CURRICULUM VITAE

1. Name:

Dr. Dilip Kumar Bhattacharya, M. Sc., Ph.D.

Fellow of International Academy of Physical Sciences

Ex. Professor and Head- Department of Pure Mathematics, University of Calcutta.

Ex. AICTE Emeritus Professor- School of Bioscience and Engineering, Jadavpur University, Kolkata

Ex. UGC Emeritus Professor- Department of Instrumental Music, Rabindra Bharati University, Kolkata

2. Address:

Mouri, P.O. Andul- Mouri, Howrah, W.B. Pin.711302, India

Phone: 91-33-26690519 (R) 9432595660 (M)

Email: dkb_math@yahoo.com

3. Date of Birth: 08.01.1943

4. Teaching Experience: 49 years

Assignment:

i) **Lecturer in Mathematics, MBB College**, (affiliated to University of Calcutta) Agartala, Tripura Education Service, 1966-1968.

ii) **Lecturer in mathematics, Taki Govt. College**, 1968-1974, WBES (West Bengal Education Service), Taki, 24 Parganas.

iii) **Assistant professor in Mathematics, Chandernagore Govt. College,** WBES (West Bengal Education Service) Chandernagore, Hooghly, 1974-1979.

iv) **Assistant professor in Mathematics, Presidency College**, WBES (West Bengal Education Service), Kolkata, 1979-1980.

v) **Lecturer in mathematics, Department of Pure Mathematics**, Calcutta University, 1980-1986.

vi) **Reader in Mathematics, Department of Pure Mathematics**, Calcutta University, 1986-1996.

vii) **Professor in Mathematics, Department of Pure Mathematics,** Calcutta University, 1996-2008.

viii) **Guest professor (2005-2008) in Biostatistics and Biomathematics** - Department of School of Bioscience and Engineering – Jadavpur University, Kolkata 700 032.

ix) Guest professor (2008) in Bio-informatics – DOEACC Center, (An autonomous Society under Ministry of Communications and Information technology, Govt. of India) at Jadavpur University Campus, Kolkata- 700 032.

x**) Guest professor (2008-2013)** - Department of Mathematics, Rabindra Bharati University, Kolkata,

xi) **Guest professor (since 2013)** - Narula Institute of Technology, Kolkata

5. Administrative experience

1) To act as Head of the department of Pure mathematics, Calcutta University
2) To act as member of the Senate, Calcutta University
3) To act as member of the Ph.D committee in the department of Pure mathematics, Calcutta University
4) To act as Secretary of the International Academy of Physical Sciences, Allahbad University.
5) To act as a member of the executive committee, Calcutta Mathematical society, Calcutta.

6. Research Activity

U.G.C. Project

Analytical study on role of music in psychosomatic stress management

7. Areas of Research:

(a) **Functional Analysis** - Banach algebra, extension and allied problems.

(b) **Complex Analysis**- Space of entire Dirichlet Series

(b) **Differential Geometry**- Abstraction of Differentiable manifold.

(c) **Differential Equation**- Mathematical modeling and Qualitative theory of ordinary differential equation and its applications in Biology and medicine.

(d) **Nonlinear Optimization**

(i)**Vector optimization of functions in abstract spaces**

(ii)**Control theoretic optimization of functionals and its vector generalization**

a. **Optimal control of single objective, multi-objective and fractional objective control problems with restrictions in the parameter domain (with or without delay)** with applications in Biology [including Fishery Biology, Marine Biology, Integrated Pest management problem under release of Sterile Insect and immigration from outside the control area*, bacterial and viral infections;* vertical and horizontal transmission of diseases, atmospheric pollution and in Inventory control problem].

b. **Optimal control of single objective, multi-objective and fractional objective control problems with restrictions in the parameter domain as well as in the state space** and their applications in realistic problems, including the state space as a manifold with boundary]

8. **(a) Total number of Publications: More than eighty**

(b) List of publications since 2000

Differentiable Manifold

1. Bhattacharya), D.K. (2002: On abstraction of differentiable manifold, Tensor, N.S. (Japan) vol. 63, pp 187-196.

Generalized Hilbert Space

1. Bhattacharya, D. K. & T. E. Aman (2003): Γ-Hilbert space and linear quadratic control problem- Rev. Acad. Canar. Cienc. (Spain), XV, No. 1-2, pp. 107 -114.

2. Bhattacharya, D. K. & T. E. Aman (2005): A partially generalized form of special linear quadratic problem and solution of operator equation between two **measure** Hilbert spaces - Rev. Acad. Canar. Cienc. (Spain), XVII, No. 1-2, pp. 107 -114

Pest Management Problem

1. Bhattacharya, D. K. and S. Karan (2003): Pest management of two non-interacting pests in presence of common predator- Journal of applied mathematics and computing, (Korea) vol. 13, 301-322.

2. Bhattacharya, D. K. and S. Karan (2004): Pest management of a single density dependent pest- The Bulletin, GUMA, Vol. 8, pp. 60 – 81.

3. Bhattacharya, D. K. and S. Karan (2004): On Bionomic model of integrated pest management of a single pest population - Journal of differential equations and dynamical systems, vol. 12, Nos. 3 & 4, July and October, pp. 301-330.

4. Bhattacharya, D. K., S. Manna and S. Begum (2004): Optimization of two species fishery model under congestion and gear saturation- Journal of Pure Mathematics, University of Calcutta.

5. Bhattacharya, D. K., S. Manna and S. Begum (2005): Bionomic Equilibrium and optimal harvesting in a two species prey-predator model where preys find refuge in the space- Journal of Pure Mathematics, University of Calcutta, Vol. 22, pp. 9-23.

6. Bhattacharya, D. K. and S. Bhattacharyya (2005): A new approach to pest management problem- Journal of Biological system, Vol. 13, No. 2, pp. 117-130.

7. Bhattacharya, D. K. and S. Bhattacharyya (2006): An improved integrated pest management model under 2-control parameters (pesticides and sterile males) – Mathematical Biosciences xxx(2007) xxx-xxx,.

8. Bhattacharya, D. K. and S. Bhattacharya (2006): Pest control through viral disease, Mathematical modeling and analysis- Jour. of theoretical Biology, Vol.238, pp. 177-197.

9. Bhattacharya, D. K. and S. Bhattacharya (2007): A more realistic approach to pest management problem – Bulletin of mathematical Biology.

10. Bhattacharya, D. K and S. Ghosh (2006): Role of viral infection in pest control- Bulletin of Mathematical Biology- DOI 10-1007/s11538-007-9235-8

11. Bhattacharya, D. K, S. Ghosh and S. Bhattacharya (2007)- Effect of temperature on viral infection and its control: A mathematical approach- Journal of theoretical Biology

Fishery Management Problem

1. Bhattacharya, D. K and S. Ghosh (2006): Maximization of revenue in Fishery models with Cobb-Douglass type of production function, Optimization letter February 2012, Volume 6, Issue 2, pp 331-338.

Methane Emission Management problem

1. Bhattacharya, D. K. and A. chakraborty (2006)- A process based mathematical model on methane emission with emission indices for control- Bulletin of Mathematical Biology , 68, pp. 1293-1304

2. Bhattacharya, D. K. and A. chakraborty (2006)- A process based mathematical model on methane emission with oxidation process from rice fields and corresponding control strategies- Environmental modeling and assessment (Springer) DOI 10.1007/s10666-006-9060-8

3. Bhattacharya, D. K., A. chakraborty, B. L. Li (2006): Spatio-temporal dynamics of methane emission of methane from rice fields at global scale- Article. Ecological complexity, Vol.3, Issue 3, 1 September 2006, pages 231-240.

Inventory Control Problem

1. Bhattacharya, D. K. (2004): On multi-item inventory- European Journal of operational research, 162, 786 -791.
2. D.K.Bhattacharya (2011) – A more realistic approach to inventory problem Opsearch, India, Springer Verlag), 16

Multi-objective Control Problem

1. Bhattacharya, D. K. & T. E. Aman (2004): Multi-objective optimal control problem-Rev. Acad. Canar. Cienc. (Spain), XVI, No. 1-2, pp. 129-142.

Control of Mercury Poisoning

1. Bhattacharya, D. K. and S. Bhattacharya (2006) - Mercury poisoning and optimal therapeutic dose- Journal of Biology and medicine

Control of Epilepsy

1. Bhattacharya, D. K. and S. K. Das (2006): Economic control of epilepsy in a given time period- Proceedings of the International 'Conference on Differential and difference equations and Applications', Florida Institute of technology, Melbourne, USA, 1-5 August, 2005.

Application of Dynamical system on Differentiable Manifold

1. Bhattacharya, D. K. and A. Gupta (2005)– Permanence and extinction of solution of ordinary differential equations on a differentiable manifold– Ganita, Vol.56.No.2, 105-117.

2. Bhattacharya, D. K. and A. Gupta (2006) – Generalization of replicator dynamics from a 3-simplex to a 2-sphere with boundary, Revista de la Academia Canaria de Ciencias, Spain, Volume XVIII, numbers 1-2.

Effect of Music and meditation through HRV and EEG

1. Anilesh Dey, Sanjay Kumar Palit, D. K. Bhattacharya, D.N. Tiberwala: “Are the effects of music and meditation on HRV similar? A time domain study”- Medical & Biological Engineering & Computing, Springer-(1 Rivision dated March 19.2014).

2. Anilesh Dey, Sanjay Kumar Palit, D. K. Bhattacharya, D.N. Tibarewala “Significance analysis of different time domain measures of HRV to differentiate normal and on-music states”. International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering,3(3),7838 -7857, 2014.

3. Anilesh Dey, Sanjay Kumar Palit, D. K. Bhattacharya, D.N. Tibarewala ,‘Effect of music on autonomic nervous system through the study of symbolic dynamics of heart rate variability signals.”, International Journal of Advances in Computer Science and its Applications, Volume 3 : Issue 2(2013),Page:120-124, ISSN:2250 – 3765.

4. Anilesh Dey, Sanjay Kumar Palit, Sayan Mukherjee, D. K. Bhattacharya, D.N. Tibarewala “Are the effects of Chinese-chi meditation and Kundalini yoga on Autonomic Nervous system distinguishable? A frequency domain study” (communicated-Journal of Biomedical Science).

5. Anilesh Dey, Sanjay Kumar Palit, D. K. Bhattacharya, D.N. Tibarewala,Dipan sarkar “Study of the effect of different music stimuli on autonomic nervous

system of a single subject."IEEE International Conference on Communication and Signal Processing, page: 1755-1759, ISBN:978-1-4799-3357-0, April 3-5, 2014, India

6. Anilesh Dey, Supriyo Chakraborty, Sanjay Kumar Palit, D. K. Bhattacharya , D.N.Tibarewala ,Mrityunjoy Roy, "Study the effect of music on HRV impulse using multi-fractal DFA analysis -IEEE International Conference on Communication and Signal Processing, page: 2085-2089, ISBN: 978-1-4799-3357-0, April 3-5, 2014, India.

7. Anilesh Dey, Sanjay Kumar Palit, Sayan Mukherjee, D. K. Bhattacharya, D.N. Tibarewala "Reduction of Stress of human-being through Rabindra Sangeet", Proceedings of the International Seminar on Current trends in Music Therapy Practices: Methodology, Techniques and Implementation (organized by Department of Vocal Music, Banaras Hindu University and I. C.C. R), Feb.17 – 18, 2012.pages.859-863

8**.** Anilesh Dey, Sanjay Kumar Palit, D. K. Bhattacharya, D.N. Tibarewala , Debraj Das, "Study the effect of music on Central nervous system through long term analysis of EEG signal in time domain". International Journal of Engineering Science and Emerging Technologies Volume:5, Number:1(2013), page 59-67, ISSN:2231-6604.

9. Anilesh Dey, Sanjay Kumar Palit, Sayan Mukherjee, D. K. Bhattacharya, D.N. Tibarewala,"A new kind of dynamical pattern towards distinction of pre-meditative and meditative states "Volume3,Number 3,(2012)pages-1611-1615. "International Journal of Research and Reviews in Computer Science" 3(3), pp. 1611-1615, 2012.

10. Anilesh Dey, Sanjay Kumar Palit, Sayan Mukherjee, D. K. Bhattacharya, D.N. Tibarewala: Are Meditative states distinguishable from the pre-meditative ones?

A new alternative study - IEEE International Conference on Advances in Engineering, Science and Management (ICAESM), 2012 , Page(s)456 – 461,Print ISBN:978-14673-0213-5.

11. Anilesh Dey, Sanjay Kumar Palit, Sayan Mukherjee, D. K. Bhattacharya, D.N. Tibarewala, “A new technique for the classification of pre-meditative and meditative states”, IEEE International Conference, “ICCIA-2011”, Print ISBN:978-1-4577-1915-8.

12. Bhattacharya, D.K., Goswami, D.P., and Tibarewala, D.N. (2010)Analysis of heart rate variability in meditation using normalized Shannon entropy- Journal of international academy of physical sciences- Vol. No.1, (2010).

13. Bhattacharya, D.K., Goswami, D.P., and Tibarewala, D.N. (2010): Concept of generative sequence- A new complexity measure for HRV signal and its application in meditation, Bulletin of Pure and applied mathematics

14. Bhattacharya, D. K., Das, S.K., M. Singha. A. Misra, S. Ghosh (2010) – Effect of music on patients by study of EEG signals – Journal of international academy of physical sciences

15. Bhattacharya, D.K., Goswami, D.P., and Tibarewala, D.N. (2011): Analysis of heart rate variability signal in meditation using second-order 2 difference plot- journal of Applied physics - 109 (11), 114703, **2011**.

16. Anilesh Dey, Sayan Mukherjee, Sanjay Kumar Palit, Subhram Das, D. K Bhattacharya “Precise signature of the effect of meditation on HRV signal and 3D Poincaré plot in cylindrical co- ordinates”. Published in Proceedings of 15th International conference of the International Academy of Physical sciences (CONIAPS XV), 9-13 December, 2012, in Rajmangala University of Technology, Thailand.

Book Chapter

1. Study of the effect of Music and Meditation on Heart rate variability, A.Dey, D. K. Bhattacharya, S. K. Palit and D. N. Tibarewala, In: IGI Global Encyclopedia of Information Science and Technology, 3rd Edition (Eds. Mehdi Khosrow-Pour), 697-710, 2014.

Attractor Reconstruction

1. Generalized auto-correlation and its application in attractor reconstruction,S. K. Palit, S. Mukherjee, and D. K. Bhattacharya, *Bulletin of Pure and Applied Mathematics* 5(2), pp. 218-230, 2011.

2. Generalized Auto-correlation and its Application in Deterministic Chaos of Continuous Non-stationary Time Series,S. K. Palit, S. Mukherjee, and D. K. Bhattacharya, *Journal of International Academy of Physical Sciences* 15 (2), pp.153-174, 2011.

3. New types of nonlinear auto-correlations of bivariate data and their applications, S. K. Palit, S. Mukherjee, and D. K. Bhattacharya, *Applied Mathematics Computation* 218, pp. 8951-8967, 2012.

4. A high dimensional delay selection for the reconstruction of proper phase space with cross auto-correlation, S. K. Palit, S. Mukherjee, D. K. Bhattacharya *Neuro-computing (Elsevier Science)*113, pp. 4957, 2013.

5. Is one dimensional map sufficient to describe the chaotic dynamics of a higher dimensional system, S. Mukherjee, S. K. Palit, D. K. Bhattacharya, *Applied Mathematics Computation (Elsevier Science)*219, pp. 11056-11064, 2013.

6. Approximate discrete dynamics of EMG signals, S. Mukherjee, S. K.Palit and D. K. Bhattacharya, *Applied Mathematics Computation*,243, 879-888, 2014.

Book Chapter

Effect of Music on Autonomic Nervous system

1. A Comparative study on three different types of music based on same Indian Raga and their effects on Human Autonomic Nervous systems, S. Mukherjee, S. K.Palit, S. Banerjee and D. K. Bhattacharya, In Chaos, Complexity **and** Leadership 2013, Springer (Eds. Sefika Sule Ercetin and Santo Banerjee), 2014.

Phase Synchronization

1. Phase synchronization of instrumental music signals, S. Mukherjee, S. K. Palit, S. Banerjee, MRK Ariffin and D. K. Bhattacharya, *The European Physics Journal Special Topics*,223 (8), 1561-1577, 2014.

Bioinformatics

i) Similarity/ Dissimilarity of DNA sequences

1. Subhram Das, Debanjan De, Anilesh Dey, D. K. Bhattacharya "Some anomalies in the analysis of whole genome sequence on the basis of Fuzzy set theory". International Journal of Artificial Intelligence and Neural Networks. Volume 3: Issue 2 [ISSN 2250-3749] Pages: 38-41. 5th June 2013

2. Subhram Das, Debanjan De "Intutionistic Fuzzy logic and differentiation of whole Genomes". Published in Proceedings of 15th International conference of the International Academy of Physical sciences (CONIAPS XV), 9-13 December, 2012, in Rajmangala University of Technology, Thailand

3. Subhram Das, Debanjan De & D. K. Bhattacharya "Similarity and Dissimilarity of Whole Genomes using Intuitionistic Fuzzy Logic" communicated in Notes on Intuitionistic Fuzzy Sets

4. Subhram Das, D. K. Bhattacharya "Geometrical method of exhibiting similarity/dissimilarity under new 3D classification curves and establishing

significance difference of different parameters of estimation" communicated in Current Bioinformatics.

Ii) Similarity/ Dissimilarity of Protein sequences

1.Saumen Ghosh, Jayanta Pal, D.K.Bhattacharyya, "Classification of Amino Acids of a Protein on the basis of Fuzzy set theory", International Journal of Modern Sciences and Engineering Technology (IJMSET), ISSN: 2349-3755, Volume 1, Issue 6, 2014, pp.30-35.

2.Soumen Ghosh, D.K.Bhattacharyya, "Symbolic representation of protein sequences on the basis of fuzzy representation of amino acids", 4th World Congress on Biotechnology, September 23-25, 2013, J Biotechnol Biomater 2013, ISSN: 2155-952X, JBTBM an open access journal, Volume 3 Issue 3, Page 104.

Book Chapter

JayantaPal, Anilesh Dey, Soumen Ghosh,D. K. Bhattacharya, Tarunima Mukherjee, "Analysis of similarity between Protein Sequences through the study of Symbolic Dynamics", International Conference on Computational Advancement in Communication Circuits and Systems (ICCACCS-2014), OCT 30th – NOV 1st, 2014.

9. Research Supervision

i) M.Phil produced (**Eleven**)

ii) Ph.D produced (**Fourteen**)

(1)A. Maity - On Γ - Banach Algebra and its applications

(2)S. Begum – Optimization in multi-fishery problems **(jointly with P.C.Bhakta, Jadavpur University)**

(3) S. Manna – On the space of entire Dirichlet series

(4) T. Roy – On two- paranomed space and two- paranormed algebra

(5) S. Karan – On integrated Pest management problems and use of sterile insect technique

(6) A. Chakraborty – A Process based mathematical model for control of methane emission from rice fields

(7) T. E. Aman – On multi-control and fractional control optimization problems

(8) S. Bhattacharya- On some new approaches to pest management problems and control of vertically transmitted diseases

(9) S. Ghosh – Mathematical modeling on some pest management problems with special emphasis on viral infection

(10) A. Gupta- On some qualitative aspects of differential equations on differentiable manifold

(11 D. Goswami- HRV analyses and its application in studying the effect of meditation

(Jointly with D.N.Tibarewala, Jadavpur University)

(12) S. Palit – Time series analysis in time domain for detecting HRV and musical signals.

(13)S. Mukherjee- Frequency delay plot and Wavelet analysis in understanding Biomedical and music signals

(14)A. Dey - Effect of music and meditation on human nervous system as revealed through HRV and EEG signals (**jointly with D.N.Tibarewala, Jadavpur University**)

iii) **Ph.D enrolled**

S. Das on Bioinformatics in Jadavpur University (**One**)

S. Ghosh on Bioinformatics in NIT Durgapur (**One**)

iv) **Ph.D to be enrolled**

J.Pal. **(one)**

10. Present Research Activities

I) To consider Bio-medical signaling as a measure of physiological changes due to Music and meditation and to perform allied nonlinear data analysis

II) To examine the effect of music input on the person in the stressed condition as reflected in Heart rate variability (HRV) and EEG (Electro-encephalogram).

III) To characterize the musical input in order to identify the efficacy of type of music used.

IV) To analyze the music signals as the input parameter by using standard signal analysis techniques and their improvements by incorporating multi-fractals and their correlations.

V) To find synchronization of biomedical EEG signals with Music signals of specific characteristics.

VI) Study of nonlinear data through reconstructed attractors.

VII) Use of recurrence plot to study higher dimensional dynamics of real data.

VIII) Study of stochastic Chaos as applied to financial time series

IX) Use of Fuzzy set, Intutionistic Fuzzy set, Rough set, Rough Fuzzy set and Intutionistic Rough Fuzzy set in Bioinformatics for early detection of Cancer.

11. Foreign visits for scientific assignments

Denver (USA); Institute of Academic Sinica, (**Taiwan)**; Meziro University,(**Japan)**; University of New South Wales, (**Australia)**; University of **Warsaw** and scientific center, Poznan, Bedleow, (**Poland)**; Florida Institute of Technology, (**USA)**; University of Averio, (**Portugal)**; University of Texas, (**USA)**; Morehouse college, Atlanta, (**USA)**.

12. Association with Learned societies and Academic Bodies

1) **Member**: Journal of Bulletin of Mathematical Biology, USA

2) **Life members** of i) Calcutta Mathematical society ii) Indian Mathematical Society iii) Ramanujam Mathematical Society iv) International society of Industrial Mathematics, India v) Indian Statistical Institute, Kolkata vi) Bihar Mathematical Society vii) 'Ganita'(Lucknow Mathematical Society.

3) **Vice President**- International society of Physical Sciences, Allahabad

4) **Scientific advisor**, ITC Sangeet Research Academy, Kolkata

13. Extra-curricular activities

Instrumentalist, B-high Grade (classical Tabla Player), All India Radio, Doordarshan Kendra, Kolkata.

Solo performance in foreign country- Vedanta Society, San Fransisco, USA, 1998.

Drama: Direction and Play (Amateur)