Curriculum Vitae

Full Name: Manmohan Singh Bhatia.
Date of Birth: 06-10-1954.
Marital Status: Married with two children.
Nationality: Indian.
E-mail: mnmbhatia@gmail.com
Phone: 022 25576283 (R) , 9757218391, 9892929394 (M).

Academic Qualifications:

High School : 1972, CBSE, Modern School, Barakhamba Road, New Delhi.
(with Distinction 77.5% aggregate).
JEE for IIT : **166 Rank**.
Graduation : 1977, BE Electrical Engg. (Electronics), Delhi college of Engineering Delhi University.
(with Distinction 70.31%).

Advanced Professional Training: 1977-78, **BARC Training School, Electronics Batch**.

Post Graduation : 1994, **PhD, IIT Delhi**, New Delhi.
PhD Courses : Physics of semiconductor devices, Thin films, Material selection and characterization, Lasers.
Thesis Title : Studies in High-Rate Physical Vapour Deposition. Surpervisors: **Dr. BA. Dassanacharya and Dr. G.L. Sharma.**

Employment **:** Scientific Officer, **Outstanding Scientist**
Head, Beam Electronics & Appl. Section, Laser & Plasma Tech. Div.
Bhabha Atomic Research Centre, Mumbai 400 085.

Academic Positions:

2004, **PhD Guide**, Electrical & Electronics engineering, **Mumbai University**.
1 PhD student did PhD under my guidance in this program (Prof. L.K. Ragha, Vice Principal, Terna College of Eng., Navi Mumbai).

2005, **Professor**, **Homi Bhabha National Institute**.
6 PhD students have completed **PhD** under my guidance in this program in various disciplines of **electrical engg. stream** (Electrical, Electronics & Instrumentation) and 2 more are in the synopsis writing stage.
8 students have done M-Tech program under my guidance from HBNI and Mumbai University.

2005, **Member Board of Engineering Studies, Homi Bhabha National Institute.**
As a board member I take part in the deliberations leading to decisions on **suitable course work and norms** for **M-Tech and PhD work.**

2006, **Co-ordinator**, Post-graduate Engineering Studies, **BARC Training School**.
2014, Professor, EXTC Ramarao Adik Institute of Technology, Nerul, Navi Mumbai.
2019, Professor, ExTC, Terna College of Engineering < Nerul, Navi Mumbai.

Distinctions and Awards:

I have received several merit prizes at the school and college level.
1993, **S.N. Seshadri Memorial Award** for Excellence in Electro-optical Instrumentation by **Indian Physics Association.**
2012, Group Achievment Award, BARC for development of high power lasers.

Affiliations:

Life member, Indian Physics Association.

Work experience:

I have 35 years of research experience in a leading multidisciplinary research laboratory (Laser & Plasma Tech. Div.of BARC). We follow multidisciplinary approach at finding solutions that are often difficult to solve otherwise using uni-polar experience. This stems from analysis of problems from several viewpoints (or fields) and choosing the optimum path. The primary theme in my work in the first ten years was system development (hardware aspects) that led to setting up of state of art full scale research facilities devoted to a range of fields like **Signal Processing & Recovery, High Power Electronics, Laser spectroscopy, Physical Vapour Deposition** (later to become my PhD subject)**, E-beam technology, EMI/EMC, High Voltage, Advanced Instrumentation including Laser Based Instrumentation.** These facilities were then used to carry out tasks of interest to the department.

Some of the projects that were completed were as under;

- 10kW, DC 1% hybrid piggy-back power source with stable operation under rapidly changing load conditions (1979-80)
- Design, fabrication, testing of a 10 kW E-bombardment Furnace (1980-81)
- Design, Fabrication and testing of 10kW pierce electron gun (1982-83).
- Design, Fabrication and testing of a 10 kW E-beam evaporator (1983-84).
- Design, Fabrication and testing of a beam steering electromagnet (1984).
- Design, Fabrication and testing of low-level signal detection system to perform in large EMI ambient (1985-86).
- Laser synchronization network for precise timing of chain of pulsed lasers with nano-second resolution (1986-87).
- Design, Fabrication and testing of a large volume electromagnet-- 4m dia. Helmholts coil pair (1995-96).
- Planning of a Surface Engineering Laboratory (2002-04).
- Building a proto-type of Indian Neutrino Observatory Magnet weighing 40 tons and a field of 1.5 Tesla (2006-08). This proto-type is a 1000:1 scale of the final INO magnet which if constructed will weigh 50 kTons (largest magnet designed anywhere!). At present we are engaged in design of this magnet. This was covered by Doordarshan in 2013.

Teaching Skills and Research Guidance:

The activity mentioned above was continued at the group level and I diversified more towards research in the open category leading to my PhD. Thereafter, I have taken progressively increasing interest in **disseminating the research insights** into **published work** and also taken keen **interest in pedagogy** especially teaching of advanced science and technology at various levels graduate, post graduate and doctoral level where the spirit to innovate and research continues to make it possible to innovate and provide a grasp of the larger landscape whatever the domain may be**.**
I have been taking courses at Post Graduate level in BARC Training School for the last 15 years and now Homi Bhabha National Institute since its inception in 2005 in various subjects in the Electrical Stream and also Engineering Maths.

I have delivered several technical lectures to cover topics of collateral nature at many local and far colleges at B-tech level. The purpose is to bolster interest in the subjects and create a learning desire by which the students feel empowered to dig for knowledge on their own. This way of approaching advanced teaching has been appreciated by a large body of students year after year. The same spirit – **'to enable students to learn to fly on their own'** to do creative thinking is also given to B-tech/M-tech students for project work. I have so far taken about 50 or more groups in this category and they have been coming from leading institutes including IIT- Bombay, IIT Delhi, VJTI Mumbai and DCE Delhi. Many of these students have reported back that the training they received here was of immense value in getting admissions to leading US universities and also jobs after that. In fact the intake limit here is set by sitting space available in the laboratory!

In the last five years, my focus as a **Professor in Homi Bhabha National Institute** has been on **guiding PhD students.** The PhD topics range from Thin-film Technology, E-beam Technology, Power Electronics, High Speed Motor Design, EMI control, Laser Technology, Microwaves and Fractional Order Controllers.

As a **member of the Board of Engineering Studies**, I take part in deliberations on **setting of syllabi and procedure and standards for evaluation of students** at various stages of academic activity. Here too the spirit of constant up-gradation, innovation, holistic teaching and creative nurturing dominates.

In last few years, taught microwave related subjects, Communication Engineering as well as AI and Internet of Things besides Electromagnetics, as outlined in Mumbai University.

Guided several BE and ME students in their project work and degrees.

LIST OF PUBLICATIONS

IN REFEREED JOURNALS

01. 'Study of G-factor of a Split-coil System'
M.S. Bhatia,
J. Phys. E, Sci. Instrum., **22**, 1989, 23.
02. 'A simple Technique for Modulating the Output of A CW E-Beam Evaporator',
M.S. Bhatia, A. Joshi, K. Patel and U.K. Chatterjee,
Rev. Sci. Instrum. **60(3)**, 1989, 505.
03. 'Observation of Non-linearity in E-beam Evaporation from Water Cooled Crucible',
M.S. Bhatia, A. Joshi, K. Patel and U.K. Chatterjee.
J. Appl. Phys. **66(3)**, 1989, 1159.
04. 'Control of Ionisation in E-beam Evaporators via Optimum Choice of Focal Coil Current',
M.S. Bhatia, K. Patel, A. Joshi and U.K. Chatterjee,
Rev. Sci. Instrum. **60(8)**, 1989, 2794.
05. 'A Pulsed Laser Photo-ionisation Technique for Recording Atomic Flux Variations during Deposition',
M.S. Bhatia, B.A. Dassanacharya and G.L. Sharma,
Rev. Sci. Instrum. **64(8)**, 1993. 2003.
06. 'A Simple Temperature Sensor for Diagnostic Use in E-Beam Evaporators',
M.S. Bhatia, U.K. Chatterjee and G.L. Sharma,
Rev. Sci. Instrum. **64(8)**, 1993, 2371.
07. 'A Novel In-situ Method for Locating the Virtual Source Position in High Rate E-Beam evaporation',
M.S. Bhatia,
Appl. Phys. Letters **65(2)**, 1994, 251.
08. 'Filamentless Operation of a High Power Electron Bombardment Furnace used for Refractory Metal Atom Beam Generation',
M.S. Bhatia, A.S. Dongare, V.K. Mago and B. Lal,
Rev. Sci. Instrum. **71(8)**, 2000, 3031.
09. 'Interference due to Degassing and Metal-oxidein an E-Bombardment Furnace while Conducting RIS and RIMS Investigations',
M.S. Bhatia, and V.K. Mago,
Vacuum **67(2),** 2002, 199.
10. 'Electron Beam Evaporation of Aluminum with a Porous Tantalum Rod in Melt Pool',
B. Dikshit, G.R. Zende, **M.S. Bhatia** and B.M. Suri,
J. Phys. D: Appl. Phys. **38**, 2005, 2484.
11. 'Hysterisis in Electron Emission Current of an Axial Electron Gun used for Evaporation of Metals',
B. Dikshit and **M.S. Bhatia,**
IEEE Transactions on Plasma Science, **35(2),** 2007, 396.
12. 'Effect of Periscope Reflecting Mirror on Uncertainty of Measured Temperature of an Electron Beam Heated Metal Vapor Source',
B. Dikshit, G.R. Zende, **M.S. Bhatia** and B.M. Suri,
Meas. Sci. & Technol. **19**, 2008, 511.
13. 'Collisional Effects on Metastable Atom Population in Vapour Generated by Electron Beam Heating',
B. Dikshit, A. Mazumdar, **M.S. Bhatia** and V.K. Mago,
J. Phys D: Appl. Phys. **41**, 2008, 521.
14. 'Ideal Distortion-less Bending of a Focussed Non-Para-axial Electron Beam',
B. Dikshit and **M.S. Bhatia**,
Nucl. Instrum and Methods, in Phys. Res. A **596**, 2008, 300.
15. 'Use of Langmuir Probe for Analysis of Charged Particles in Metal Vapour Generated by Electron Beam Heating',
B. Dikshit and **M.S. Bhatia**,
J. of Phys.: Conference Series **114**, 2008, 012030.
16. 'Use of Multi-wavelength Emission from Hollow Cathode Lamp for Measurement of State Resolved Atom Density of Metal Vapor Produced by Electron Beam Evaporation',
A. Mazumdar, B. Dikshit, **M.S. Bhatia** and V.K. Mago,
Rev. Sci. Instrum., **79**, 2008, 093305.
17. 'Design of LCL-T Resonant Converter Including the Effect of Transformer Winding Capacitance',
M. Borage, K.V. Nagesh, **M.S. Bhatia** and S. Tiwari,
IEEE Trans. on Ind. Electronics, **56(5)**, 2009, 1420.

18. 'Characteristics and Design of Asymmetrical Duty-Cycle Controlled LCL-T Resonant Transformer',
M. Borage, K.V. Nagesh, **M.S. Bhatia** and S. Tiwari,
IEEE Trans. on Power Electronics (Accepted)
19. 'Evolution of a Two-Temperature Plasma Expanding with Metal Vapour Generated by Electron Beam Heating',
B. Dikshit, G.R. Zende, **M.S. Bhatia** and B.M. Suri,
IEEE Trans. in Plasma Science, 37, 7, 1196-1202 (2009)
20. 'Convection in molten pool created by a concentrated energy flux on a solid metal target',
B. Dikshit, G.R. Zende, **M.S. Bhatia** and B.M. Suri,
Physics of fluids, 21, 084105, (2009)
21. 'A Feasibility Study of Fractional Spherical Head Model for SAR Evaluation',
L.K. Ragha and **M.S. Bhatia**,
IETECH J. of Communication Techniques, Vol.3, (2009), 051-057.
22. 'Evaluation of SAR Reduction for Mobile Phone Using RF Shield',
L.K. Ragha and **M.S. Bhatia**,
Int. Jour. Recent Trends in Engg., Vol.2, 5, Nov. 2009, 58-62.
23. 'Numerical Evaluation of SAR for Compliance Testing of Personal Wireless Devices',
L.K. Ragha and **M.S. Bhatia**,
Int. Jour. Of Recent Trends in Engg. Vol.2, 6, Nov. 2009, 69-72.
24. "Evaluation of SAR Red

IN INTERNATIONAL CONFERENCES

1. "Electromagnetic compatibility of Laser Based Systems",
M.S. Bhatia,
Int. Conf. on Electromag. Interference & Compatibility, INCEMIC 89, Bangalore, India, Sept. 14-16, 1989.
2. "Shielding and Pick-up Problems in Laser laboratories",
M.S. Bhatia,
Int. Workshop on Lasers and their Applications, IWOLA, CAT, Indore, India, Feb. 4-7, 1991.
3. "Improved Magnetics for Laboratory Transformers for Reduction of Stray Magnetic fields",
M.S. Bhatia,
Int. Conf. on Electromagnetic Interference & compatibility, INCEMIC 92, Calcutta, India, Dec. 2-4, 1992.
4. "Development of Process Monitoring and Process Control Techniques Applicable to E-Beam HRPVD",
M.S. Bhatia,
Int. Conf. on Vac. Sci. & Technol. And SRS Systems, CAT, Indore, India, Jan. 30- Feb. 2, 1995.
5. "Microstructure of Thick Copper Deposits Obtained by E-Beam Evaporation at Rates Exceeding 1 Micron per Second",
M.S. Bhatia,
Int. Conf. on Vac. Sci. & Technol. and SRS Systems, CAT, Indore, India, Jan 30- Feb. 2, 1995.
6. "Some Problems in Non-Contact Thermometry of Vapour Emitting Zones In E-Beam Evaporators,
M.S. Bhatia,
Int. Conf. on Instrumentation, ICI 96, Bangalore, India, Aug. 6-8, 1996.
7. "On EMI Potential of Lasers",
M.S. Bhatia and G. Kumar,
Int. Conf. on Electromagnetic Interference and Compatibility INCEMIC 2001/2002, Bangalore, India,
Feb. 21-23, 2002.
8. "Mapping of Radiation fields from a Discharge Laser Head",
M.S. Bhatia, V.K. Madan, A.S. Dongare, R. Phulluke, G. Kumar and V. Agarwal,
Int. Conf. on Electromag. Interfer. & Comp. INCEMIC 2001/2002, Bangalore, India, Feb. 21-23, 2002.
9. "Conducted EMI Issues and the Design of EMI Filters for AC Power Supply Feeding a Copper Vapour Laser Type',
R. Phulluke, V. Agarwal, G. Kumar, **M.S. Bhatia**, V.K. Madan and A.S. Dongare,
Int. Conf. on Electromag. Interference and Compatibility INCEMIC 2001/2002, Bangalore, India,
Feb. 21-23, 2002.
10. "EMI Production in a Laser Pulse Switch-out System",
S. Krishnan, A. Singh, R. Chari, **M.S. Bhatia** and S. M. Oak,
Int. Conf. on Electromagnetic Interference and Compatibility INCEMIC 2001/2002, Bangalore, India,
Feb. 21-23, 2002.

NATIONAL SYMPOSIA

1. "Noise Considerations in Laser Opto-Galvanic Spectroscopy using Hollow Cathode Discharge",
M.S. Bhatia, B.M. Suri and R. Kapoor,
Symposium on Quantum Electronics, BARC, Mumbai, Jan. 14-16, 1985.
2. "Two-colour Photo-ionisation of UI",
V.K. Mago, A.K. Ray, R. Kapoor, A. Joshi, **M.S. Bhatia** and B.M. Suri,
Forth Quantum Electronics Symposium, Cochin University, Cochin, Dec. 29 1986 – Jan. 1 1987.
3. "On-Line Rate Monitoring in PVD Systems via Laser Multiphoton Ionisation",
M.S. Bhatia, B.A. Dassanacharya and G.L. Sharma,
Natl. Laser Symposium, IIT Madras, Feb. 17-19, 1993.
4. "A Magnetic Field Set-up for use in Spectroscopic Studies Related to Optical Pumping",
M.S. Bhatia, P.T. Kathar and B. Lal,
Natl. Conf. on Current Trends in Atomic & Molecular Physics, CURTAMP – 93, BARC, Mumbai, Dec.

21-23, 1993.

5. "On Obtaining Velocity Spectrum of Depositing Species by Laser Multiphoton Ionisation",
   M.S. Bhatia, B.A. Dassanacharya and G.L. Sharma,
   Natl. Laser Symposium, CAT Indore, Jan. 29 1993 - Feb. 2, 1994.
6. "Application of Four Level Controller to Motorised Variac fed High Voltage System,
   M.S. Bhatia and A.S. Dongare,
   Natl. Symp. On Advances in Control & Instrumentation, SACI 94, BARC Mumbai, Mar. 16-18, 1994.
7. "Monitoring Rate variations in E-Beam Evaporators",
   M.S. Bhatia, B.A. Dassanacharya and G.L. Sharma,
   Natl. Laser Symposium, IRDE Dehradun, Feb. 10-14, 1995.
8. "Manifestations of Non-Ideality in in Design of Electronic Equipment",
   M.S. Bhatia,
   Conf. on Current trends in Electronic Product Design & Technology, CEDT Mohali, Chandigarh, April 6-8, 1995.
9. "Vacuum Design Considerations in a Co-axially Insulated E-Gun for Use in Vacuum Evaporation",
   M.S. Bhatia, B. Dikshit and B. Lal,
   Natl. Symp. on Vac. Sci. & Technol. and Power Beams, BARC Mumbai, Nov. 19-21, 1997.
10. "Electron Beam Positioning on Target Surface in an Evaporator with Axial E-Gun",
    M.S. Bhatia, B. Dikshit and B. Lal,
    Natl. Symp. on Vac. Sci. & Technol. and Power Beams, BARC Mumbai, Nov. 19-21, 1997.
11. "Construction of a B-H Curve Plotter at 1 MHz",
    A.S. Dongare and **M.S. Bhatia**,
    Natl. Symp. on Vac. Sci. & Technol. and Power Beams, BARC Mumbai, Nov. 19-21, 1997.
12. "Measurement of Uranium Atom Density in Ground State and Characterisation of Vaour Distribution in an Electron Beam Evaporator by Absorption Spectroscopy",
    B. Dikshit, **M.S. Bhatia** and V.K. Mago,
    DAE-BRNS Symp. on Spectroscopy of Lanthanides & Actinides (SLA-99), Nov. 16-19, BARC Mumbai, 1999.
13. "Circular Mesh Monopole Antenna for EMI/EMC Applications",
    P.V. Anob, G. Kumar, K.P. Ray, **M.S. Bhatia** and V.K. Madan,
    Natl. Symp. on Antennas and Propagation, Cochin University, cochin, Dec. 6-8, 2000.
14. "Mitigation of EMI in Typical R&D Systems- Some Case Studies",
    K. Nanu,G.V. Rao, K.V. Nagesh, S. Khole, B.N. Karkera, R.K. Rajawat, B. Dikshit and **M.S. Bhatia**.
    Natl. Conf. on Electromagnetic compatibility, EMC 2000, Chennai, Dec. 14-15, 2000.
15. "Developmental Trends in Virtual and Intelligent Instrumentation",
    M.S. Bhatia and V.K. Madan,
    Advances in Computer Engineering ACE 2000, World Trade Cetre, Mumbai, Dec. 16-18, 2000.
16. "Measurement of Excitation Cross-section of Uranium Transitions by Saturation Method",
    M.L. Shah, Vas Dev, B. Dikshit, A.K. Phullani, **M.S. Bhatia** and B.M. Suri,
    DAE-BRNS Natl. Laser Symp., Shri Chitra Thirumal Int. of medical Sciences and Technol., Thiruvantpuram, Nov. 14-16, 2002.
17. "Convective Heat Transfer in Electron Beam Heating",
    B. Dikshit and **M.S. Bhatia**,
    Natl. Symp. on Vac. Sci. & Technol. and Vac. Metallurgy, BARC Mumbai, Oct. 15-17, 2003.
18. "Evaporation Studies with a Porous Rod in Melt Pool During Electron Beam Heating",
    B. Dikshit, G.R. Zende, Shaji C. Kumar, **M.S. Bhatia** and B.M. Suri,
    Symp. on E-Beam Technol. & Applications, SEBTA, BARC Mumbai, 2005.
19. "Characterisation of Thin Films Deposited by Efficient E-Beam Heating using Inductively Coupled Plasma Atomic Emission Spectroscopic Technique",
    Shaji C. Kumar, M. Sundersanan, B. Dikshit, G. Zende, **M.S. Bhatia** and B.M. Suri,
    Symp. on E-Beam Technol. & Applications, BARC Mumbai, 2005.
20. "Numerical Methods for Bio-electromagnetic Computation: A General Perspective",
    L.K. Ragha and **M.S. Bhatia**,
    Proc. of SPIT-IEEE, Mumbai, Feb. 4-5, 2008.
21. "Safety Standards for Non-ionising Radiation from Wireless and Microwave Systems",
    L.K. Ragha and **M.S. Bhatia**,
    39th Mid Term Symposium, Jaipur,, April 12-15, 2008.

INVITED TALKS/ARTICLES

1. "Instrumentation in Laser Laboratories"
   M.S. Bhatia,
   Int. Workshop on Lasers & Their Applications', IWOLA, CAT Indore, Feb. 4-7, 1991.
2. "Electron Beam High Rate physical Vapour Deposition – Techniques, Processes & Applications",
   M.S. Bhatia,
   BARC Newsletter 135, 1995.
3. "Development of Fibre-Optics : A Perspective",
   M.S. Bhatia,
   Inaugural Lecture at IEEE Chapter Bhartiya Vidya Bhavan, Navi Mumbai., 1997.
4. "Physics Education in Indian Universities and Scientific Temper: Its Nurturing & Induction",
   M.S. Bhatia,
   Seminar on Physics Education, Basic Research and New Technologies IPAS 2003

5. “EMI Issues with Lasers”,
   M.S. Bhatia,
   Invited Talk Int. Conf. on Electromagnetic Interference and Compatibility INCEMIC 2006, Bangalore, India, Jan. 21-23, 2006.
6. “Lasers in Communications and Fiber Optics”,
   M.S. Bhatia,
   Invited Talk , Two-Day Seminar on Lasers and Applications, Jan. 30-31, Shah & Anchor Kutchhi Engineering College, Mumbai, 2006.
7. “Lasers: An Introduction”
   M.S. Bhatia,
   Inaugural Talk in Workshop on Laser Based Instrumentation, Natl. Laser Symposium, BARC Mumbai, 2007.

Several pedagogical talks addressed to B-Tech students were given at local colleges on a regular basis covering a wide range of topics related to optical engineering, laser applications, thin film technology, e-beams and their applications.

INTERNAL REPORTS

1. ‘Study of Two Medium Size C-Core Electromagnets Generating Low Magnetic Fields’,
   M.S. Bhatia, S. Dass and U.K. Chatterjee,
   BARC 1352/ 1987.
2. ‘Design Modifications and Performance Appraisal of Indigenous and Imported Copper Vapor Lasers’,
   A.S. Dongare, G.K. Kalwale and **M.S. Bhatia**,
   BARC/2003/I/014.