's website (www.irpel.org), in which the registration form was included for intending participants for online registration. The printed poster and its soft copies were sent by post and e-mail to more than 100 institutions in India. The intending participants were asked to write a few lines in the registration form how they are involved in teaching and research in the topic of school and their motivation to undertake the course.

Selection of Candidates

The submitted registration forms were examined and a list of selected fellows were published in the website to enable them to reserve train/air tickets. Due consideration was given to select participants from all over India and to give preference to candidates from North Eastern regions. The following Table 1 may provide an idea how the objective was fulfilled.

Table 1. List of selected fellows

| No | Name | Position | Institution |
|----|--------------------------|------------------------|--|
| 1. | Sri Niladri Pratap Maity | Lecturer & HoD | Mizoram University |
| 2. | Smt. Reshmi Das | Lecturer | Mizoram University |
| 3. | Sri N. Basant Singh | Sr. Lecturer | Manipur Inst Technology |
| 4. | Sri Susahanta K. Dutta | Asst. Prof | NEHU, Shillong |
| 5. | Smt. Sweetly Sarma | Lecturer & Ph.D worker | Lalit Ch Bharali College, Maligaon & Scholar, Elec. Sc, Gauhati Univ |

| | | | |
|-----|-------------------------------|-------------------------|---|
| 6. | Sri Jayanta Barman | Ph.D. scholar | USIC, Gauhati Univ. |
| 7. | *Smt. Jumi Kakati | Do | Dept El Sc, Gauhati Univ. |
| 8. | *Smt. Moumita Mazumdar | Lecturer | Tripura University |
| 9. | Sri Nikhil Raj | M. Tech student | NIT, Kurukshetra |
| 10. | Sri Abhilash M. T. | Lecturer | BITS-Pilani, Goa Camus |
| 11. | * Dr. Nilanjan Halder | Postdoc Fellow | IIT-Bombay |
| 12. | Sri Sudheer Nune | M. S. Worker | IIT-Madras |
| 13. | Sri M. Nagarajan | Ph.D. worker | Crystal Growth Centre, Anna University |
| 14. | Sri M. Balaji | Do | Do |
| 15. | Munawar Basha S. | Do | Do |
| 16. | * Smt. Sangeeta Palo | Lecturer & Ph.D. worker | Rowland Inst. Tech & Berhampur University |
| 17. | Dr. Ranajit Ghosh | Lecturer | Haldia Inst Technology, WB |
| 18. | * Sri Goutam Paul | Lecturer | Do |
| 19. | *Sri Falguni Sinha Babu | Lecturer | BESU, Shibpur WB |
| 20. | Sri Soumyen Banerjee | Lecturer | Inst Engg Management, Kolkata |
| 21. | Sri Subhro Ghosal | Lecturer | Acharya Prafulla Ch. College, Kolkata |
| 22. | Dr. Upendra Nath Nandi | Reader | Scottish Church College, Kolkata |
| 23. | Dr (Smt) Madhumita Das Sarkar | Reader | WB Univ. Technology, Kolkata |
| 24. | Smt. Poulami Rakshit | Research Scholar | INRAPHEL, CU |
| 25. | *Sri T. R. Lenka | Lecturer/ Ph.D. worker | NIST-Berhampur, Orissa/IIT-B |
| 26 | * Sri Das | Do | do |

The persons with * could not attend due to examination and other duties. In addition to above, more than 25 M. Tech/M.Sc students of different departments of the University and researchers also attended the lectures regularly.

Inaugural Function

The inauguration of the Summer School was held at 10 AM on June 2, 2008 at the Meghnad Saha auditorium of the University with Professor Suranjan Das, the Vice Chancellor of the University, as the President. Professor Debes Das, the Minister-in-Charge of Information Technology, Govt of West Bengal, delivered the inaugural address. Prof. D. J. Chattopadhyay, the Pro Vice Chancellor (Academic Affairs) of the University spoke about the initiatives taken by the Nanofabrication Centre of the University with support from MHRD. Professor Susanta Sen (Dean, Faculty of Technology) introduced the participants to the long heritage of research and education in the University and faculty of technology. Professor Goutam Ghosh, Head of the Department, gave the introductory address narrating the achievements of the department and Professor P. K. Basu, CAS Coordinator, described how the department was selected as the UGC-NRC and what are the proposed activity of the NRC. Dr. D. Guha offered a vote of thanks.

Course Structure and Faculty

The aim of the school was to start from the very fundamental topics related to physics of semiconductor materials and devices and at the end to make the participants aware of the latest developments in the area of Semiconductor based nanoscience and nanotechnology. For this purpose the initial classes were devoted to fundamental principles that are introduced to first year B. Tech students of INRAPHEL. Since these students come with B. Sc. (Physics Honours) background, the level is higher than what is taught in most Engineering Institutions in India offering 4 year B. Tech degree after higher secondary. One of the objectives to develop the course in the manner described is to make the participants aware of the need for fundamentals to initiate M. Tech courses and to undertake basic research in nanoscience and nanotechnology. The following table 2 gives the list of topics covered and the names of faculties conducting the courses.

Table 2. List of Topics and Speakers

| Topics of Theoretical courses | Name of Speaker | Affiliation of Speaker |
|--|---------------------------|---|
| Overview of the course | Prof. P. K. Basu | INRAPHEL, CU |
| Quantum theory, band structure, transport, Excess Carriers | Prof. P. K. Basu | Do |
| Growth of Materials | Dr. Kuntal Chakrabarty | SNBNCBS, Kolkata |
| Fabrication of materials and devices | Dr. Abhijit Mallik | Dept El. Sc, CU |
| p-n junction theory | Dr. Bratati Mukhopadhyay | INRAPHEL |
| Bipolar Junction Transistors | Dr. Gopa Sen | Do |
| MOSFET: Fundamentals, Threshold voltage, Short Channel Effects, Low power Design, Nanoscale FETs | Dr. Sanatan Chattopadhyay | Dept El Sc, CU |
| CMOS Circuits | Prof. Susanta Sen | INRAPHEL, CU |
| Photonic Devices | Dr. N. R. Das | Do |
| Fundamentals of Nanostructures, and their applications | Prof. P. K. Basu | Do |
| Characterization of materials and Devices | Prof. S. Dhar | Dept El Sc, CU |
| Nanophotonics: Surface Plasmon Waves | Prof. P. K. Saha | INRAPHEL, CU |
| Topic of Lab Courses | Supervisor | Affiliation |
| Simulation Programmes: SPICE | Dr. Sumitra Ghosh | INRAPHEL, CU |
| Simulation of Nanoelectronic Devices with Silvaco softwares | Dr. Abhijit Biswas | Dept. E&TCE, Jadavpur University |
| Photoluminescence characterization | Prof. S. Dhar | Dept El. Sc, CU |
| Scanning Electron Microscopy | Dr. P. K. Maity | Dept. Chem Tech, CU/ Central Facility under TEQIP |

Seminars

The participants were also exposed to the latest developments in the emerging area of semiconductor nanotechnology through seminar lectures delivered by experts from India and abroad. The titles and lecturers of the seminars are given in the following table 3.

Table 3. List of Seminars and Speakers

| Title | Speaker | Affiliation |
|--|----------------------------|-------------------------------------|
| <i>Photonic Engineering of THz Quantum Cascade Lasers with Aperiodic Lattices</i> | Dr. Subhasish Chakrabarti | Dept E& EE, Univ. of Manchester, UK |
| <i>Explanation of strange PL observed on annealing of III-V semiconductor nanostructures</i> | Prof. Dipankar Biswas | INRAPHEL, CU |
| <i>Single electronics- a prospective substitute beyond CMOS for VLSI circuits</i> | Prof. Subir Sarkar | E&TCE, JU |
| <i>Nanofluidics and biochips</i> | Prof. Bhargab Bhattacharya | ISI, Kolkata |
| <i>Carbon Nanotubes</i> | Dr. Kuntal Chakrabarti | SNBNCBS, Kolkata |
| <i>Terahertz electronics and communication</i> | Prof. P. K. Basu | INRAPHEL, CU |

The participants were preregistered for a 2 day Workshop entitled “Nanomaterials and Devices: Fabrication & Characterization Techniques” (Nano-Fact) held during June 13 and 14. The topics covered and speakers and their affiliation are entered in the following table 4.

Table 4. Topics and Speakers in 2 day Workshop Nano-Fact

| Topic | Speaker | Affiliation |
|--|------------------------------|---|
| MBE Growth and Characterization of InGaAs/GaAs nanostructured Quantum Dot based heterostructures | Prof. Subhananda Chakraborty | Dept. EE, IIT-Bombay, Mumbai |
| Semiconductor Nanostructures for Device Applications | Prof. Samit Kumar Roy | Dept of Physics & Meteorology, IIT-Kharagpur. |
| Gold Nanoparticles in Biosensors and Medicine | Prof. Chanchal Mitra | School of Chemistry, University of Hyderabad |
| Nanoscience and Nanotechnology | Prof. Prasenjit Sen | School of Physical Science, JNU, New Delhi |
| Industry Exposure | Dr. Arup Chatterjee: | ICAN-NANO, Kolkata |
| Nanomedicine: Nanoparticles of Biodegradable Polymers for Cancer Diagnosis and Treatment at its earliest Stage | Prof. S. S. Feng | National University of Singapore, Singapore |
| Nanotechnology: Application in Medicine for better Therapy | Prof. R. N. Saha | BITS, Pilani. |

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|---|------------------------|---|
| Enantiomeric Synthesis of Chiral Drugs and Drug Intermediates through Biotechnological Routes | Prof. U. C. Banerjee | NIPER, Mohali |
| Semiconductor nanowires: synthesis, characterization, and devices | Dr. Arnab Bhattacharya | TIFR, Mumbai |
| Brick-by-Brick assembly of Nanoparticles for Electronic Devices and Sensors | Prof. Joydip Datta | Asia Institute of Technology, Thailand |
| Journey through Micro to Nano scale: Materials Science using Ion Beams | Prof. D. C. Kothari | Dept. of Physics and Centre of Nanotechnology, University of Mumbai, Mumbai |

Visits to Other Institutions

All the participants, some of the faculties and M. Tech students participating in the school made a one-day visit to the Saha Institute of Nuclear Physics, Kolkata, where the scientists showed the visitors their growth, fabrication and characterization facilities. These include the following:

1. Molecular Beam Epitaxy for Si based Quantum Structures;
2. Secondary Ion Mass Spectroscopy;
3. X-ray diffractometer;
4. Dektak set-up;
5. TEM and SQUIDs;
6. Ion Implantation facility.

Distribution of Lecture Materials

All the speakers made powerpoint presentation of their lectures and all of them were stored in a dedicated computer. The registered participants were given a 2 GB pendrive, in which they copied all the lecture materials and other information they downloaded from internet. The participants were provided reading room facilities in the departmental library.

Feedback from Participants

A carefully prepared questionnaire form was distributed amongst all the participants inviting comments about course content, method of presentation, choice of speakers, whether the course material would be helpful for their research and/or development of curriculum in UG/PG levels, overall performance of the school and whether they would encourage their colleagues and students to visit the UGC-NRC in INRAPHEL. Questions were also asked about the hall management, distribution of notes, access to other facilities, etc.

The participants were highly satisfied with the activities of the school and the method of distribution of learning resources. The balance between theory and lab work, in their opinion, was right. Some participants however expected more lab exposure, assignment of brief but research oriented problems and seminar by participants. A few suggested that a more focused topic could be chosen.

Tests and Certificates

A few teachers gave assignments based on their lectures. However, due to time constraint, especially since two days were lost due to bandh, the tests could not be conducted.

The registered participants were awarded Participation Certificates signed by the Head of the Department and the Coordinator : CAS Program cum Director of Seminars at the Valedictory session.

**(B) A Preliminary Report on the Winter School on *Broadband Microwave Communication Systems*
(MiSCom 09)**

List of Lectures, Training, Seminars

| No | Speaker | Affiliation | Title of talk |
|----|----------------------|--|--|
| 1. | Prof. P. K. Saha | INRAPHEL | Keynote address : Half a Century of Research in Microwaves in INRAPHEL |
| 2. | Dr. K. P. Ray | Head, RF & Microwave Power System Division SAMEER, Mumbai | Printed Transmission Lines and Radiating Structures |
| 3. | Prof. P K. Saha | INRAPHEL | i) Horns and Feeds-I & II ii) Broadband Transmission Media |
| 4 | Dr. P. Hari Krishna | V istech Information Systems Pvt. Ltd., Basavanagudi, Bangalore - 560 004 | FEM: Commercial Simulator and Applications (I) |
| 5 | Dr. H. P. Ravindra | As above | FEM: Commercial Simulator and Applications (II) |
| 6 | Prof. J. P. Banerjee | INRAPHEL | i) Microwave Semiconductor Devices ii) Laboratory Works |
| 7 | Dr. M.T.Sebastian | National Institute of Interdisciplinary Science & Technology NIIST, Trivandrum, 695 019 | Dielectric Materials for Wireless Communication |
| 8 | BSNL Staff | | BSNL: Satellite Link and Communications |
| 9 | Prof. D. Guha | INRAPHEL | Broadband Dielectric Resonator Antennas |
| 10 | Sri S. Biswas | Dept. of E& C Engg Institute of Technology & Marine Engineering Jhinga, P.O Amira, South 24 Parganas | CAD Design and Lab (I) |
| 11 | Prof. A. Maitra | INRAPHEL | Broadband Microwave Radio-I |
| 12 | Prof. P. K. Goswami | INRAPHEL | Broadband Amplifier |
| 13 | Prof. S. K. Koul | IIT, DELHI | Integrated Antennas |
| 14 | Prof. B. N. Biswas | Academy of Technology, Adisaptogram, Hooghly, WB. | Microwave Photonic Link |
| 15 | Prof. A. K. Mishra | Department of Electronics and Communication Engineering (ECE), IIT, Guwahati | Radar Imaging: An Introduction |

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|----|----------------------|--|--|
| 16 | Dr. M. Biswas | INRAPHEL/ WBSU | Hand on Training for Printed Antennas |
| 17 | Prof. B. Gupta | ETCE dept., Jadavpur University, Kolkata 700 032 | Broadband matching network |
| 18 | Prof. D. R. Poddar: | ETCE dept., Jadavpur University, Kolkata 700 032 | EM Interference and Compatibility |
| 19 | Dr. R. Ghatak | Dept. of Physics, The University of Burdwan, WB | Virtual Microwave Measurements |
| 20 | Prof. R. Garg | IIT-KHARAGPUR | Ultra Wideband Antennas |
| 21 | Prof. R. K. Mishra | Electronic Science Department Berhampur University Berhampur, ORISSA | Optimization Techniques in Electromagnetics |
| 22 | Prof. P. K. Basu | INRAPHEL | Broadband Communications |
| 23 | | | CAD Lab/Library |
| 24 | Prof. J. P. Banerjee | INRAPHEL | Hands on training |
| 25 | | | Visits to Haringhta Field Station, CU & Visit to BSNL Satellite Earth Station at Kulpi |
| 26 | | | Seminar by Participants |

List of Participants in MisCom

| No. | Name | Designation | Affiliation |
|-----|------------------------|---|---|
| 1. | Pranjal Borah | Project Student, GMRT, TIFR | C/O, Head Of the Department, Department of Electronics Science, Gauhati University, Assam, Guwahaty 14. |
| 2 | Halappa Ramappa Gajera | Lecturer in DOSElectronics, Post Graduate Center, | University of Mysore , Hassan, Karnataka, India-573220 |
| 3 | Sanjib Kumar Mandal | Scientist "C" | DEAL – DRDO, Dehradun |
| 4 | Ms. Payal Majumdar | Ph.D. student & Cooperative Teacher | Department of Electronic Science, University of Delhi South Campus (UDSC), New Delhi |
| 5 | Yogendra Kumar Awasthi | Lecturer cum Research Scholar | Microwave Research Laboratory, UDSC, New Delhi |
| 6 | Ayan Karmakar | Project Engineer | Semi-Conductor Laboratory, S.A.S Nagar, Sector-72, Mohali, Near Chandigarh |
| 7 | Paramjeet Singh | Research Fellow | Department of Electronic Science, UDSC, New Delhi |
| 8 | Himanshu Singh | Ph.D. student cum | Microwave Research Laboratory, Dept. of Electronic |

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|----|----------------------|---------------------------------|---|
| | | Lecturer, Aurobino College | Science, UDSC, New-Delhi-21 |
| 9 | Ashwani Kumar | Lecturer, Sri Aurobindo College | Ph. D. Student in Microwave Research Laboratory, University of Delhi, New-Delhi |
| 10 | Somak Bhattacharyya | Lecturer | Academy of Technology, Hoogly, WB |
| 11 | Dhrubajyoti Bhaumick | Project Student | GMRT, TIFR |
| 12 | Subhadeep Banerjee | Student | Techno India, Salt Lake, Kolkata |
| 13 | Ankit Ladha | Student | Techno India, Salt Lake, Kolkata |
| 14 | Ms. Poulomi Gupta | Student | Acharya Prafulla Chandra College, New Barackpur, Kolkata |
| 15 | Ms. Ruma Mandal | Student | Acharya Prafulla Chandra College, New Barackpur, Kolkata |
| 16 | Ms. Archita Banerjee | Ph.D. Student | Registered Ph.D. student of INRAPHEL, CU |