

FACULTY ACADEMIC PROFILE/ CV

1. **Full name of the faculty member:** Susanta Sen
2. **Designation:** Professor
3. **Specialisation :** Quantum Electron Devices, VLSI Design, Instrumentation
4. **Contact information :**
Institute of Radio Physics and Electronics, University of Calcutta, 92, A.P.C. Road,
Kolkata – 700 009, India
e-mail: susanta.rpe@caluniv.ac.in, susanta.rpe@gmail.com
5. **Academic qualifications:**

College/ university from which the degree was obtained	Abbreviation of the degree
University of Calcutta	B. Sc. (Hons. in Physics)
University of Calcutta	B. Tech. in Radio Physics and Electronics
University of Calcutta	M. Tech. in Radio Physics and Electronics (Specialization in ‘Solid State and Quantum Electronics’)
University of Calcutta	Ph. D. (Tech.) in Radio Physics and Electronics

6. **Positions held/ holding:**
Lecturer, University of Calcutta : 1978 – 1985
Reader, University of Calcutta : 1985 – 1989
Post Doctoral Member of Technical Staff, At & T Bell Laboratories, USA : 1986 – 1988
(on leave from the University of Calcutta)
Professor, University of Calcutta : 1989 – till date

7. **Research interests:**

Please cite briefly the areas of research interests

- Quantum Electron Devices
- VLSI Design
- Electronic Instrumentation

8. **Research guidance :**

Number of researchers awarded Ph.D degrees : 2

Number of researchers pursuing M.Phil/ Ph.D :

9. **Projects :**

Completed projects :

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Current projects :

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10. **Select list of publications:**

a) ***Journals:***

1. Method of measuring loaded Q-factor of single ended cavity resonators using reflection bridge; G. Ghosh, S. Sen, D. Dasgupta and P. K. Saha: *Rev. Sci. Instrum.*, **49**, 378 (1978).
2. Hysteresis effect in coaxial line Gunn oscillators; S. Sen: *J.I.E.T.E.*, **25**, 397 (1979).
3. New cavity perturbation technique for microwave measurement of dielectric constants; S. Sen, P. K. Saha and B. R. Nag: *Rev. Sci. Instrum.*, **50**, 1594 (1979).
4. Resonant modes in re-entrant cavities; S. Sen, P. K. Saha and B. R. Nag: *The Radio and Electronic Engr.*, **50**, 113 (1980).
5. Equivalent circuit of a gap in the central conductor of coaxial lines; S. Sen and P. K. Saha: *IEEE Trans. Microwave Theory and Tech.*, **MTT-30**, 2026 (1982).
6. An anodic oxidation technique for the growth of transparent conducting layers of SnO₂; S. Dhar, S. Sen and D. Biswas: *J. Electrochem. Soc.*, **132**, 2030 (1985).
7. Hot electron resonant tunneling through a quantum well: A new electron spectroscopy; F. Capasso, S. Sen, A. Y. Cho and A. L. Hutchinson: *Gallium Arsenide and Related Compounds 1986*, Ed: W. T. Lindley, **83**, 539 (1986).
8. Quantum well resonant tunneling bipolar transistor operating at room temperature; F. Capasso, S. Sen, A. C. Gossard, A. L. Hutchinson and J. H. English: *IEEE Electron Dev. Lett.*, **EDL-7**, 573 (1986); also in *IEEE IEDM Tech. Digest 1986*, p. 282.
9. Resonant tunneling electron spectroscopy; F. Capasso, S. Sen, A. Y. Cho and A. L. Hutchinson: *Electronics Lett.*, **23**, 28 (1987).

10. Resonant tunneling gate field effect transistor; F. Capasso, S. Sen, F. Beltram and A. Y. Cho: *Electronics Lett.*, **23**, 225 (1987).
 11. Resonant tunneling spectroscopy of hot minority electrons injected in gallium arsenide quantum wells; F. Capasso, S. Sen, A. Y. Cho and A. L. Hutchinson: *Appl. Phys. Lett.*, **50**, 930 (1987).
 12. Resonant tunneling device with multiple negative differential resistance and demonstration of a three-state memory cell for multiple valued logic applications; F. Capasso, S. Sen, A.Y. Cho, D. Sivco: *IEEE Electron Dev. Lett.*, **EDL-8**, 297 (1987).
 13. Negative transconductance resonant tunneling field-effect transistor; F. Capasso, S. Sen, and A. Y. Cho: *Appl. Phys. Lett.*, **51**, 526 (1987).
 14. The resonant tunneling field-effect transistor: A new negative transconductance device; S. Sen, F. Capasso, F. Beltram and A. Y. Cho: *IEEE Trans. Electron. Dev.*, **ED-34**, 1768 (1987).
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15. Physics and new device applications of resonant tunneling in quantum well heterostructures; F. Capasso, S. Sen, A. Y. Cho: *Physica Scripta*, **T-19**, 199 (1987).
 16. Resonant tunneling: Physics , new transistors and superlattice devices; F. Capasso, S. Sen, and A. Y. Cho: *Quantum Well and Superlattice Phys.*, **SPIE-792**, 10 (1987).
 17. Resonant tunneling device with multiple negative differential resistance: Digital and signal processing applications with reduced circuit complexity; S. Sen, F. Capasso, A. Y. Cho and D. Sivco: *IEEE Trans. Electron Dev.*, **ED-34**, 2185 (1987).
 18. Integration of GaAs/AlAs resonant tunneling diodes for digital and analog applications with reduced circuit complexity; S. Sen, F. Capasso and A.Y. Cho: *IEEE GaAs IC Symp. Tech. Digest 1987*, p. 61, Portland, OR, USA (1987).
 19. Room temperature operation of $\text{Ga}_{0.47}\text{In}_{0.53}\text{As}/\text{Al}_{0.48}\text{In}_{0.52}\text{As}$ resonant tunneling diodes; S. Sen, F. Capasso, A. L. Hutchinson and A. Y. Cho: *Electronics Lett.*, **23**, 1229 (1987).
 20. Observation of resonant tunneling through compositionally graded parabolic quantum well; S. Sen, F. Capasso, A. C. Gossard, R. A. Spah, A. L. Hutchinson and S. N. G. Chu: *Appl. Phys. Lett.*, **51**, 1428 (1987)
 21. Resonant tunneling through quantum wells: Physics and device applications; F. Capasso, S. Sen, A. Y. Cho, A. C. Gossard and R. A. Spah: *Solid State Electronics*, **31**, 723 (1988).
 22. Summary Abstract: Negative transconductance resonant tunneling field effect transistor and monolithically integrated resonant tunneling diodes; S. Sen, F. Capasso and A. Y. Cho: *J. Vac. Sci. and Tech. B*, **6**, 676 (1988).

23. New resonant tunneling devices with multiple negative resistance regions and high room temperature peak-to-valley ratio; S. Sen, F. Capasso, D. Sivco and A. Y. Cho: *IEEE Electron Dev. Lett.*, **9**, 402 (1988).
24. Stacked double barriers and their application in novel multi-state resonant tunneling bipolar transistors; S. Sen, F. Capasso, A. Y. Cho and D. L. Sivco: *Gallium Arsenide and Related Compounds 1988*, Ed: J. S. Harris, **96**, 605 (1988).
25. Multiple state resonant tunneling bipolar transistor operating at room temperature and its application as a frequency multiplier; S. Sen, F. Capasso, A. Y. Cho and D. L. Sivco: *IEEE Electron Dev. Lett.*, **9**, 533 (1988).
26. Multiple negative transconductance and differential conductance in a bipolar transistor by sequential quenching of resonant tunneling; F. Capasso, S. Sen, A. Y. Cho and D. L. Sivco: *Appl. Phys. Lett.*, **53**, 1056 (1988).
27. New resonant tunneling bipolar transistor (RTBT) with multiple negative differential resistance characteristics operating at room temperature with large current gain; S. Sen, F. Capasso, A. Y. Cho and D. L. Sivco: *IEEE IEDM Tech. Digest 1988*, p. 834 (1988)
28. Parity generator circuit using a multi-state resonant tunneling bipolar transistor ; S. Sen, F. Capasso, A. Y. Cho and D. L. Sivco; *Electronics Lett.*, **24**, 1506 (1988).
29. Microwave multiple-state resonant tunneling bipolar transistors; L. Lunardi, S. Sen, F. Capasso, A. Y. Cho, P. R. Smith and D. L. Sivco: *IEEE Electron Dev. Lett.*, **10**, 219 (1989).
30. Quantum functional devices: Resonant tunneling transistors, circuits with reduced complexity and multiple-valued logic; F. Capasso, S. Sen, F. Beltram, L. M. Lunardi, A. S. Vengurlekar, P. R. Smith, N. J. Shah, R. J. Malik and A. Y. Cho: *IEEE Trans. Electron Dev.*, **36**, 2065 (1989).
31. Quasi-ballistic resonant tunneling of minority electrons into the excited states of a quantum well; A. S. Vengurlekar, F. Capasso, S. Sen, A. L. Hutchinson, S. N. G. Chu, D. Sivco and A. Y. Cho; *Appl. Phys. Lett.*, **55**, 2529 (1989).
32. Observation of charge storage and intersubband relaxation in resonant tunneling via a high sensitivity capacitance technique; E. F. Schubert, F. Capasso, A. L. Hutchinson, S. Sen and A. C. Gossard: *Appl. Phys. Lett.*, **57**, 2820 (1990).
33. Current Voltage characteristics of resonant tunneling diodes; S. Sen, B. R. Nag and S. Midday: *Physical Concepts of Materials for Novel Optoelectronic Device Applications*, **SPIE-1362 (II)**, 750 (1991).
34. Quantum transistors and circuits break through the barriers; F. Capasso, S. Sen, L. M. Lunardi and A. Y. Cho: *IEEE Circuits and Devices Mag.*, p. 18 (May 1991).
35. Resonant tunneling bipolar transistor (RTBT): New functional device for electronics of the future; S. Sen, F. Capasso, F. Beltram and A. S. Vengurlekar: *J.I.E.T.E.*, **38**, 120 (1992).

36. Dependence of $\text{Al}_{0.48}\text{In}_{0.52}\text{As}$ Schottky diode properties on molecular beam epitaxial growth temperature; A. S. Brown, P. Bhattacharya, J. Singh, P. Zaman, S. Sen and F. Turco: *Appl. Phys. Lett.*, **68**, 220 (1996).
37. An Improved Lead Compensation Technique for Three-Wire Resistance Temperature Detectors: *IEEE Trans. Instrumentation & Measurements*, **48**, 903 (1999).
38. High-responsivity High-gain $\text{In}_{0.53}\text{Ga}_{0.47}\text{As}/\text{InP}$ Quantum-Well Infrared Photodetectors Grown Using Metal-Organic Vapor Phase Epitaxy; A. Mazumdar, A. Shah, M. Gokhale, Susanta Sen, S. Ghosh, B. M. Arora and D. C. Tsui: *IEEE J. Quantum Electronics*, **41**, 872 (2005).
39. Surface ozone and its precursors at two sites in the northeast coast of India; N. N. Purkait, S. De, S. Sen and D. K. Chakrabarty: *Indian J. of Radio & Space Physics*, **38**, 86 (2009).
40. Wavelength-Specific Ultraviolet Photodetectors based on AlGaIn Multiple Quantum Wells; Pallabi Pramanik, Sayantani Sen, Chirantan Singha, Abhra Shankar Roy, Alakananda Das, Susanta Sen, , D. V. Sridhara Rao and Anirban Bhattacharyya: *IEEE Journal Of Quantum Electronics*, **Vol. 52**, No. 3 (2016).
41. Controlling the compositional inhomogeneities in $\text{Al}_x\text{Ga}_{1-x}\text{N}/\text{Al}_y\text{Ga}_{1-y}\text{N}$ MQWs grown by PA-MBE: Effect on luminescence properties; Pallabi Pramanik, Sayantani Sen, Chirantan Singha, Abhra Shankar Roy, Alakananda Das, Susanta Sen, Deepak Kumar, D. V. Sridhara Rao and Anirban Bhattacharyya: *Journal of Crystal Growth* **439**, 60–65, (2016).

b) Books/ book chapters :

1. Resonant tunneling devices and their application; F. Capasso, S. Sen, F. Beltram and A. Y. Cho: Chapter-5 in *Submicron Integrated Circuits*, Ed: R. K. Watts, p. 204, John Wiley, New York (1989).
2. Resonant tunneling diodes and transistors: Physics and circuit applications; S. Sen, F. Capasso and F. Beltram: Chapter-5 in *Introduction to Semiconductor Technology: GaAs and Related Compounds*, Ed: C. Wang, pp. 231-301, John Wiley, New York (1990).
3. Physics and device applications of resonant tunneling; F. Capasso, S. Sen, F. Beltram and A. Y. Cho: Chapter-7 in *Physics of Quantum Electron Devices*, Ed: F. Capasso, pp. 181-252, Springer-Verlag, Berlin Heidelberg (1990).
4. Quantum Electron Devices; F. Capasso, S. Sen and F. Beltram: in *High Speed Semiconductor Devices*, Ed: S. M. Sze, John Wiley, New York (1990).
5. Photonic and Electronic Devices Based on Artificially Structured Semiconductors; F. Beltram, F. Capasso and S. Sen: Chapter-10 in *Electronic Materials*, Ed: J. R. Chelikowski and A. Franciosi, pp. 233-285, Springer-Verlag, Berlin Heidelberg (1991).
6. Quantum Electron Devices: Physics and Applications; F. Capasso, F. Beltram, S. Sen, A. Palevski and A. Y. Cho: Chapter-1 in *High Speed Heterostructure Devices*, Vol. Eds: R. A. Kiehl and T. C. L. G. Sollner: *Semiconductors and Semimetals Vol. 41*, Eds: R. K. Willardson, A. C. Beer and E. R. Weber, pp. 1-77, Academic Press, New York (1994).

c) Conference/ seminar volumes:

1. Some chemical etchants for InP; Co-author: S. Dhar: **Second Internat. Workshop on the Physics of Semiconductor Devices (IWPSD)**, Delhi, India (1983)
2. A digital power factor meter; Co-author: D. Biswas: **Second Internat. Symp. on Instrumentation**, IIST, Calcutta, India (Dec. 16 -18, 1983).
3. A. Microprocessor controlled digital temperature monitor; Co-author: A. Banerji: **Second Internat. Symp. on Instrumentation**, IIST, Calcutta, India (Dec. 16 -18, 1983).
4. Etchants for orienting InP; Co-authors: S. Dhar and D. Biswas: **Third Nat. Seminar on the Physics of Semiconductor Devices**, IISc, Bangalore, India (Jan., 1984)
5. Hot electron resonant tunneling through a quantum well: A new electron spectroscopy; Co-authors: F. Capasso, A. Y. Cho and A. L. Hutchinson: **13th International Symp. on Gallium Arsenide and Related Compounds**, Las Vegas, NV, USA (Sept. 28 - Oct. 1, 1986).
6. Quantum well resonant tunneling bipolar transistor operating at room temperature; Co-authors: F. Capasso, A. C. Gossard, A. L. Hutchinson and J. H. English: **IEEE International Electron Device Meeting 1986**, Los Angeles, CA, USA (Dec. 7-10, 1986).
7. Resonant tunneling transistors and hot electron spectroscopy; Co-authors: F. Capasso, A. Y. Cho and A. C. Gossard: **Third International Conference on Superlattices, Microstructures and Microdevices**, Chicago, IL, USA (Aug. 17-20, 1987).
8. Negative transconductance resonant tunneling field effect transistors and monolithically integrated resonant tunneling diodes; Co-authors: F. Capasso and A. Y. Cho: **8th Molecular Beam Epitaxy Workshop**, Los Angeles, CA, USA (Sept. 9-11, 1987).
9. Integration of GaAs/AlAs resonant tunneling diodes for digital and analog applications with reduced circuit complexity; Co-authors: F. Capasso and A. Y. Cho: **IEEE Gallium Arsenide IC Symp. 1987**, Portland, OR, USA (Oct. 13-16, 1987).
10. Observation of resonant tunneling through a compositionally graded parabolic quantum well; Co-authors: F. Capasso, A. C. Gossard, R. A. Spah and A. L. Hutchinson: **IEEE International Electron Device Meeting 1987**, Washington, DC, USA (Dec. 6-9, 1987).
11. Stacked double barriers and their application in novel multi-state resonant tunneling bipolar transistors; Co-authors: F. Capasso, A. Y. Cho and D. L. Sivco: **15th International Symposium on Gallium Arsenide and Related Compounds**, Atlanta, GA, USA (Sept. 11-14, 1988).
12. Multiple state resonant tunneling bipolar transistor operating at room temperature with high current gain and its circuit applications; Co-authors: F. Capasso, A. Y. Cho and D. L. Sivco: **IEEE International Electron Device Meeting 1988**, San Francisco, CA, USA (Dec. 12-14, 1988).
13. The design of resonant tunneling transistors; Co-authors: F. Capasso and A. Y. Cho: **National Conference on Electronic Circuits and Systems**, Roorkee, India (Nov. 1989).

14. Design of microprocessor based instruments for 50 Hz compatibility; Co-authors: S. Pradhan and P. Kundu, **International Conference on Electromagnetic Interference and Compatibility**, Calcutta, India (Dec 1992)
15. Software error correction takes care of analog to digital converter nonlinearity; Co-authors: S. Pradhan and T. Samanta: **All India Seminar on Integrated Electronics**, Roorkee, India (March 1993)
16. An investigation of imperfections in InGaAs/InP p-I-n/HBT OEIC structures grown by MOVPE; Co-authors: M. R. Gokhale, B. M. Arora, A. P. Shah, A. Bhattacharya and K. S. Chandrasekaran; **International Conference on Fiber Optics and Photonics, (Photonics- 2000)**, Calcutta, India (Dec., 2000).
17. In_{0.53}Ga_{0.47}As/InP Quantum-Well Infrared Photodetectors Grown Using Metal-Organic Vapor Phase Epitaxy; Co-authors: A. Mazumdar, A. Shah, M. Gokhale, S. Ghosh, and B. M. Arora: **International Conference on Computers and Devices for Communication (CODEC-04)**, Kolkata, Jan. 1-3, 2004.
18. Measurement of Total Columnar Ozone at Kolkata using Ground and Satellite Based Instrument; Co-authors: Sanghamitra De, D. K. Chakraborty and N. N. Purkait; **National Space Science Symposium – 2006**, Dept. of Physics, Andhra University, Vishakhapatnam, Feb. 9-12, 2006.
19. Surface Ozone Scenario at and around Kolkata; Co-authors: Sanghamitra De, D. K. Chakraborty and N. N. Purkait; **National Space Science Symposium – 2006**, Dept. of Physics, Andhra University, Vishakhapatnam, Feb. 9-12, 2006.
20. Could tsunami affect total ozone column? Co-authors: D. K. Chakraborty, N. N. Purkait and Sanghamitra De; **Indian National Conference of URSI – INCURSI 07 (Golden Jubilee of Radio Science in India)**, National Physical Laboratory, New Delhi, Feb. 21-24, 2007.
21. Analysis of process induced stress in the channel of nano-scale CMOS devices with TiN liner; Co-authors: B. N. Chowdhury, S. Chattopadhyay, in proceedings of the **International Conference on Communications, Computers & Devices (ICCCD-2010)**, I. I. T. Kharagpur (2010), India.
22. Nanostructured Solar Cells: The Next Generation Photovoltaics; Co-authors: Sanatan Chattopadhyay and Anirban Bhattacharyya; **Joint Workshop on “Green Energy” with focus on “Cognitive Networks and Spectrum Management”**, Aalborg University, Aalborg, Denmark (May 31 – June 2, 2010).
23. Fast and Computationally Efficient Boundary Detection Technique for Medical Images; co-authors: A. Das and P. Goswami; **Proc. American Physical Society (APS) March Meeting 2011**, 21-25 March, 2011, Dallas, Texas, USA (<http://meetings.aps.org/Meetings/MAR11/Event/143050>).
24. Study of substrate induced strained-Si/Si-Ge channel for optimizing CMOS digital circuit characteristics; co-authors: Sanatan Chattopadhyay and Bratati Mukhopadhyay; **International Conference on Computers and Devices for Communication (CODEC – 2012)**, Kolkata, Dec. 17-19, 2012.
25. Growth of bulk AlGaIn films and AlN / GaN Quantum Wells by Plasma Assisted Molecular Beam Epitaxy; co-authors: Pallabi Pramanik, Sayantani Sen,

Chirantan Singha, Alakananda Das, Abhra Shankar Roy, S. Dhar, Anirban Bhattacharyya
International Union of Materials Research Societies-International Conference in Asia-2013 (IUMRS-ICA-2013), IISc Bangalore, December 2014.

26. Theoretical and Experimental Studies on AlGa_N Multiple Quantum Wells for Ultraviolet Emitters; co-authors: Chirantan Singha, Pallabi Pramanik, Sayantani Sen, Alakananda Das, Abhra Shankar Roy, Anirban Bhattacharyya **2nd IEEE International Conference on Emerging Electronics (ICEE 2014)**, IISc Bangalore, December 2014.
27. Solar Blind Photodetectors based on AlGa_N Bulk Films and Quantum Wells; co-authors: Sayantani Sen, Pallabi Pramanik, Chirantan Singha, Alakananda Das, Abhra Shankar Roy, Anirban Bhattacharyya; **2nd IEEE International Conference on Emerging Electronics (ICEE 2014)**, IISc Bangalore, December 2014.
28. Study on the AlGa_N/AlGa_N Multiple Quantum Well Structures grown by Plasma Assisted Molecular Beam Epitaxy; co-authors: Chirantan Singha, Pallabi Pramanik, Sayantani Sen, Abhra Shankar Roy, Alakananda Das, Anirban Bhattacharyya, **Workshop on Photonics Imaging and Sensing**, Centre for Research in Nanoscience and Nanotechnology, University of Calcutta, March 2015.
29. Solar Blind Photodetectors based on AlGa_N Bulk Films; Sayantani Sen, Pallabi Pramanik, Chirantan Singha, Alakananda Das, Abhra Shankar Roy, Anirban Bhattacharyya; **Workshop on Photonics Imaging and Sensing**, Centre for Research in Nanoscience and Nanotechnology, University of Calcutta, March 2015.
30. Design of AlGa_N Quantum Well based Resonant Cavity Enhanced Photodetector; co-authors: Chirantan Singha, Pallabi Pramanik, Sayantani Sen, Alakananda Das, Anirban Bhattacharyya, **18th International Workshop on Physics of Semiconductor Devices (IWPSD-2015)**, IISc Bangalore, December 2015.
31. Photoconductive and MSM Photodetectors based on AlGa_N Multiple Quantum Wells; co-authors: Sayantani Sen, Pallabi Pramanik, Chirantan Singha, Abhra Shankar Roy, Alakananda Das, Susanta Sen, Anirban Bhattacharyya, **18th International Workshop on Physics of Semiconductor Devices (IWPSD-2015)**, IISc Bangalore, December 2015.
32. III-Nitride Materials Grown by MBE for Deep Ultraviolet Detectors; co-authors: Sayantani Sen, Pallabi Pramanik, Chirantan Singha, Abhra Shankar Roy, Alakananda Das, Susanta Sen, Anirban Bhattacharyya, **6th International Conference on Computers and Devices for Communication (CODEC-2015)**, Institute of Radio Physics and Electronics, University of Calcutta, December 2015.
33. Optical properties of AlN/GaN MQWs grown by Molecular Beam Epitaxy; co-authors: Chirantan Singha, Pallabi Pramanik, Sayantani Sen, Alakananda Das, Abhra Shankar Roy, Susanta Sen, Anirban

Bhattacharyya, **National Conference on Semiconductor Materials and Devices (NCSMD-2016)**, IIT Jodhpur, March 2016.

d) **Other publications :**

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12. **Membership of Learned Societies:**

Fellow, Institute of Engineers (India)
Life Member, Computer Society of India

13. **Patents :**

1. An alloy for soldering/brazing Aluminium; Indian Patent application No. 1134/Cal/1978-K dated Oct. 20, 1978. Patent sealed under No. 150909. Co-inventor: S. Dhar.
2. Resonant tunneling device and mode of device operation; US Patent No. 4,853,753 dated Aug. 1, 1989. Co-inventors: F. Capasso and A. Y. Cho.
3. Apparatus including resonant tunneling device having multiple-peak current-voltage characteristics; US Patent No. 4,902, 912 dated Feb. 20, 1990. Co-inventors: F. Capasso, A. Y. Cho, M. Shoji and D. Sivco.
4. Sequential quenching resonant tunneling transistor; US Patent No. 4,999,697 dated March 12, 1991. Co-inventors: F. Capasso and A. Y. Cho.

14. **Invited lectures delivered :**

1. Microelectronics; **Recent Trends in Physics Research**, Indian Physics Association, Calcutta Chapter, Calcutta, India (Sept. 1981).
2. Resonant tunneling transistors and circuits; Co-author: F. Capasso: **US Air Force Office of Scientific Research Workshop on Quantum Electronic Devices**, Atlanta, GA, USA (Sept. 15-16, 1988).
3. Perpendicular transport through quantum wells and superlattices; **School on Optoelectronic Materials and Devices**, TIFR, Bombay, India (Aug. 29 - Sept 6, 1989).
4. Resonant tunneling transistors; **School on Optoelectronic Materials and Devices**, TIFR, Bombay, India (Aug. 29 - Sept. 6, 1989).
5. Physics and device applications of resonant tunneling; **Colloq. at the Seeker Head Laboratory - RCI (DRDO)**, Hyderabad, India (Dec. 7, 1989).
6. Resonant tunneling: Its prospects and promises; **Colloq. at the Solid State Physics Laboratory**, Delhi, India (May 1990).

7. Resonant tunneling bipolar transistors: Physics and circuit applications; **Professor S. K. Mitra Birth Centenary Memorial Lecture**, Institute of Radio Physics and Electronics, Calcutta University, Calcutta, India (Aug. 24, 1990).
8. Resonant tunneling diodes and transistors: Electronic Devices for the twenty-first century; A course of **4 talks** delivered as **Visiting Professor** at the **Tata Institute of Fundamental Research**, Bombay, India (Dec. 1990).
9. Quantum tunneling phenomenon: The path to functional devices; **DAE National Symp. on Solid State Physics**, Varanasi, India (Dec. 1991).
10. Boundary conditions at the interfaces of nonparabolic semiconductors; Solid State Electronics Group Seminar, **Tata Institute of Fundamental Research**, Bombay, India (June 8, 1992).
11. Tunneling through heterostructures; **BARC Physics Colloq.**, **Bhabha Atomic Research Centre**, Trombay, Bombay, India (May 26, 1993).
12. New optical phenomenon in quantum wells and superlattices; Solid State Electronics Group Seminar, **Tata Institute of Fundamental Research**, Bombay, India (June 4, 1993).
13. Resonant tunneling devices: Prospects and recent trends in research; **Centre National de la Recherche Scientifique (CNRS)**, Grenoble, France (Sept. 15, 1993).
14. Resonant tunneling transistors: Their development and applications; **Center for High Frequency Microelectronics**, **University of Michigan**, Ann Arbor, MI, USA (Oct. 29, 1993).
15. Resonant tunneling transistors: Design, application and prospects; **Hitachi Cambridge Laboratory**, **University of Cambridge**, Cambridge, UK (Dec. 17, 1993).
16. Quantum well light modulators; **Material Surfaces and Interfaces**, **Institute of Physics**, Bhubaneswar, India (April 10-12, 1995).
17. Emerging Issues in VLSI Scaling: Approaching the Quantum Confinement Limit; **IEEE India Conference (INDICON 2004)**, Indian Institute of Technology, Kharagpur (Dec. 21-22, 2004).
18. A brief history of initial phase of development of electronic science in India; Co-authors: M. H. Engineer, P. K. Saha and P. K. Basu: **Indian National Conference of URSI – INCURSI 07 (Golden Jubilee of Radio Science in India)**, National Physical Laboratory, New Delhi, Feb. 21-24, 2007.
19. Information and communication technology scenario in the coming decade: Indian opportunities and the role of academics; **International Conference on Information Technology**, Haldia Institute of Technology, March 22, 2007.
20. FPGA and HDL: A reconfigurable platform; **National Workshop on Signal Processing and its application to Software Defined Radio**, Govt. College of Engineering and Ceramic Technology, Kolkata, Jan. 11-12, 2008.

21. Nanotechnology and its challenges in electronics, **One-day Seminar on Nanotechnology** organized by BIT-Kolkata, Indian Association for the Cultivation of Science (IACS), Kolkata, Jan. 30, 2009.
22. CMOS and beyond: From micro to nano electronics, **Workshop on Challenges in Electronics**, Saha Institute of Nuclear Physics (SINP), Nov. 27, 2009.
23. Keynote address in **All India Seminar on Wireless Networks and Social Development**, Institute of Engineers (India), Kolkata, Jan. 8, 2010.
24. Nanoelectronics Research in the University of Calcutta, **Canada-India Frontiers Workshop**, York University, Toronto, Ontario, Canada, October 11-12, 2011.
25. Nanoelectronics Research in the University of Calcutta, **International Workshop on Nanotechnology**, Dhaka, Bangladesh, Sept. 21 – 23, 2012.
26. Digital Design using FPGA, Embedded Tutorial in **International Symposium on Electronic System Design (ISED)**, Kolkata, India, December 19 – 22, 2012.
27. Growth of AlGaN alloys by Molecular Beam Epitaxy and development of Optoelectronic Devices based on them, **National Workshop on III-Nitride Materials and Devices**, SSPL Delhi (Dec 2013)
28. Electronics: Its emergence as a discipline in the twentieth century and the role of the University of Calcutta, Keynote Address in **Winter School on Advances in Semiconductors, Communication Electronics and Nano-technology (ASCENT – 2014)**, UGC NRCPS Program of the Institute of Radio Physics and Electronics in collaboration with National Institute of Technology, Yitupia, Arunachal Pradesh, May 26 – 30, 2014.
29. CMOS VLSI Design, **Winter School on Advances in Semiconductors, Communication Electronics and Nano-technology (ASCENT – 2014)**, UGC NRCPS Program of the Institute of Radio Physics and Electronics in collaboration with National Institute of Technology, Yitupia, Arunachal Pradesh, May 26 – 30, 2014.
30. Electronics: The twentieth century wonder and the role of the University of Calcutta, **Bharat-Nepal Siksha Maitree Karyakram**, University of Calcutta, Nov. 12, 2014.
31. Digital CMOS Design: How to make both ends meet, **National Institute of Technology, Patna, Foundation Day Lecture**, NIT Campus, Patna, January 28, 2015.
32. From Electronics to Photonics: The World scenario and We, Keynote Address, **Photonics, Electronics, Nano-technology, Integrated Circuits and Systems (PHOENICS – 2016)**: an UGC NRCPS outreach program of the Institute of Radio Physics and Electronics in collaboration with Tripura University, Agartala, March 02 – 05, 2016.
33. CMOS Logic Design, **Photonics, Electronics, Nano-technology, Integrated Circuits and Systems (PHOENICS – 2016)**: an UGC NRCPS outreach program of the Institute of Radio Physics and Electronics in collaboration with Tripura University, Agartala, March 02 – 05, 2016.

34. CMOS Process Flow, **Photonics, Electronics, Nano-technology, Integrated Circuits and Systems (PHOENICS – 2016)**: an UGC NRCPS outreach program of the Institute of Radio Physics and Electronics in collaboration with Tripura University, Agartala, March 02 – 05, 2016.

15. **Awards :**

Homi Bhabha Fellowship during 1992-93

16. **Other notable activities :**

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Signature of the faculty member

Date: