UDSC **UNIVERSITY OF DELHI SOUTH CAMPUS**

DEPARTMENT OF BIOPHYSICS

Date: 11-April-2013

Departmental Research Committee (DRC) of Dept. of Biophysics consisting of following members met at Dept. of Biophysics on 11-April-2013.

i. Prof. Anil Tyagi (Vice-chancellor nominee of DRC).

ii. Prof. Indranil Dasgupta (Head Dept of Biophysics & Dean FIAS).

iii. Dr. Subhendu Ghosh (Associate Professor, Dept. of Biophysics)

iv. Dr. Manisha Goel (Asstt. Prof. Dept of Biophysics).

v. Dr. Manish Kumar (Asstt. Prof. Dept of Biophysics).

Following matters were discussed:

1. The DRC was briefed about that successful qualification in mandatory two courses required for Ph.D course-work examination of following candidates. A progress report of their work during the last one year was also presented to DRC.

Sr. No.	Name	Enrollment Number	Supervisor	Courses Opted	
				Course 1	Course 2
1.	Shobha Kumari	SDC-6/12	Dr. Manisha Goel	Enzymes & techniques in biochemistry (Dept. of Biochemistry Code: BIOCHEM VIII)	Protein–Structure, Folding and Engineering (Dept. of Biochemistry Code: BIOCHEM I)
2.	Shikha Rani	SDC-4/12	Dr. Manisha Goel	Plant-pathogen interaction (Dept. of Microbiology; Code: MIC X)	Protein–Structure, Folding and Engineering (Dept. of Biochemistry Code: BIOCHEM I)
3.	Ved Vrat Verma		Dr. Manisha Goel	Not applicable since candidate has M.Tech degree; 6 months progress report attached.	
4.	Bandana Kumari	SDC-8/12	Dr. Manish Kumar	Immunology (Dept. of Microbiology; Code: MIC IV)	Cell Biology & Biochemistry (Dept. of Genetics; Code: GEN 0703)

After due consideration the DRC recommends

A. **Confirmation of registration for Ph.D course of the above-mentioned four students.**

B. **Extension of Non-NET fellowship of Bandana Kumari for the year 2013-14.**

2. Also, Mrs. Shikha Rani has gone on maternity leave since 01-April-2013 and is expected to resume duties by 10th Aug-2013 (a copy of an application submitted by the candidate in this regard is attached).

3. Sh. Rajeev Gupta, PhD. Student registered with Dr. Subhendu Ghosh, has submitted an application for 1st extension of PhD. Tenure. The committee considered his application and recommended extension for six months with effect from 30th May, 2013, i.e. up to 30th November, 2013.

4. The committee discussed the optional courses to be offered by the Department of Biophysics during the session 2013-14. The following courses have been approved for the same.

   (i) Physical Methods in Biology by Dr.Subhendu Ghosh: 1st Semestar

   (ii) Computers Applications in Biology by Dr. Manisha Goel & Dr. Manish Kumar: 1st Semester

   (iii) Information Processing & the Brain by Dr.Subhendu Ghosh: 2nd Semester

The meeting ended with thanks to Prof. Anil Tyagi for his guidance and support.

Prof. Anil Tyagi | Prof. Indranil Dasgupta | Dr. Subhendu Ghosh

Dr. Manisha Goel | Dr. Manish Kumar

UDSC

दिल्ली विश्वविद्यालय दक्षिणी परिसर

UNIVERSITY OF DELHI SOUTH CAMPUS

DEPARTMENT OF BIOPHYSICS

Date: 23-Jan-2016

The Departmental Research Committee (DRC) met on 23.01.2016. Following members were present.

i. Prof. P. K. Burma (Head, Department of Biophysics & Dean FIAS).
ii. Prof. J.S. Virdi (Vice-chancellor nominee).
iii. Dr. Subhendu Ghosh (Associate Professor, Department. of Biophysics)
iv. Dr. Manisha Goel (Assistant Professor, Department of Biophysics).
v. Dr. Manish Kumar (Assistant Professor, Department of Biophysics).

1. The DRC was briefed about the change in number of papers required for the course work as per the new PhD Ordinance. The faculty members briefed the DRC about introducing two new papers titled 'Omics Biology' and 'Research Methodology'. The members were also briefed about the restructuring of an old paper named 'Computer Applications in Biology'. The committee examined the contents of the new and the restructured papers and discussed in detail the possible exposure and benefits these papers may give to the students.

2. Overall following papers are being offered by Department of Biophysics:

S. No.	Code	Teacher(s)	Title	Semester in which these papers will be offered
i.	BPHY001	Dr. Subhendu Ghosh	Physical Methods in Biology	July-Dec
ii.	BPHY002	,,	Information Processing and the Brain	Jan-May
iii.	BPHY003	Drs. Manisha Goel & Manish Kumar	Computer Applications in Biology	July-Dec & Jan-May
iv.	BPHY004	,,	Omics Biology	July-Dec & Jan-May
v.	BPHY005	,,	Research Methodology	July-Dec & Jan-May

After due consideration, the DRC recommended that the proposed papers may be included as optional papers (papers listed at Sr. No. i to iv) for the PhD course work. Paper at sr. no. v (Research Methodology) will be compulsory.

The meeting ended with a vote of thanks to the chair.

Prof. J. S. Virdi
(V.C. nominee)

Prof. P. K. Burma
(Head, Department of Biophysics)

Dr. Subhendu Ghosh
(Member, DRC)

Dr. Manisha Goel
(Member, DRC)

Dr. Manish Kumar
(Member, DRC)

SYLLABUS FOR COURSES OFFERED IN PH.D. COURSE WORK

(Applicable from January 2016 onwards)

Department of Biophysics,
University of Delhi South Campus,
Benito Juarez Road, New Delhi-110021

Department of Biophysics, UDSC

Course Title: Physical Methods in Biology

Teacher: Dr. Subhendu Ghosh

Preamble:

In almost all the researches in experimental biology methods based on the principles of Physics are used. While using equipments (optical and others) it is necessary for the students to understand the principles in order to achieve correct analysis of the experimental data and to design new and suitable experiments. The present course is designed keeping in view the above-mentioned points.

Syllabus:

1. **Spectroscopy:**
   i. Historical background of development of optics; Corpuscular theory of light; Wave theory of light; Electromagnetic theory of light; Planck's concept and modern theory of light; Electronic structures of atoms & molecules; Theory of chemical bonding.

   [4 classes]

   ii. Scattering of Light.

   [2 classes]

   iii. UV & Visible absorption spectrophotometry; Lambert Beer's Law; molar extinction coefficient and its determination; instrumentation & applications.

   [6 classes]

   iv. Fluorescence Spectroscopy: principles and applications; Polarization of light; Fluorescence studies of plane-polarized light.

   [6 classes]

   v. Optical Rotatory Dispersion (ORD); Circular Dichroism (CD).

   [8 classes]

   vi. Fundamentals of X-ray Crystallography: instrumentation and biological applications.

   [8 classes]

   vii. Principles of magnetic resonance; Nuclear Magnetic Resonance (NMR) & Electron Spin Resonance (ESR) and biological applications; Relaxation studies.

   [8 classes]

2. **Hydrodynamic Methods:** Viscosity; Sedimentation equilibrium and Velocity Centrifugation; Density Gradient method; Applications to bio-macromolecules and bio-materials.

   [6 classes]

3. **Chromatography:** Partition and Absorption Chromatography; Paper and thin layer chromatography, gel filtration; Ion-exchange and affinity chromatography; GLC, HPLC and FPLC; Emerging trends in chromatography.

   [6 classes]

4. **Electrophoresis:** Behavior of bio-macromolecules in electric fields; Types of electrophoresis; PAGE; Agarose Gel Electrophoresis; 2D Electrophoresis; Dialectrophoresis.

[4 classes]

5. **Radioactive Methods:** Radioactive isotopes; Nature of radioactive decay; sample preparation and counting; G.M. and Scintillation counters; Precautions in radio isotope handling; Autoradiography and its biological applications.

[4 classes]

6. **Emerging topics in Biophysical methods.**

[2 classes]

Suggested Books:

1. Physical Biochemistry. David Freifelder, (1984), W.H. Freeman & Co.
2. Biological Spectroscopy. L.D. Cambell & R. Dwek (1984), Benjamin-Cumming Pub. Co.
3. Biophysical Chemistry. C. Cantor & P. Schimmel (1980), W.H. Freeman & Co.

Evaluation:

1. 50% on written test.
2. 25% on term papers/ periodic evaluation.
3. 25% on Seminar presentation/ discussions.

Department of Biophysics, UDSC

Course Title: Information Processing and the Brain

Teacher: Dr. Subhendu Ghosh

Preamble:

In recent years there has been a lot of exchange of knowledge among neurobiology, computer science/ informatics, physics, mathematics, psychology/ behavioral science and other disciplines. This has not only enriched Brain Science, but also took it beyond the typical boundaries of biology. Keeping in view these developments in Brain research the present course has been designed in order to keep the students up to date about the interfaces of the above-mentioned disciplines. This is a course, which comes under the category of Cognitive Neuroscience, a true interdisciplinary in nature.

Syllabus:

1. **Electrical behavior of the biological membrane**: Model membranes; Biological membranes and Dynamics; Membrane Capacitance; Transport across cell and organelle membranes; Ion Channels; Experimental methods to study Ion Channels.

   [16 classes]

2. **Nervous System:** Introduction to Nervous system; Neurons; Glial cells; Sensory Receptors and perception; Chemical and Electrical synapses.

   [10 classes]

3. **Computability:** Origin of the concept of computability; Turing machines; Logic circuits; principles of functioning of a computer.

   [4 classes]

4. **Synaptic Transmission:** Physicochemical principles; Resting potential; Action Potential; Membrane theory of action potential; Hodgkin Huxley's (HH) model; Mathematical solutions of H-H equations.

   [10 classes]

5. **Models of Neurons & Action Potential:** Artificial neurons; FHN and other models; Physiological neuronal network versus artificial neural network.

   [10 classes]

6. **Neural Basis of Cognition and Behavior:** Principles of learning & memory; Cellular mechanism of learning & memory and comparison with machine learning; Animal behavior.

   [10 classes]

7. **Intrinsic or Non-Synaptic Plasticity:** The phenomenon and its importance; the role of various Ion Channels.

   [2 classes]

8. Open discussions on the interface of artificial neural net and the brain.

   [2 classes]

Suggested Books:

1. Scott, A. (2002) Neuroscience: A Mathematical Primer, Springer
2. Churchland, P.S. & Sejnowski, T.J. (1999). The Computational Brain, MIT Press.
3. Nelson, P. C. (2004). Biological Physics, W.H. Freeman & Co., Chapter 12.
4. Gazzaniga, M.S. et al. (2002). Cognitive Neuroscience: The Biology of the Mind, W.W. Norton & Co.
5. Rosenzweig et.al. (2005). Biological Psychology, Sinauer Associates, Inc.
6. Kendel, (2002). Principles of Neural Science.
7. Lytton, W.W. (2002). From Computers to Brain, Springer.
8. Haken, H. (2002). Brain Dynamics, Springer.
9. Kluwe, R.H. et al. (2003). Birkhauser.
10. Landau, L.J. & Taylor, J.G. (1998) Concepts for Neural Networks, Springer.

Evaluation:

1. 50% on written test.
2. 25% on term papers/ periodic evaluation.
3. 25% on Seminar presentation/ discussions.

Department of Biophysics, UDSC

Course Title: Computer Applications in Biology

Teachers: Drs. Manisha Goel & Manish Kumar

Preamble:

Modern biological data generation and interpretation can't be done without use of computational tools. Further the large amount of data from the genome projects has necessitated establishment of computer databases that feature rapid assimilation, usable formats and algorithm software programs for efficient management and interpretation of biological data. This has given rise to an interdisciplinary field, popularly known as 'Bioinformatics', which harnesses computer science, mathematics, physics, and biology. This paper will introduce different biological databases and analysis tools used for this purpose.

Syllabus:

Section 1: Sequence analysis

1. **Biological Databases:** Introduction; Types of databases in terms of biological information content; Protein and gene information resources. Specialized genomic resources.

[4 classes]

2. **Sequence Formats:** Different formats of molecular biology data.

[4 classes]

3. **Sequence Alignment:** Methods and algorithms of pairwise and multiple sequence alignment; Global and local alignment; Alignment scoring matrices; Database similarity searching; Different approaches of motif detection; Concept and use of protein families.

[4 classes]

4. **Notion of homology:** Concept of orthology, paralogy and homology in gene and protein sequences.

[4 classes]

5. **Molecular Phylogenetics:** Methods and tools for phylogenetic analysis; Creation evaluation and interpretation of evolutionary trees; Advantages and disadvantages of phenetic and cladistic approaches.

[8 classes]

6. **Genomics and Gene Annotation:** Organization and structure of prokaryotic and eukaryotic genomes; Genome annotation and databases; Automated in-silico methods of finding gene and relevant features.

[8 classes]

Section 2: Structural Bioinformatics

1. **Protein Structure:** Amino acid properties; Levels of Protein structure; General properties and characteristics.

[2 classes]

2. **Structure Determination Methods:**

i. ***X-ray Crystallography:*** Crystallography as microscopy, Principles and techniques of macromolecular crystallization, data collection, structure solution and refinement methods; Validation of structures.

ii. ***NMR:*** Principles of nuclear spin and magnetic resonance, biological applications.

[4 classes]

3. **Protein Structure Databases:** Understanding structures from Protein Data Bank (PDB); Accessing and mining other protein structure classification databases such as SCOP, CATH.

[4 classes]

4. **Molecular Visualization:** Tools for viewing and interpreting macromolecular structures.

[2 classes]

5. **Protein Secondary Structure Prediction:** *Ab-initio* and homology based methods.

[2 classes]

6. **Protein Structure Comparison:** Various algorithms and programs for superimposition of structures; RMSD calculations, multiple structure alignment methods such as DALI and VAST.

[4 classes]

7. **Basics of Molecular Modeling:** Basic principles of tertiary structure prediction, Homology modeling.

[4 classes]

8. **Advanced Methods of Protein Structure Prediction:** Threading and *ab-initio* protein structure prediction.

[4 classes]

9. **Inferring Function from Protein Structure:** Using evolutionary information; Gene neighbor-hood; Phylogenetic profiles; Gene fusion; Catalytic templates; Prediction and analysis of binding cavities for function prediction.

[6 classes]

Suggested Readings:

1. Introduction to Computational Biology: An Evolutionary Approach, By Haubold & Wiele, Springer International Edition.
2. Introduction to Bioinformatics, A. Lesk. OUP- India. Essential Bioinformatics by Jin Xiong, Cambridge University Press.
3. Statistical methods in Bioinformatics: An introduction by W. Ewens and G.R. Grant Springer-Verlag.
4. Bioinformatics: Sequence and genome analysis, by David mount, 2nd edition. Cold Spring Harbor lab press.
5. Bioinformatics: A practical guide to the analysis of genes & proteins. Edited by Baxevanis & Outlette, John Wiley & sons, inc. publication.
6. An Introduction to Protein Informatics by Karl-Heinz Zimmermann, Springer International Edition. Fundamental Concepts of Bioinformatics by Krane, Pearson Education.
7. Discovering Genomics, Proteomics and Bioinformatics, 2nd ed. by Campbell Pearson Education.

8. Structural bioinformatics: an algorithmic approach. F. J. Burkowski. Chapman & Hall/CRC, 2009.
9. Structural Bioinformatics, 2nd Edition, Jenny Gu (Editor), Philip E. Bourne (Editor), Wiley-Blackwell.

Evaluation:

1. 100% on written test.

Department of Biophysics, UDSC

Course Title: Omics Biology

Teachers: Drs. Manisha Goel & Manish Kumar

Department: Biophysics, UDSC

Preamble:

In the last decade, a revolution has taken place in the way in which biological research has been pursued. These developments have enabled us to cast the hypothesis in a system wide approach and do the experiments in a high-throughput manner to accept or reject the hypothesis. Most high-throughput methods result in generation of large amount of data (the so called 'Big Data'). The large amount of data is not only difficult to handle but also more difficult to analyze. Keeping these developments in view, the course curriculum for 'OMICS Biology' has been prepared. The new course curriculum shall provide ample opportunity to the students to expose themselves to the latest happenings in the biological research. The course will provide an overview of the important concepts of different topics of high throughput techniques, their advantages and disadvantages and also the interpretation and analysis of result.

Syllabus:

Section 1:

1. **Proteomics:** Application of mass spectroscopy for identification of proteins; Conformational variants of proteins; Structural and functional implications of post-translation modifications; Intrinsic protein disorder; Protein motion and simulation; Current developments and recent progress.

[8 classes]

2. **Structural Genomics:** Aims and need; High throughput methods of structure determination; Inferring function from structure; Methods to detect positive selection in genes; Structure-function implications of type-I and type-II functional divergence signals in proteins; Protein engineering; current developments.

[8 classes]

3. **Macromolecular Interactions:** Prediction, analysis and comparison of interaction of proteins with DNA, small ligands and other proteins; Methods and applications of docking approaches; Current developments.

[8 classes]

4. **High-throughput Lead Screening:** Different approaches to drug designing; High-throughput vs. rational drug designing; Target identification and validation; Analyzing the active site of a target, scoring & lead optimization; Objective and concept of QSAR, Current developments.

[8 classes]

Section 2:

1. **High Throughput Genomic Sequencing:** 1000 Genome Projects; ENCODE; NGS vs conventional sequencing; Different file formats; Basic concepts of computing sequencing data in terms of algorithm and data structure; Metagenomics of microbial communities; Current developments.

[8 classes]

2. **Metabolomics:** Introduction to spectroscopic analytical platforms (MS & NMR) commonly used in metabolic profiling; Metabolomics standards and databases e.g. KEGG, BioCyc, MetExplore and Cytoscape for metabolic pathway and network analysis; Current developments.

[8 classes]

3. **Large Scale Gene Expression Analysis (Microarray, Transcriptomics):** Data preprocessing and normalization; Identification of differential genes (including methods suitable for NGS data analysis); Clustering, down-stream enrichment analyses; Current developments.

[8 classes]

4. **Genome-wide Association Studies (GWAS):** Introduction and need of GWAS; Study design at marker, gender and subject levels; Progress and promises of GWAS; Current developments.

[8 classes]

Suggested Readings:

1. Microarray Bioinformatics by Dov Stekel, published by Cambridge University Press.
2. Structural Bioinformatics, 2nd Edition, Jenny Gu (Editor), Philip E. Bourne (Editor), Wiley-Blackwell.
3. Salzberg SL. Nucleic Acids Res. 2001 Mar 1;29 (5): 1185-90. 8. Resources for Small Regulatory RNAs.
4. George W.Bell, Fran lewitter. Current Protocols in Molecular Biology. Unit Number: UNIT 19.8 DOI: 10.1002/0471142727. mb 1908s87.
5. Additional reading materials will be provided with each class.

Evaluation:

1. 100% on written test.

Department of Biophysics, UDSC

Course Title: Research Methodology

Teachers: Drs. Manisha Goel & Manish Kumar

Preamble:

The main purpose of this course is to introduce students to quantitative and qualitative methods for conducting meaningful inquiry and research. They will gain an overview of research intent and design, methodology and technique, format and presentation, data management and analysis, commonly used statistical methods, ethical, IPR and other relevant issues. These topics will develop each student's ability to become more effective, efficient and aware about the way they should conduct their research activities.

Syllabus:

1. **Research Methodology:** What is a research problem? Philosophy and meaning of research; Identification and definition of research problem; Survey of available literature and bibliographical research; Search and verification of facts, the analysis of evidence; truth & causation; sources of prejudice and bias; Formulation of Research problem

   [2 classes]

2. **Science in Indian context:** History and evolution of Science in India; Societal impressions of scientists and research in India; Historic milestones in modern Indian science (case studies); Current challenges.

   [2 classes]

3. **Ethical Research:** Current understanding of ethics; International code and guidelines; Historical perspectives.

   [2 classes]

4. **Plagiarism:** Concept and importance of understanding plagiarism; What is and what is not plagiarism? Methods and ways to detect and avoid plagiarism; Available tools and software to detect plagiarism.

   [6 classes]

5. **Intellectual Property Right:** Concepts and types of intellectual property; Who needs intellectual property protection? Objectives and differences among patent, copyright and trademark; Procedure for obtaining a patent; Protection against infringement; Indian and global institutions involved in IPR; Issues in patentability; Search engines for patent; IP for Bioinformatics; Types of Bioinformatics Patents.

   [6 classes]

6. **Statistical Analysis of Data:** Statistical analysis; Measures of central tendency, Measures of dispersion; Measures of association/relationship, regression and correlation analysis; Hypothesis testing (for proportion and means); Tests of significance.

   [16 classes]

7. **Basic Computer:** Introduction and working knowledge of Windows, Linux, Unix, Mac.

   [5 classes]

8. **Use of ICT in Research:** methods to search required information effectively, Reference Management Software like Zotero/Mendeley, tools for paper formatting like LaTeX/MS Office, tools for bibliography management in research papers and thesis.

   [6 classes]

9. **Research writing:** Prewriting considerations; Preparation of Manuscripts; Research paper writing, book reviews; Difference between literature review for thesis and review articles, Difference between summary and abstracts; Writing research grant proposals, referencing and citation methods/styles; Structure, language and style in the thesis; Foot–notes, diagrams, bibliographies, index, quotation and translation; Reference management software.

[6 classes]

10. **Research presentation:** Making posters; Delivering oral presentation; Conference presentations *vs* dissertation presentations.

[4 classes]

11. **Publishing Research:** Open source *vs* traditional journal publishing; Understanding of impact factors and citation index.

[3 classes]

12. **Good lab practices:** Recording data; Lab safety; Guidelines on safe use of reagents and chemicals; Bio-safety issues; Handling and disposal of chemical, radioactive and biological hazardous material; Computer lab safety rules.

[6 classes]

Suggested Readings:

1. The analysis of Biological Data. Michael Whitlock, Dolph Schluter. Roberts and Company Publishers.
2. Study material will be provided with each topic.

Evaluation:

1. 50% Written Examination
2. 25% Term paper submission
3. 25% Discussion and presentation of Term paper