CV of Dr. Sujaul Chowdhury

Full name : Professor Dr. Mohammed Sujaul Haque Chowdhury

Abbreviated name: Dr. Sujaul Chowdhury or S. Chowdhury

Date of birth : 06 January 1973

Marital status : Married to Zobada Kanak Khan since 08 August 1997, father of one child (son): Md. Sahat Chowdhury born on 27 January 2004 at Comilla, Bangladesh.

Nationality : Bangladeshi

Address from 30 September 1998 to 30 August 2001:
Md. Sujaul Haque Chowdhury
Ph.D. student of Physics
Department of Physics and Astronomy
Kelvin Building, Room 402
University of Glasgow, Glasgow G12 8QQ
Scotland, United Kingdom
Fax: 44 141 330 5299
Tel: 44 141 330 4709
http://www.physics.gla.ac.uk
http://www.ssp.gla.ac.uk

Address from 01 July 2003 to 19 June 2004 :
Dr. Md. Sujaul Haque Chowdhury
(Humboldt Research Fellow)
Max Planck Institute for Solid State Research
Room number 5M23
Heisenberg Street 1
D-70569 Stuttgart, Germany
E-mail: s.chowdhury@fkf.mpg.de
Fax: 49 711 689 1572
Tel: 49 711 689 1586
Web: http://www.fkf.mpg.de/klitzing

Occupation:
Professor
Department of Physics
Shahjalal University of Science and Technology
Sylhet 3114, Bangladesh

Present and permanent address:
Department of Physics
Shahjalal University of Science and Technology
Sylhet 3114, Bangladesh
E-mail: s.chowdhury-phy@sust.edu
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Fax: 880 821 715257,
Tel: 880 821 714479 / 713850 (PABX)
Mobile: 880 1711 392244
Web: http://www.sust.edu
https://www.sust.edu/d/phy/faculty-profile-detail/157
http://schowdhury-phy.weebly.com (out of order at present)
(http://www.geocities.com/schowdhuryphy is no longer available)

Research interest: Nanoelectronics, Magnetotransport in semiconductor nanostructures, Nanostructure Physics.

Area of Ph.D. research :
Experimental study and theoretical understanding of the transport of electrons in two-dimensional lateral surface superlattices.

Title of Ph.D. thesis :
"Transport of electrons in two-dimensional lateral surface superlattices".

List of papers published in journals (chronologically):

(1) A **review paper** was **published** in "Jahangirnagar Physics Studies", a journal published by Jahangirnagar University, Bangladesh.

Jahangirnagar Physics Studies **8** (1998) 43-67

"Phenomenological optical model for the heavy ion physics"
S. H. Choudhury, M. Y. Ali, M. H. Ahsan and M.A. Zaman*
Department of Physics, Shahjalal University of Science and Technology, Sylhet, Bangladesh.
**Department of Physics, Jahangirnagar University, Savar, Dhaka, Bangladesh.*

(2) A **paper** was **published** in **Physical Review B** as **rapid communication**

Physical Review B **62** (2000) R4821-4824

"Importance of symmetry breaking in two-dimensional lateral-surface superlattices"
S. Chowdhury, C. J. Emeleus, B. Milton, E. Skuras, A. R. Long
Department of Physics and Astronomy, Glasgow University, Glasgow G12 8QQ, U.K.
J. H. Davies, G. Pennelli and C. R. Stanley
Department of Electronics and Electrical Engineering, Glasgow University, Glasgow G12 8QQ, U.K.

(3) A **paper** was **published** in **Physical Review B**

Physical Review B **63** (2001) 153306-1 — 153306-4

"Switching of guiding center-drift direction in asymmetric two-dimensional lateral surface superlattices"
S. Chowdhury, E. Skuras, C. J. Emeleus, A. R. Long
Department of Physics and Astronomy, Glasgow University, Glasgow G12 8QQ, U.K.
J. H. Davies, G. Pennelli and C. R. Stanley
Department of Electronics and Electrical Engineering, Glasgow University, Glasgow G12 8QQ, U.K.

(4) A **paper** was **published** in **Journal of Applied Physics.**

Journal of Applied Physics **90** (2001) 2623-2625

"Two-dimensional arrays of magnetic nanostructures characterised using an underlying two-dimensional electron gas"
E. Skuras, A. R. Long, **S. Chowdhury**, M. Rahman
Department of Physics and Astronomy, Glasgow University, Glasgow G12 8QQ, U.K.
K. J. Kirk
School of Information and Communication Technologies, University of Paisley, Paisley PA1 2BE, U.K.
J. H. Davies, *Department of Electronics and Electrical Engineering, Glasgow University, Glasgow G12 8QQ, U.K.*

(5) A **paper** was **published** in **Journal of the Korean Physical Society.**

Journal of the Korean Physical Society **39** (2001) 529-533

"Transport of Electrons in Two-Dimensional Square and Rectangular Lateral Surface Superlattices"
S. Chowdhury, A. R. Long, E. Skuras, C. J. Emeleus
Department of Physics and Astronomy, Glasgow University, Glasgow G12 8QQ, U.K.
J. H. Davies
Department of Electronics and Electrical Engineering, Glasgow University, Glasgow G12 8QQ, U.K.

(6) A **paper** was **published** in **Journal of the Korean Physical Society.**

Journal of the Korean Physical Society **39** (2001) 544-548

"Anisotropy Effects in Two-Dimensional Magnetic Superlattices"
E. Skuras, A. R. Long, **S. Chowdhury**, E. Boyd, M. Rahman
Department of Physics and Astronomy, Glasgow University, Glasgow G12 8QQ, U.K.
K. J. Kirk
School of Information and Communication Technologies, University of Paisley, Paisley PA1 2BE, U.K.
J. H. Davies
Department of Electronics and Electrical Engineering, Glasgow University, Glasgow G12 8QQ, U.K.

(7) **The most significant publication:**

A **paper** was **published** in **Physical Review B.**

Physical Review B **69** (2004) 035330-1 — 035330-5

"Inverse flux quantum periodicity in the amplitudes of commensurability oscillations in two-dimensional lateral surface superlattices"
S. Chowdhury, A. R. Long, E. Skuras
Department of Physics and Astronomy, Glasgow University, Glasgow G12 8QQ, U.K.
J. H. Davies, K. Lister, G. Pennelli, and C. R. Stanley
Department of Electronics and Electrical Engineering, Glasgow University, Glasgow G12 8QQ, U.K.

(8) A **paper** was **published** in **Physica E.**

Physica E **22** (2004) 389-393

"Magnetoresistance oscillations in a modulated 2DEG periodic in the ratio h/e to flux per unit cell"
P. Vasilopoulos, X. F. Wang
Concordia University, Department of Physics, 1455 de Maissonneuve Ouest, Montreal, Canada H3G 1M8
F. M. Peeters
Departement Natuurkunde, Universiteit Antwerpen (UIA), Universiteitsplein 1, B-2610, Antwerpen, Belgium
S. Chowdhury, A. R. Long, J. H. Davies
Nanoelectronics Research Centre, University of Glasgow, Glasgow G12 8QQ, U.K.

(9) A **paper** was **published** in **Physical Review B.**

Physical Review B **72** (2005) 045320-1 — 045320-8

"Experimental evidence for predicted magnetotransport anomalies in rectangular superlattices"

M. C. Geisler, **S. Chowdhury**, J. H. Smet, L. Höppel, V. Umansky*, R. R. Gerhardts and K. von Klitzing

Max-Planck-Institut für Festkörperforschung, Heisenbergstrasse 1, D-70569 Stuttgart, Germany
*Braun Center for Submicron Research, Weizmann Institute of Science, Rehovot 76100, Israel

Latest papers:
Research paper (Oct 2017):
Electron Transmission Through Non-Tunneling Regime of GaAs-AlGaAs Coupled Quantum Wells
Authors: Dr Sujaul Chowdhury, Dr Mizanur Rahman
Publisher: Grin Publishing, Paperback: 12 pages, ISBN: 9783668526051

Research paper (30 Oct 2019):
Effects of magnetic field on quasi-bound energy levels of GaAs-AlGaAs coupled quantum well
Authors: Uttam Kumar Chowdhury, Sujaul Chowdhury, Md Jabed Iqbal
Physica E **117** (2020) 113796

List of papers published in conference proceedings / workbooks:

(chronologically)
(1) A **paper** was **published** in the *Proceedings of the 25th International Conference on the Physics of Semiconductors* (**ICPS25**), 17-22 September 2000, Osaka, Japan, edited by Noboru Miura and Tsuneya Ando, (Springer-Verlag Berlin Heidelberg, 2001); **Part I**, **p. 757-758**.

"Transport in asymmetric two-dimensional lateral surface superlattices"
S. Chowdhury, A. R. Long, J. H. Davies[+], D. E. Grant, E. Skuras and C. J. Emeleus
Department of Physics and Astronomy, Glasgow University, Glasgow G12 8QQ, U.K.
[+]Department of Electronics and Electrical Engineering, Glasgow University, Glasgow G12 8QQ, U.K.

(2) A **paper** was **published** in the workbook of the 14th *International Conference on the Electronic Properties of Two-Dimensional Systems* (**EP2DS-14**), 30 July - 03 August 2001, Prague, Czech Republic. **TP. 27**, **p. 583-586**.

"Inverse flux quantum periodicity in the amplitudes of Weiss oscillations in two-dimensional lateral surface superlattices"
S. Chowdhury, A. R. Long, J. H. Davies, K. Lister, and E. Skuras
Nanoelectronics Research Centre, University of Glasgow, Glasgow G12 8QQ, U.K.

(3) A **paper** was **published** in the workbook of the *15th International Conference on the Electronic Properties of two-dimensional Systems* (**EP2DS-15**), 14 July-18 July 2003, Nara, Japan. **p. 881-884**.

"Magnetoresistance oscillations in a modulated 2DEG periodic in the ratio h/e to flux per unit cell"
X. F. Wang, P. Vasilopoulos
Concordia University, Department of Physics, Montreal, Canada
F. M. Peeters
Departement Natuurkunde, Universiteit Antwerpen (UIA), Universiteitsplein 1, B-2610, Antwerpen, Belgium
S. Chowdhury, A. R. Long, J. H. Davies
Nanoelectronics Research Centre, University of Glasgow, Glasgow G12 8QQ, U.K.

Presentations in international conferences: (chronologically)

(1) An abstract was **accepted** for POSTER presentation in the *2nd International Conference on the Physics of Dusty Plasma* (ICPDP99), 24-28 May 1999, Hakone, Japan.
"Decay Instability of dust-ion-acoustic waves into a modified-dust-acoustic and a dust-lower-hybrid waves in a magnetized dusty plasma"
S. H. Chowdhury
Department of Physics, Shahjalal University of Science and Technology, Sylhet, Bangladesh
M. Salimullah
Department of Physics, Jahangirnagar University, Savar, Dhaka, Bangladesh.

(2) POSTER presentation in *Condensed Matter and Materials Physics Conference 1999* (CMMP-1999), 19-22 December 1999, Leicester, England, Abstract number SEMa.P1.10.

"The importance of broken symmetry in explaining the magnetotransport in 2-dimensional lateral surface superlattices"
S. Chowdhury, C. J. Emeleus, B. Milton, J. H. Davies and A. R. Long
Nanoelectronics Research Centre, University of Glasgow, Glasgow G12 8QQ, U.K.

(3) POSTER presentation in the *25th International Conference on the Physics of Semiconductor* **(ICPS25)***,* 17-22 September 2000, Osaka, Japan.

M119 "Transport in asymmetric two-dimensional lateral surface superlattices"
S. Chowdhury, A. R. Long, J. H. Davies, D. E. Grant, E. Skuras and C. J. Emeleus
Nanoelectronics Research Centre, University of Glasgow, Glasgow G12 8QQ, U.K.
(da781TK1, D064)

(4) **ORAL** presentation in the *International Conference on Superlattices, Microstructures and Microdevices* **(ICSMM-2000)**, 25-27 September 2000, Kyongju, Korea.

"Transport of electrons in two-dimensional square and rectangular lateral surface superlattices"
S. Chowdhury, A. R. Long, J. H. Davies, E. Skuras and C. J. Emeleus
Nanoelectronics Research Centre, University of Glasgow, Glasgow G12 8QQ, U.K.

(5) POSTER presentation in the *International Conference on Superlattices, Microstructures and Microdevices* **(ICSMM-2000)**, 25-27 September 2000, Kyongju, Korea.

"Anisotropy effects in two-dimensional magnetic superlattices"
E. Skuras, A. R. Long, E. Boyd, **S. Chowdhury**, M. Rahman and J. H. Davies
Nanoelectronics Research Centre, University of Glasgow, Glasgow G12 8QQ, U.K.

(6) POSTER presentation in *Condensed Matter and Materials Physics Conference 2000* (CMMP-2000), 19-21 December 2000, Bristol, England. Abstract number SMp.P2.28

"Switching of the direction of guiding centre drift in asymmetric two-dimensional lateral surface superlattices"
S. Chowdhury, A. R. Long, J. H. Davies, E. Skuras and C. J. Emeleus
Nanoelectronics Research Centre, University of Glasgow, Glasgow G12 8QQ, U.K.

(7) POSTER presentation in *Condensed Matter and Materials Physics Conference 2000* (CMMP-2000), 19-21 December 2000, Bristol, England. Abstract number SMp.P2.29

"Enhanced magnetoresistance oscillations in two-dimensional lateral surface superlattices — evidence for inverse flux quantum periodicity"
S. Chowdhury, A. R. Long, J. H. Davies, K. Lister, E. Skuras and C. J. Emeleus
Nanoelectronics Research Centre, University of Glasgow, Glasgow G12 8QQ, U.K.

(8) POSTER presentation in the *14th International Conference on the Electronic Properties of Two-Dimensional Systems* (**EP2DS-14**), 30 July-03 August 2001, Prague, Czech Republic.

"Inverse flux quantum periodicity in the amplitudes of Weiss oscillations in two-dimensional lateral surface superlattices"
S. Chowdhury, A. R. Long, J. H. Davies, K. Lister, E. Skuras and C. J. Emeleus
Nanoelectronics Research Centre, University of Glasgow, Glasgow G12 8QQ, U.K.

Presentation in symposium:

ORAL presentation in the *1st symposium of the Semiconductor Technology Research Centre (STRC), University of Dhaka, Dhaka, Bangladesh, 01 February 2003.*

"What electrons do in two-dimensional periodic potentials and a perpendicular magnetic field"
Sujaul Chowdhury
Department of Physics, Shahjalal University of Science and Technology, Sylhet, Bangladesh.

Participation in symposium:

International symposium "**Quantum Hall Effect: Past, Present and Future,** 2-5 July 2003, Max Planck Institute for Solid State Research, Stuttgart, Germany.

I made it categorical that Composite Fermions are not real; it is just a way to explain experimental results; the problem is theoretical in nature; an internal field is assumed for which there is no reasons. What I actually meant is that there is nothing called Composite Fermions. Magnetic dipoles align with external magnetic field, not cancel the external magnetic field, as we know from dipole theory of ferromagnetism.

Thesis as part of the requirements of Master of Science:

A Thesis was submitted in April 1996 as part of the requirements for the degree of Master of Science (M.Sc.) in Physics.

"Relativistic Harmonic Oscillator and Related Matters and Optical Model Studies on Heavy Ion Physics" by Md. Sujaul Haque Chowdhury
Department of Physics, School of Physical Sciences, Shahjalal University of Science and Technology, Sylhet, Bangladesh.

Academic records:

Name of Examination / degree	Education board/ School/College/ University	Year of passing / obtaining	Total marks of the Examination held	Total marks secured*	Percen-tage of marks secured*	Class/ position secured*
Doctor of Philosophy (Ph.D.) in Physics	University of Glasgow, United Kingdom	2001	—	—	—	—
Master of Science (M.Sc.) in Physics with thesis	Shahjalal University of Science and Technology, Sylhet, Bangladesh	1996	900	712	79.11	First Class First, First in Faculty, record marks in university
Bachelor of Science (B.Sc.) Honours in Physics with integrated courses	Shahjalal University of Science and Technology, Sylhet, Bangladesh	1994	3000	2283	76.1	First Class Second
Higher Secondary Certificate (H.S.C.)** (Science Group)	Comilla Education Board, Comilla Victoria Government College, Comilla, Bangladesh	1991	1200	996	83	First Class (Third in merit list)**
Secondary School Certificate (S.S.C.)** (Science Group)	Comilla Education Board, Sylhet Government Pilot High School, Sylhet, Bangladesh	1989	1000	810	81	First Class (16th in merit list)**

*** The threshold marks for first class in all these examinations is 60%.**

**** These examinations are held by dividing the country into a few zones (four at that time). The examination of each part is administered by an Education Board. Each Education Board prepares a merit list with the results of the examinations.**

Academic distinctions and awards received (in reverse chronological order):

1. I was among those Humboldt Research Fellows who were accorded a **reception** by His Excellency Johannes Rau, the then honourable **President** of the **Federal Republic of Germany** on 15 June 2004 at Villa Hammerschmidt, **Bonn, Germany.**

2. I have been awarded an Alexander von **Humboldt Research Fellowship** tenable at the **Max Planck Institute** for Solid State Research, **Stuttgart**, Germany for postdoctoral research under Professor Dr. Klaus von Klitzing**, Nobel Laureate in Physics in 1985**.

3. I was awarded the **Thomson Experimental Prize 2000** by the University of Glasgow, United Kingdom in recognition of my research achievement in my Ph.D. research.

4. I was awarded a **prize and a certificate** by the **Institute of Physics** (**IOP**), United Kingdom "**for the best poster presentation**" in Condensed Matter and Materials Physics Conference 2000 (CMMP2000), 19-21 December 2000, Bristol, England. The abstract number in question is SMp.P2.29. The abstract was titled "Enhanced magnetoresistance oscillations in two-dimensional lateral surface superlattices — evidence for inverse flux quantum periodicity".

5. I was awarded an **Overseas Research Student (ORS) Award 1998** of the British Government **tenable at the University of Glasgow**, United Kingdom, **for Ph.D**. The award **was renewed twice** for the 2nd and 3rd year of Ph.D.

6. I was awarded one of the two "**University of Glasgow Postgraduate Scholarships**" which the "Physical Sciences Graduate School" of the University of Glasgow awarded every year in open competition.

7. I obtained **record marks in Shahjalal University of Science and Technology**, Sylhet, Bangladesh, **in the Master of Science (M.Sc.) Examinations**. Hence I was awarded the **Chancellor Gold Medal** by His Excellency **Justice Shahabuddin Ahmed**, the then honourable **President of the People's Republic of Bangladesh** in the Convocation Ceremony of the university held on 29 April 1998.

8. I was **appointed a Lecturer** in the Department of Physics of Shahjalal University of Science and Technology soon after my M.Sc. **in view of my academic records**.

9. I was awarded the **University Grants Commission Scholarship** while studying for Master of Science.

10. I received **book award from** the then honourable **Prime Minister** of the People's Republic of Bangladesh for the results of Higher Secondary Certificate (H.S.C.) Examination.

11. I was among those who were accorded a reception and I also received book award from the then First Lady of the People's Republic of Bangladesh for the results of Secondary School Certificate (S.S.C.) Examination.

Teaching and/or research experience:

Teaching experience: I have a total of 18 years of teaching experience. I have teaching experience of three years as Lecturer and four years as Assistant Professor and about 10 years as an Associate Professor in the Department of Physics of Shahjalal University of Science and Technology, Sylhet, Bangladesh, I served as a Lecturer from 06 October 1996 to 06 October 1999. Then I was appointed as an Assistant Professor with effect from 06 October 1999. I was promoted to an Associate Professor on 01 July 2004. I have been promoted to Professor of Physics on 11 August 2014.

Doctoral research experience: I have had the Ph.D. research experience of about three years from 25 September 1998 to 06 September 2001 in the Department of Physics and Astronomy of the University of Glasgow, United Kingdom, working in the Nanoelectronics Research Centre of the university. I was on "study leave" from Shahjalal University of Science and Technology during this period.

Laboratory demonstrator: Moreover, from October 1998 to October 2000, I had the opportunity to gather the experience of a part-time laboratory demonstrator in a Physics Honours Laboratory of the Department of Physics and Astronomy of the University of Glasgow, United Kingdom.

Postdoctoral research experience: From 01 July 2003 to 19 June 2004, I was a Humboldt Research Fellow working as a post-doc at Max Planck Institute for Solid State Research, Stuttgart, Germany under Professor Dr. Klaus von Klitzing, Nobel Laureate in Physics in 1985. I was on "study leave" from Shahjalal University of Science and Technology for one year.

Laboratories supervised:

	Laboratory	Students of which department	Students of which year	Students of which semester
1.	Physics Honours Laboratory	Physics	1st	—
2.	Physics Honours Laboratory	Physics	2nd	—
3.	Physics Honours Laboratory	Physics	3rd	—
4.	Physics Laboratory	Industrial and Production Engineering	1st	1st
5.	Physics Laboratory	Electronics and Computer Science	1st	1st
6.	Physics Laboratory	Chemistry	2nd	—
7.	Physics Laboratory	Chemical Technology and Polymer Science	2nd	—
8.	Physics Laboratory	Chemistry	2nd	1st
9.	Physics Honours Laboratory	Physics	4th	1st

Courses conducted (in chronological order):

	Course title	Students of which department	Students of which year	Students of which semester
1.	Heat, Waves and Vibrations	Physics	1st	2nd
2.	Classical Mechanics and Relativity	Physics	2nd	2nd
3.	Solid State Physics	Physics	3rd	—
4.	Solid State Physics	Physics	M.Sc.	1st
5.	Structure of Matter, Waves and Oscillations	Civil and Environmental Engineering	1st	1st
6.	Mechanics, Properties of Matter and Waves	Mathematics	1st	1st
7.	Electrodynamics	Physics	3rd	1st
8.	Microelectronics: Physics and Processing	Physics	M.Sc.	2nd
9.	Quantum Mechanics-I	Physics	3rd	1st
10.	Quantum Mechanics-II	Physics	3rd	2nd
11.	Newtonian Mechanics	Physics	1st	1st
12.*	Nanostructure Physics and Nanoelectronics-I	Physics	M.S.	1st
13.*	Nanostructure Physics and Nanoelectronics-II	Physics	M.S.	2nd
14.	Solid State Physics-I	Physics	4th	1st
15.	Solid State Physcis-II	Physics	4th	2nd
16.	Microelectronics: Physics and Processing-II	Physics	M.S.	2nd
17.	Classical Mechanics (Lagrangian and Hamiltonian formulations)	Physics	2nd	2nd
18.	Quantum Mechanics	Physics	4th	—
19.	Mathematical Physics	Physics	2nd	1st

* Courses I offer and conduct regularly.

Courses conducting currently in Department of Physics, SUST:

* Nanostructure Physics and Nanoelectronics - I (M.S. 1st semester)
* Nanostructure Physics and Nanoelectronics - II (M.S. 2nd semester)
* Newtonian Mechanics (1st year 1st semester Honours)
* Computational Physics Lab (4th year 1st semester Honours)
* Physics Lab (4th year 1st semester Honours)

Thesis/ project students supervised (in the Department of Physics of Shahjalal University of Science and Technology, Sylhet, Bangladesh):

1. M.Sc. **Thesis** titled: **Quantum Hall Effect**
   Name of student: Debashish Deb Chowdhury
   Registration number: 0096120016

2. M.Sc. **Thesis** titled: **Diluted Magnetic Semiconductors.**
   Name of student: Mirza Nurul Islam.
   Registration number: 0099120023

3. M.Sc. **Thesis** titled: **Transport of Electrons Through Magnetic Barrier**.
   Name of student: Md. Atiqur Rahman
   Registration number: 0099120022

4. M.Sc. **Project** titled: **Lecture Notes on Microelectronics: Physics and Processing.**
   Name of student: Syed Shafayeat Hossain
   Registration number: 0099120032
   Formed basis of part of a textbook published:
   Alpha Science imprint ISBN: 978-1842659052
   Narosa imprint ISBN: 978-81-8487-377-1

5. M.Sc. **Thesis** titled: **Magnetotransport in two-dimensional electron and hole gas: effect of in-plane magnetic field and metal-insulator transition.**
   Name of student: Sanjay Kumar Saha
   Registration number: 2001120015

6. 4th year Honours **Project** titled: **Lecture Notes on Quantum Mechanics: Part-I**
   Name of student: Sudipta Saha
   Registration number: 2000130061
   Project completed.
   Formed basis of part of a textbook published:
   Alpha Science imprint ISBN: 978-1842658864
   Narosa imprint ISBN: 978-81-8487-354-2

7. 4th year Honours **Project** titled: **Lecture Notes on Quantum Mechanics: Part-II**
   Name of student: Anupom Tutul Chowdhury
   Registration number: 2001132044
   Project completed.
   Formed basis of part of a textbook published:
   Alpha Science imprint ISBN: 978-1842658864
   Narosa imprint ISBN: 978-81-8487-354-2

8. **M.S. thesis** titled "**Tunneling of double barrier by electrons**"
   Name of student: Bimalendu Das
   Registration number: 2003120004

9. 4th year Honours **Project** titled: **Observations of chopped-head peaks of commensurability oscillations of two-dimensional superlattices**
   Name of student: MD. KUDRAT-E-KHODA
   Registration number: 2002132033
   Formed basis of part of a monograph published: ISBN 978-3838394930

10. **M.S. thesis** titled **"Nanoelectronics of single barrier at zero magnetic field"**
    Name of student: Md. Lutfuzzaman
    Registration number: 2004120005
    Published as part of a book: ISBN: 978-3639334098

11. **M.S. thesis** titled
    "Tunneling of two identical barriers: transmission coefficient ($E < V_0$)"
    Name of student: Mitu Chandra Acharjee
    Registration number: 2004120017
    Published as a book: ISBN: 978-3838375700

12. **M.S. thesis** titled
    "Effect of effective mass inequality on transmission coefficient of symmetric rectangular double barrier ($E < V_0$)"
    Name of student: Anupom Tutul Chowdhury
    Registration number: 2005122018
    Published as a book: ISBN: 978-3838376783

13. **M.S. thesis** titled
    "Transverse wavevector dependent transmission coefficient of single rectangular tunnel barrier"
    Name of student: Md. Sarwer Hossain
    Registration number: 2005122009
    Published as a book: ISBN: 978-3838378114

14. **M.S. thesis** titled
    "Analytical calculation and numerical investigation of effects of longitudinal magnetic field on transmission coefficient of single rectangular tunnel barrier by three dimensional electron gas (3DEG)"
    Name of sudent: Polash Ranjan Dey
    Registration number: 2006122002
    Published as a book: ISBN: 978-3838368436

15. **M.S. thesis** titled
    "Calculation of confined energy levels of electrons, light holes and heavy holes of isolated GaAs-AlGaAs quantum wells: numerical confirmation that energy of transmission peaks of symmetric rectangular double barrier are the same as those of confined energy levels in the quantum well if isolated"
    Name of student: Saumitra Singha Dash
    Registration number: 2006122012
    Published as a book: ISBN: 978-3838377469

16. **M.S. thesis** titled
"Analytical calculation of general expressions of transmission coefficient of single and symmetric double barrier of general shape using WKB method and transfer matrix method: **analytical calculation and numerical investigation of transmission coefficient of different types of single and symmetric double barriers encountered in Nanostructure Physics"**
Name of student: Md. Bodrul Haque Ruhel
Registration number: 2006122022
Published as a book: ISBN: 978-3838373829

17. M.S. thesis titled:
"**Nanostructure Physics of isolated Quantum Well in magnetic field: effects of longitudinal magnetic field on confined energy levels"**
Name of Student: Md. Manirul Islam
Registration number: 2007122043
Published as a book: ISBN**:** 978-3639334098

18. M.S. thesis titled:
"**Transverse wavevector in Nanostructure Physics of isolated Quantum Well: effects on confined energy levels"**
Name of student: Rafiqul Islam
Registration number: 2007122037
Published as part of a book: ISBN: 978-3639337242

19. M.S. thesis titled:
Further numerical investigation and quantitatively exact explanation of transverse wavevector dependence of transmission coefficient of single rectangular tunnel barrier"
Name of student: Fayez Ullah
Registration number: 2007122028
Published as part of a book: ISBN: 978-3639337242

20. M.S. project titled:
"**Breakthroughs in nanoelectronics research on two-dimensional superlattices"**
Name of student: MD. KUDRAT-E-KHODA
Registration number: 2007122050
Published as part of a book: ISBN: 978-3838394930

21. M.S. project titled:
Lecture Notes on Quantum Mechanics (for 4th year Honours)
Name of student: Bayezid Ahmmed Sonet
Registration number: 2007122052
Project completed. Formed basis of a textbook:
Alpha Science imprint ISBN: 978-1842658864
Narosa imprint ISBN: 978-81-8487-354-2

22. MS Thesis: Longitudinal Magnetic Field in WKB Method in Nanostructure Physics: Effects on Transmission Coefficient of Single and Symmetric Double Barriers by 3DEG
Student: Md. Mahbub Alam
Registration number: 2008122002
Collaborator: Sudipta Saha, Scientific Officer, Atomic Energy Commission, Khulna, Bangladesh.
Published as a book: ISBN: 978-3656476825

23. MS Thesis:
Nanostructure Physics of non-isolated Quantum Well of symmetric rectangular double barrier: analytical calculation of equation obeyed by quasi-bound energy levels of the Quantum Well
Student: Md. Abdus Samad
Registration number: 2008122023
Status: published as part of a book ISBN: 978-3-656-39596-6

24. MS Thesis:
Nanostructure Physics of non-isolated Quantum Well of symmetric double barrier of general shape: using WKB method analytical calculation of equation obeyed by quasi-bound energy levels of the Quantum Well
Student: Dipak Dash
Registration number: 2008122041
Status: published as part of a book ISBN: 978-3-656-39596-6

25. MS Thesis: Nanostructure Physics of Symmetric Rectangular Double Barrier in Longitudinal Magnetic Field: Effects of Magnetic Field on Transmission Coefficient By Three Dimensional Electron Gas
Student: Md. Arifur Rahman, Registration number: 2008122027
Published as a book. ISBN: 978-1936040735

26. MS Project: Microelectronics: Physics and Processing
Student: Kazi Suffekul Islam, Registration number: 2008122043
Project completed. Formed basis of a textbook:
Alpha Science imprint ISBN: 978-1842659052
Narosa imprint ISBN: 978-81-8487-377-1

27. MS Project: Nanostructure Physics and Nanoelectronics
Student: Md. Muzammel Haque
Registration number: 2008122034
Project completed. Formed basis of a textbook:
Alpha Science imprint ISBN: 978-1842659052
Narosa imprint ISBN: 978-81-8487-377-1

28. M.S. thesis titled:
"Oscillatory resonant transmission waxing and waning in amplitude: Nanostructure Physics of symmetric double barrier in non-tunneling regime"
Name of student: Piklu Sutradhar
Registration number: 2009122011
Status: published as a monograph: ISBN: 978-3659169397

29. MS thesis titled
Oscillatory transmission through non-tunneling regime of isolated Quantum Well: Parametric dependence of maxima and of minima
Name of student**:** Chaion Chandra Sarker
Registration number: 2009122029
Status: published as a monograph: ISBN**:** 978-3656384618

30. MS thesis titled:
Oscillatory transmission through non-tunneling regime of single rectangular tunnel barrier: Parametric dependence of maxima and minima
Name of student: Mahmud Hasan
Registration number: 2009122014
Status: published as a monograph: ISBN**:** 978-3656389668

31. MS thesis titled:
Oscillatory Transmission Through Non-Tunneling Regime of Symmetric Rectangular Double Barrier: Parametric variations of transmission peaks
Student: Abidur Rahman
Registration number: 2010122009
Published as a book: ISBN: 978-3656461777

32. MS thesis titled:
Nanostructure Physics of one-side bound Quantum Well: Analytical calculation of transcendental equation obeyed by quasi-bound energy levels
Student: Zuned Ahmed
Registration number: 2010122004
Published as part of a book: ISBN: 978-3656658658

33. MS thesis titled:
Nanostructure Physics of a Quantum Well adjacent to a tunnel barrier: numerical investigation
Student: Md Emrul Hasan
Registration number: 2011122022
Published as part of a book: ISBN: 978-3656658658

34. MS thesis titled:
WKB Method in Nanostructure Physics of a Quantum Well Adjacent to a Tunnel Barrier of General Shape
Student: Debobrata Deb Tushit
Registration number: 2012122002
Published as a book: ISBN: 9781631817335

35. MS thesis titled:
Nanostructure physics of coupled quantum well: parametric variations of energy spectrum
Student: Md. Jabed Iqbal
Published as a book: ISBN: 9781631817526

36. MS thesis titled:
Non-tunneling regime of coupled quantum well
Student: Mizanur Rahman
Published as a book: ISBN: 9781631818097

37. MS thesis titled:
Numerical solutions of boundary value problems with derivative boundary conditions
Student: Abhijeet Debnath Abhi
Published as a book: ISBN: 9781631816321

38. MS thesis titled:
Numerical solutions of boundary value problems with so-called shooting method
Student: Mubin M. Al Furkan
Published as a book: ISBN: 9781685070397

39. MS thesis titled:
Numerical solutions of boundary value problems with so-called shooting method
Student: Nazmus Sayadat Ifat
Published as a book: ISBN: 9781685070397

Academic monographs published:

1.
Longitudinal magnetic field applied to Nanostructure Physics:
effects on transmission coefficient of single rectangular tunnel barrier by three dimensional electron gas (3DEG)
Spine: Exploring Nanostructure Physics
Authors: Polash Ranjan Dey and **Sujaul Chowdhury**
Paperback: 288 pages, **Publisher:** LAP LAMBERT Academic Publishing (June 28, 2010),
Language: English, **ISBN-10:** 3838368436, **ISBN-13:** 978-3838368436,
Product Dimensions: 8.7 x 5.9 x 0.6 inches.

2.
WKB method applied to Nanostructure Physics:
transmission coefficient of single and symmetric double barriers encountered in Nanostructure Physics
Spine: Exploring Nanostructure Physics-II
Authors: Md. Bodrul Haque Ruhel and **Sujaul Chowdhury**
Paperback: 200 pages, **Publisher:** LAP LAMBERT Academic Publishing (June 24, 2010),
Language: English, **ISBN-10:** 3838373820, **ISBN-13:** 978-3838373829,
Product Dimensions: 8.7 x 5.9 x 0.5 inches

3.
Nanostructure Physics of symmetric rectangular double barrier:
transmission coefficient and parametric dependence of energy of resonant peaks
Spine: Exploring Nanostructure Physics-III
Authors: Mitu Chandra Acharjee and **Sujaul Chowdhury**
Paperback: 184 pages, **Publisher:** LAP LAMBERT Academic Publishing (June 25, 2010),
Language: English, **ISBN-10:** 383837570X, **ISBN-13:** 978-3838375700,
Product Dimensions: 8.7 x 5.9 x 0.4 inches

4.
Effective mass inequality in Nanostructure Physics:
effects illustrated with single and symmetric rectangular double barrier
Spine: Exploring Nanostructure Physics-IV
Authors: Anupom Tutul Chowdhury and **Sujaul Chowdhury**
Paperback: 148 pages, **Publisher:** LAP LAMBERT Academic Publishing (July 6, 2010),
Language: English, **ISBN-10:** 3838376781, **ISBN-13:** 978-3838376783,
Product Dimensions: 8.7 x 5.9 x 0.3 inches

5.
Nanostructure Physics of isolated Quantum Well:
energy of confined levels are exactly same as energy of resonant transmission peaks of double barrier
Spine: Exploring Nanostructure Physics-V
Authors: Saumitra Singha Dash and **Sujaul Chowdhury**
Paperback: 200 pages, **Publisher:** LAP LAMBERT Academic Publishing (July 6, 2010),
Language: English, **ISBN-10:** 383837746X, **ISBN-13:** 978-3838377469,
Product Dimensions: 8.7 x 5.9 x 0.4 inches

6.
Nanostructure Physics of single rectangular tunnel barrier:
transverse wavevector dependence of transmission coefficient
Spine: Exploring Nanostructure Physics-VI
Authors: M Sarwer Hossain and **Sujaul Chowdhury**
Paperback: 224 pages, **Publisher:** LAP LAMBERT Academic Publishing (July 6, 2010),
Language: English, **ISBN-10:** 3838378113, **ISBN-13:** 978-3838378114,
Product Dimensions: 8.7 x 5.9 x 0.5 inches

7.
Breakthroughs in nanoelectronics research on 2D superlattices:
greatest triumph of fundamental nanoelectronics research
Spine: Nanoelectronics research: breakthroughs
Authors: MD. KUDRAT- E-KHODA, Xue Feng Wang, and **Sujaul Chowdhury**
Paperback: 148 pages, **Publisher:** LAP LAMBERT Academic Publishing (August 19, 2010), **Language:** English, **ISBN-10:** 3838394933, **ISBN-13:** 978-3838394930,
Product Dimensions: 8.7 x 5.9 x 0.3 inches

8. Book published in 2011:
Nanostructure Physics of isolated Quantum Well in magnetic field:
effects of longitudinal magnetic field on confined energy levels
Spine: Exploring Nanostructure Physics - VII
Authors: Md. Manirul Islam, Md. Lutfuzzaman and Sujaul Chowdhury
Paperback: 284 pages, **Publisher:** VDM Verlag Dr. Müller (**February 16**, 2011),
Language: English, **ISBN-10:** 3639334094, **ISBN-13:** 978-3639334098,
Product Dimensions: 8.7 x 5.9 x 0.6 inches

9. Book published in 2011:
Transverse wavevector in Nanostructure Physics: QW and tunnel barrier:
effects on confined energy levels of isolated Quantum Well (QW) and on transmission coefficient of tunnel barrier
Spine: Exploring Nanostructure Physics - VIII
Authors: Rafiqul Islam, Fayez Ullah, Sujaul Chowdhury
Paperback: 212 pages, **Publisher:** VDM Verlag Dr. Müller (**March 1**, 2011),
Language: English, **ISBN-10:** 3639337247, **ISBN-13:** 978-3639337242,
Product Dimensions: 8.7 x 5.9 x 0.5 inches

10.
"Oscillatory resonant transmission waxing and waning in amplitude*:
Nanostructure Physics of symmetric double barrier in non-tunneling regime"
Spine: Exploring Nanostructure Physics - XII
Authors: Piklu Sutradhar, Sujaul Chowdhury
Paperback: 164 pages, **Publisher:** LAP LAMBERT Academic Publishing (12-7-2012),
Language: English, **ISBN-10:** 3659169390, **ISBN-13:** 978-3659169397,
Product Dimensions: 8.7 x 5.9 x 0.4 inches

11.
Oscillatory transmission through non-tunneling regime of isolated Quantum Well:
Parametric dependence of maxima and of minima
Authors: Sujaul Chowdhury and Chaion Chandra Sarker
Paperback: 163 pages, **Publisher:** Grin Verlag (7 Mar 2013)
ISBN-10: 3656384614, **ISBN-13:** 978-3656384618,
Product Dimensions: 21 x 14.8 x 1.1 cm

12.
Oscillatory transmission through non-tunneling regime of single rectangular tunnel barrier:
Parametric dependence of maxima and minima
Authors: Sujaul Chowdhury and Mahmud Hasan
Paperback: 146 pages, **Publisher:** Grin Verlag (15 Mar 2013)
ISBN-10: 3656389667, **ISBN-13:** 978-3656389668, **Product Dimensions:** 21 x 14.8 x 1 cm

13.
Nanostructure Physics of non-isolated Quantum Well of symmetric double barrier:
analytical calculation of equation obeyed by quasi-bound energy levels of the Quantum Well
Authors: Sujaul Chowdhury, Abdus Samad, Dipak Dash*
Paperback: 138 pages**, Publisher:** Grin Verlag (29 Mar 2013)
ISBN (eBook): 978-3-656-39506-5, **ISBN (Book):** 978-3-656-39596-6
***Dipak employed WKB method in Nanostructure**

14.
Oscillatory Transmission Through Non-Tunneling Regime of Symmetric Rectangular Double Barrier: Parametric variations of transmission peaks
Authors: Dr Sujaul Chowdhury and Abidur Rahman
Paperback: 140 pages, **Publisher**: GRIN Verlag (August 5, 2013), **Language**: English
ISBN-10: 3656461775, **ISBN-13**: 978-3656461777, **Product Dimensions**: 0.3 x 5.8 x 8.2 inches

15.
Longitudinal Magnetic Field in Wkb Method in Nanostructure Physics:
Effects on Transmission Coefficient of Single and Symmetric Double Barriers by 3DEG
Authors: Dr Sujaul Chowdhury, Mahbub Alam and Sudipta Saha
Paperback: 188 pages, **Publisher**: GRIN Verlag (August 21, 2013), **Language**: English
ISBN-10: 3656476829, **ISBN-13:** 978-3656476825, **Product Dimensions**: 8.3 x 5.8 x 0.4 inches

16.
Nanostructure Physics of Symmetric Rectangular Double Barrier in Longitudinal Magnetic Field:
Effects of Magnetic Field on Transmission Coefficient By Three Dimensional Electron Gas
Authors: Md. Arifur Rahman, Sujaul Chowdhury
Paperback: 157 pages, **Publisher**: Academic Press Corporation, Salt Lake, USA (2013)
currently: American Academic Press, www.academicpress.us
Language: English **ISBN-10**: 1936040735, **ISBN-13**: 978-1936040735

17.
Nanostructure Physics of a Quantum Well adjacent to a tunnel barrier:
Analytical calculation and numerical investigations of transcendental equations obeyed by quasi-bound energy levels
Authors: Sujaul Chowdhury, Zuned Ahmed, Md Emrul Hasan
Paperback: 104 pages, Publisher: GRIN Verlag (June 10, 2014), Language: English
ISBN-13: 978-3656658658, Product Dimensions: 21 x 14.8 x 0.6 cm

18.
WKB Method in Nanostructure Physics of a Quantum Well Adjacent to a Tunnel Barrier of General Shape
Authors: Sujaul Chowdhury and Debobrata Deb Tushit
Paperback: 129 pages, Publisher: American Academic Press, Language: English
ISBN: 9781631817335

19.
Nanostructure Physics of Coupled Quantum Well: Parametric Variations of Energy Spectrum
Authors: Sujaul Chowdhury and Md Jabed Iqbal
Paperback: 216 pages, Publisher: American Academic Press, Language: English
ISBN: 9781631817526

20.
Non-tunneling regime of coupled quantum well
Authors: Sujaul Chowdhury and Mizanur Rahman
Paperback: 215 pages, Publisher: American Academic Press, Language: English
ISBN: 9781631818097

21.
Coupled quantum well in longitudinal magnetic field
Authors: Uttam Kumar Chowdhury, Sujaul Chowdhury
Publisher: American Academic Press, Paperback: 152 pages, Language: English
ISBN: 9781631818196

22.
Monograph (November 2017):
Solid State Device Physics
Author: Sujaul Chowdhury
Paperback: 67 pages
Publisher: American Academic Press
Language: English
ISBN: 9781631819025

23.
Monograph: 31 May 2018
Numerical Solutions of Initial Value Problems Using Mathematica
Authors: Sujaul Chowdhury , Ponkog Kumar Das
Status: Published with IOP, UK http://iopscience.iop.org/book/978-1-6817-4976-1
Available as e-book, paperback and hardback from
e.g. www.amazon.com and www.amazon.co.uk

24.
Monograph 05 Sep 2018
Numerical Solutions of Boundary Value Problems with Finite Difference Method
Authors: Sujaul Chowdhury , Ponkog Kumar Das , Syed Badiuzzaman Faruque
Status: published with IOP, UK http://iopscience.iop.org/book/978-1-64327-280-1
Available as e-book, paperback and hardback from
e.g. www.amazon.com and www.amazon.co.uk

25.
Monograph: February 2019
Numerical solutions of partial differential equations using finite difference method and Mathematica
Authors: Sujaul Chowdhury , Ponkog Kumar Das
Publisher: American Academic Press
Paperback: 94 pages
ISBN: 9781631819933

26.
Monograph (July 2019)
Numerical solutions of boundary value problems with derivative boundary conditions
Authors: Sujaul Chowdhury, Abhijeet Debnath Abhi
Publisher: American Academic Press
ISBN: 9781631816321
Paperback: 157 pages

27.
Monograph (February 2021)
Monte Carlo Methods: A Hands-On Computational Introduction Utilizing Excel
Author: Sujaul Chowdhury
Publisher: Springer
ISBN: 9783031013010
Paperback: 133 pages
DOI: 10.2200/S01073ED1V01Y202101MAS037

28.
Monograph: (October 2021)
Numerical Solutions of Boundary Value Problems With So-called Shooting Method
Authors: Sujaul Chowdhury, Mubin M. Al Furkan, Nazmus Sayadat Ifat
Publisher: Nova Science Pub Inc
DOI: https://doi.org/10.52305/PYJB1601

29.
Monograph: (October 2021)
Numerical Solutions of Boundary Value Problems of Non-linear Differential Equations
Authors: Sujaul Chowdhury, Syed Badiuzzaman Faruque, Ponkog Kumar Das
Publisher: CRC Press

30.
Monograph: (November 2021)
Magnetic Field Effects on Quantum Wells
Authors: Sujaul Chowdhury, Chowdhury Shadman Awsaf and Ponkog Kumar Das
Publisher: American Institute of Physics (AIP)
DOI: https://doi.org/10.1063/9780735423879

Textbooks

1.

"Quantum Mechanics" (Textbook for Physics Honours)
Author: Sujaul Chowdhury
Publisher: Narosa, Delhi, India www.narosa.com ISBN: 978-81-8487-354-2
Co-publisher and international distributor: Alpha Science, Oxford, UK www.alphasci.com
ISBN: 978-1842658864

2.

"Nanostructure Physics and Microelectronics" (Textbook for M.S. in Physics)
Author: Sujaul Chowdhury
Publisher: Narosa, Delhi, India www.narosa.com ISBN: 978-81-8487-377-1
Co-publisher and international distributor: Alpha Science, Oxford, UK www.alphasci.com
ISBN: 978-1842659052
.

3.

"Lecture Notes on Physics" (Mathematical Physics, Classical Mechanics, Classical Electrodynamics, Solid State Physics)
Author: Sujaul Chowdhury
Paperback: 521 pages
Publisher: American Academic Press
ISBN: 9781631817700

4.

"Lecture Notes on Physics" (2nd Ed. March 2021)
(Mathematical Physics, Classical Mechanics,
Classical Electrodynamics, Solid State Physics)
Author: Sujaul Chowdhury
Paperback: 552 pages
Publisher: American Academic Press
ISBN: 9781631815263

5.

Computational Physics
Author: Sujaul Chowdhury (October 2021)
Paperback: 100 pages
Publisher: American Academic Press
ISBN: 9781631815546

Upcoming books:

3 more books are upcoming. One is a textbook on Electrodynamics and 2 are monographs on Computational Physics.

I designed and successfully conducted the following course for **M.Sc.** students of the Department of Physics of Shahjalal University of Science and Technology, Sylhet, Bangladesh.

Microelectronics: Physics and Processing

Semiconductor theory: Band model and calculation of Fermi energy of insulator and intrinsic semiconductor, law of mass action, calculation of donor and acceptor levels of extrinsic semiconductor, band model and calculation of Fermi level of n-type semiconductor, 1 impurity atom per 10^6 semiconductor atom raises conductivity of Si and GaAs crystals by 6 and 10 orders of magnitude respectively. **Introduction to semiconductors**: Elemental and binary semiconductors, bonding in Si and GaAs crystals, diamond and zincblende structures as two interpenetrating FCC crystals, alloy semiconductors (ternary and quaternary), bandgap engineering, Vegard's law, clustering, alloy scattering, substrate and epitaxial layer, semiconductor heterojunction and heterostructure, lattice-matched heterostructures, pseudomorphic heterostructures. **Semiconductor crystal growth and doping**: Bulk crystal growth of elemental (Si) and compound (GaAs) semiconductors: Bridgman method, Czochralski method, Floating zone method; wafer preparation, epitaxial material growth: liquid phase epitaxy (LPE), vapour phase epitaxy (VPE) or chemical vapour deposition (CVD) (halide process, hydride process and organometallic chemical vapour deposition (OMCVD)), molecular beam epitaxy (MBE), mechanism of carrier generation by doping in elemental and compound semiconductors, amphoteric dopant, unintentional doping of bulk crystal and epitaxial layer, compensation, doping during bulk semiconductor crystal growth, doping during epitaxial processes, shallow and deep states, modulation doping, delta doping, doping by diffusion: limited source diffusion and error function diffusion, doping by ion implantation: damage, annealing. **Theory of junctions**: p-n junction: band model and rectification, metal-semiconductor junction: band model rectifying action, band model and ohmic contact, Schottky barrier, surface states and Fermi level pinning, metal-metal contact: band model and rectification, semiconductor heterojunctions: band model. **Lithography and microelectronic processing**: Resist: sensitivity, contrast and resolution, optical lithography, photoresist materials and processes, electron beam lithography, proximity effect, e-beam resist, x-ray lithography, etching: wet versus dry etching, plasma etching, ion beam milling, etching of dielectrics, metallization etching, Si and SiO_2 etching, overcutting, undercutting, thermal oxidation, CVD of polysilicon, SiO_2 and Si_3N_4, metallization: gates, ohmic contact: rapid thermal annealing, physical vapour deposition (PVD) of metal: evaporation and sputtering. **Structure, fabrication and physics of microdevices**: Fabrication of p-n junction, fabrication of Si based npn bipolar junction transistor (BJT), band model and transistor action of BJT, MOSFET: device structure and fabrication of PMOS, NMOS and CMOS, high electron mobility transistor (HEMT): GaAs-AlGaAs HEMT and InGaAs-InAlAs HEMT.

Books recommended:

1. S. S. Hossain: "Lecture Notes on Microelectronics: Physics and Processing", submitted in 2003 as an M.Sc. project to Department of Physics, Shahjalal University of Science and Technology, Sylhet, Bangladesh.
2. Hong H. Lee: Fundamentals of Microelectronic Processing
3. Pallab Bhattacharya: Semiconductor Optoelectronic Devices
4. T. F. Bogart: Electronic Devices and Circuits
5. R. L. Singhal: Solid State Physics
6. M. L. Riaziat: Introduction to High Speed Electronics and Optoelectronics
7. J. D. Giacomo: VLSI Handbook
8. S. M. Sze: VLSI Technology
9. David Elliot: Microlithography

I designed and successfully conducted the following course for **M.S. 2nd semester** students of the Department of Physics of Shahjalal University of Science and Technology, Sylhet, Bangladesh.

PHY 559 MICROELECTRONICS: Physics and Processing –II
4 Hours/week 4 Credits

Theory of junctions: p-n junction: electrostatics, band model, explanation of rectifying action using band model; metal-semiconductor junction: band model before and after contact, explanation of rectifying action using band model; differences between rectifying metal-semiconductor contact and p-n junction; metal-semiconductor junction: ohmic contact: explanation using band model, turning a rectifying metal-semiconductor junction into ohmic contact by doping heavily, surface states, Fermi level pinning, Schottky barrier, metallisation: gate and ohmic contact, semiconductor heterostructure: band model and electronic structure of heterostructure between two n-type semiconductors, between a p-type semiconductor and an n-type semiconductor of larger bandgap, between two p-type semiconductors. **Lithography and microelectronic processing**: Resist and lithography, positive and negative resist, sensitivity, contrast and resolution of resist; optical lithography, constitution and use of photoresist material; electron beam lithography, e-beam sources, e-beam resist, proximity effect, x-ray lithography, wet etching: wet etching of SiO_2, Si, Si_3N_4, GaAs, dry etching: dry etching of different materials, ion beam milling, etching of metallization; thermal oxidation, CVD of polysilicon, SiO_2 and Si_3N_4; physical vapour deposition (PVD): evaporation, different sources of heat, sputtering, step coverage. **Structure, fabrication and physics of microdevices**: Fabrication of p-n junction with metal contact in n-Si substrate; fabrication of Si based npn bipolar junction transistor (BJT) in substrate and in epitaxial materials with a buried layer; explanation of transistor action of BJT using band model; device structure of both enhancement and depletion type NMOS, PMOS and CMOS; device structure of GaAs-AlGaAs high electron mobility transistor (HEMT) and of InGaAs-InAlAs HEMT: different parts, their purposes, 2DEG.

Books recommended:

1. Lee, H.H.: Fundamentals of Microelectronic Processing
2. Bhattacharya, P.: Semiconductor Optoelectronic Devices
3. Bogart, T.F.: Electronic Devices and Circuits
4. Singhal, R.L.: Solid State Physics
5. Riaziat, M.L.: Introduction to High Speed Electronics and Optoelectronics
6. Giacomo, J.D.: VLSI Handbook
7. Sze, S. M.: VLSI Technology
8. Elliot, D.: Microlithography
9. Hossain, S.S.: Lecture Notes on Microelectronics: Physics and Processing, M.Sc. project (2003), Department of Physics, Shahjalal University of Science and Technology, Sylhet, Bangladesh.
10. Stephen A. Campbell: The Science and Engineering of Microelectronic Fabrication (Oxford University Press, 2001).

I designed and regularly offer and conduct the following two courses for **M.S.** 1st and 2nd semester students of the Department of Physics of Shahjalal University of Science and Technology, Sylhet, Bangladesh.

PHY 541 Nanostructure Physics and Nanoelectronics – I

4 *Hours/week, 4 Credits*

Band structure of real solids: Details of free electron theory, electron in periodic potential: Kronig Penney model, dispersion relation, Bragg reflection, Brillouin zone and its boundary, velocity, momentum, effective mass of electron in periodic potential, electrical conductivity of insulator, semiconductor and metal (monovalent and divalent) in terms of band model, qualitative and quantitative aspects of nearly free electron theory and tight binding model. Energy band structure of real crystals (Si and GaAs): how to 'read', light hole, heavy hole, direct and indirect bandgap, optical absorption and emission, direct and indirect transition, why collisions with phonon instead of lattice ions, many valley character of conduction band and negative differential resistance. **Physics of nanostructures:** (a) **Different nanostructures**: tunnel barrier, quantum well (QW), symmetric and asymmetric rectangular double barrier, (1D vertical) superlattice, multi-quantum well (MQW), p-n junction: electrostatics and band model, doping, slab and delta modulation doping and 2DEG, high electron mobility transistor (HEMT), MOSFET: structure, band model, inversion layer and its electronic structure, delta doped layer and its electronic structure. (b) **GaAs-AlGaAs QW**: band model, electronic structure, subbands, density of states, occupation of subbands, intrinsic optical properties, exciton in bulk GaAs and in GaAs-AlGaAs QW, exciton confinement in QW, absorption spectrum of bulk GaAs and of GaAs-AlGaAs QW, inferring bulk crystal quality and interface quality of GaAs-AlGaAs QW from the absorption spectrum, effect of confinement on shallow impurities in QW. (c) **Multi-quantum well and superlattices**: GaAs MQW and superlattice: electronic structure depending on barrier width, graded bandgap material and AlGaAs sawtooth superlattice and its electronic structure, doping superlattice and its electronic structure. (d) **Quantum wires and dots**: DOS in 1D, quantum wire: energy levels, subbands, DOS, occupation of subband, realisation by etching and by split gate bias, quantum dot: realisation, energy levels and DOS.

Books recommended:

1. M. Jaros, (Oxford University Press): Physics and Applications of Semiconductor Microstructures
2. J. H. Davies, (Cambridge University Press): The Physics of Low-dimensional Semiconductors

PHY 561 Nanostructure Physics and Nanoelectronics – II
4 *Hours/week, 4 Credits*

Nanoelectronics: Realisation of and electron transmission through rectangular and triangular barriers, tunnel diode: band model and I-V characteristics, hot electron, velocity overshoot in hot-electron transport: size effect of nanostructure and choice of material, transfer of hot electrons into secondary valleys: negative differential resistance, size effect of nanostructure and choice of material, impact ionisation: avalanche current multiplication and sawtooth superlattice. **Magnetotransport in nanostructure**: Degenerate and non-degenerate 2DEG: demarcation, carrier statistics, energy spectrum of 2DEG in in-plane magnetic field and in uniform normal magnetic field: Landau level (LL), number of states per LL, LL broadening, quantum and transport lifetime and mobility, LL filling and filling factor, energy spectrum and DOS of 3DEG in uniform magnetic field, conductivity and resistivity tensors for 2DEG at low and high magnetic fields, Shubnikov de Haas (SdH) effect and its characteristics, integer Quantum Hall effect (QHE), fractional QHE, Quantum wire: different transport regimes, magnetotransport in quantum wire: edge states, skipping orbits. **Carriers in nanostructure:** 2DEG in MODFET versus MOSFET, electrostatics of MODFET: Schottky barrier, explanation and calculation of CB edge profile, distribution of carriers expelled from dopants between 2DEG and surface states, threshold voltage: normally-on and normally-off MODFET, shallow and deep donor levels in AlGaAs, persistent photoconductivity, parallel conduction, superlattice selectively doped MODFET, surface segregation of dopants, towards highest mobility of 2DEG, sources of scattering in 2DEG.

Books recommended:
1. M. Jaros, (Oxford University Press): Physics and Applications of Semiconductor Microstructures
2. J. H. Davies, (Cambridge University Press): The Physics of Low-dimensional Semiconductors
3. C. Weisbuch and B. Vinter (Academic Press): Quantum Semiconductor Structures: Fundamentals and Applications
4. Alexander Y. Shik (World Scientific): Quantum Wells: Physics and Electronics of Two-dimensional Systems
5. David K. Ferry and Stephen Marshall Goodnick (Cambridge University Press): Transport in Nanostructures

Future plan

International Centre for research on Nanostructure Physics and Nanoelectronics (ICNP), Shahjalal University of Science and Technology, Sylhet, Bangladesh

The plan envisages establishment of a full-scale, self-contained, international centre for research at doctoral and post-doctoral levels on Nanostructure Physics and Nanoelectronics in Shahjalal University of Science and Technology, Sylhet, Bangladesh.

On several hundred acres of land in the rear of the administrative building of the university, costing equivalent of millions of Euro, the centre will house material growth and characterisation facilities of all sorts including molecular beam epitaxy (MBE), electron beam lithography by beam-writer, all sorts of microscopy, liquefaction plants of helium and nitrogen, superconducting magnets for magnetic field in excess of 80 Tesla and so on.

In this age of mobility, this is for researchers from across the globe, from Australia, Newzealand in the east to Chile, Peru in the west (except Bangladesh), to explore new horizons and to do research aloof from any prejudice.

Updated in February 2023