Course Structure
of
PhD Program
in
Biosciences & Biomedical Engineering
(BSBE)
and Syllabi of Courses

Course Structure for PhD program in Biosciences and Biomedical engineering

(w.e.f. AY 2013-14)

(A) Semester-I (Autumn / Spring)

Sr. No.	Course code	Course Name	L-T-P-Credits
1	ZZ xxx	Elective-I	x-x-x-3
2	ZZ xxx	Elective-II	x-x-x-3
3	ZZ xxx	Elective- III	x-x-x-3
4	BSE 797 / BSE 798*	Ph.D. Seminar Course	0-2-0-2

(B) Semester-II (spring / autumn)

Sr. No.	Course code	Course Name	L-T-P-Credits
1	ZZ xxx	Elective-IV	x-x-x-3
2	ZZ xxx	Elective-V	x-x-x-3
4	BSE 798 / BSE 797*	Ph.D. Seminar Course	0-2-0-2

NOTE:

1. A PhD student having **MTech/ME//MPhil** qualification has to do one semester coursework (with 2-3 PhD level courses). Minimum number of courses will be 2 PhD level courses and one PhD seminar course i.e. *(minimum coursework of 8 credits)*.
2. A PhD student having **MSc/ BTech/ BE** or equivalent qualification has to do 5 to 7 PhD level courses of at least 3 credits each and 1-2 PhD seminar courses of at least 2 credits each. Minimum number of courses will be 5 PhD level courses and one PhD seminar course *(minimum coursework of 17 credits).*

* PhD Seminar course can be taken either in Autumn or in Spring Semester or both as suggested by the Faculty Advisor/Thesis Supervisor.

Courses for the Electives-I to VI (In addition to this course list, a student can also opt from the PG courses being offered by other disciplines.)

S. No.	Course Code	Course Name	L-T-P-Credits
1.	BSE 601	Advanced molecular Biology	2-1-0-3
2.	BSE 602	Modern NMR Spectroscopy	1-2-0-3
3.	BSE 603	Analytical Biochemistry	2-1-0-3
4.	BSE 604/ BSE 404	Biomedical Imaging	2-1-0-3
5.	BSE 605/ BSE 405	Molercular Biophysics	2-1-0-3
6.	BSE 606	Molecular Virology and Viral Pathogenesis	2-1-0-3
7.	BSE 607	Bioremediation: Principles & Practices	2-1-0-3
8.	BSE 608	Advanced Drug Delivery Systems	2-1-0-3
9.	BSE 702	Applied Genetic Engineering	2-1-0-3
10.	CH 704	Chemistry at Surfaces and Interfaces	2-1-0-3
11.	CH 706	Photochemistry	2-1-0-3
12.	CH 711	Bio-organic and Medicinal Chemistry	2-1-0-3
13.	CH 720	Asymmetric Synthesis	2-1-0-3
14.	MA 706	Numerical Linear Algebra	2-1-0-3
15.	PH 650	Numerical Methods	2-1-0-3
16.	PH 781	Theory of complex systems	2-0-2-3
17.	HS 671	Human Factors and Higher Cognitive Processes	2-0-2-3
18.	EE 619 / EE 419	Biomedical Optics	2-1-0-3
19.	EE 701	Time frequency analysis	2-1-0-3
20.	ME 607 / ME 407	Biofluid Mechanics	2-1-0-3
21.	ME 418 / ME 618	Computational Fluid Dynamics	2-1-0-3

1.	Course Code	**BSE 601**
2.	Title of the Course	**Advanced Molecular Biology**
3.	Credit Structure	L-T-P-C 2-1-0-3
4.	Name of the Concerned Discipline	Biosciences and Biomedical Engineering
5.	Pre–requisite, if any	Basic knowledge of biology
6.	Scope of the Objective	The course will give an overview of advances and recent discoveries in the area of Molecular Biology, in addition to fundamentals in the area.
7.	Course Syllabus	Structure of genetic material, Central dogma; Replication: eukaryotic and prokaryotic replication, mechanism and control, Nucleosomes: eukaryotic and prokaryotic genome packing, heterochromatin, euchromatin; Transcription: mechanism of RNA transcription in prokaryotes and eukaryotes; model systems of transcriptional control: lac operon, lambda phage; promoters, enhancers, repressors; antitermination and attenuation; post-transcriptional regulation and RNA processing: processing of heterogeneous nuclear RNA: splicing, capping, polyadenylation; Translation: universal genetic code, degeneracy of codons, mechanisms of initiation, elongation and termination of translation, wobble hypothesis, genetic code in mitochondria; Mutations: nonsense, missense, frameshift and point mutations; suppression; DNA repair: photoreactivation, excision, mismatch and SOS repair; Recombination: mechanism of homologous recombination in prokaryotes, site specific recombination, insertion sequences, transposons; Epigenetics, DNA methylation, chromatin modification and gene regulation.
8.	Suggested Books	**Text Books** 1. Robert F., Weaver, Molecular Biology, 4th ed., McGraw-Hill, 2003. [ISBN-10: 0071275487 | ISBN-13: 978-0071275484] 2. B. Lewin., Genes IX. 9th ed., Jones and Bartlett Publishers, 2007. [ISBN-10: 0763740632 | ISBN-13: 978-0763740634] 3. H.Lodish et al., Molecular Cell Biology. 6th ed., W.H.Freeman, 2007. [ISBN-10: 0716776014 | ISBN-13: 978-0716776017] **Reference Books or Journals** 4. Alberts et al., Molecular Biology of the Cell, 4th ed., Garland Publishing, Inc., 2002. 5. Tropp B.E., Molecular Biology: Genes to Proteins, 3rd ed., Jones & Bartlett Publishers, 2007 [ISBN-10: 0763709166 ISBN-13: 978-0763709167 6. Selected articles from the journal Nature, Science, Cell, etc.

1.	Course Code	**BSE 602**
2.	Title of theCourse	**Modern NMR Spectroscopy**
3.	Credit Structure	L-T-P-C 1-2-0-3
4.	Nameof theConcerned Discipline	Biosciences and Biomedical Engineering
5.	Pre–requisite, if any	None
6.	Scope of the Objective	This course intends to give an overview of fundamentals and advances in the area of NMR Spectroscopy which relates to **structure biology**.
7.	Course Syllabus	NMR phenomenon; parameters; chemical shifts; spin-spin coupling; Bloch equation; the rotating frame of References; pulses; free induction decay; Fourier transform; signal to noise ratio; signal averaging; sampling; spin echoes; measuring T1 and T2; application to biology; ^{13}C NMR; gated decoupling; assignments; DEPT; heteronuclear correlation; nuclear Overhauser effect; steady state NOE; transient NOE; internuclear distances; applications to biomolecular structure determination; multiple-pulse NMR; polarisation transfer; One, Two and multi-dimensional experiments; COSY; TOCSY; NOESY; ROESY; chemical exchange; application to Biological molecules: proteins; nucleic acid and sugars etc. NMR of biologically relevant nuclei. NMR in Bio-medicine: MRI and fMRI; NMR in Metabolomics
8.	Suggested Books	**Text Books** 1. Edwin D. Becker; High Resolution NMR. Academic Press, 1968. 2. J. K. M. Sanders and B. K. Hunters; Modern NMR Spectroscopy. Oxford Univ. Press, 1987 3. E. Derome; Modern NMR Techniques for Chemistry Research. Pergamon Press, 1987. 4. K.Wuthrich; NMR of Proteins and Nucleic Acids. Wiley-Interscience, 1986. 5. KVR Chary & G. Govil; NMR in Biological System, Springer, 2008. **Reference from Journals/Book** 1. Teng Quincy; Structural Biology: Practical NMR Applications, Springer, 2010 2. B. D. Nageswara Rao, Marvin D. Kemple; NMR as a structural tool for macromolecules: current status and future directions; Plenum Press, 1996 3. David G. Gadian; NMR and its applications to living systems, Oxford science publications, 2008 4. Selected articles from the journal Nature, Science, Cell, etc.

1.	Course Code	**BSE 603**
2.	Title of the Course	**Analytical Biochemistry**
3.	Credit Structure	L-T-P-C 2-1-0-3
4.	Name of the Concerned Discipline	Biosciences and Biomedical Engineering
5.	Pre–requisite, if any	Nil
6.	Scope of the Objective	This course intends to give knowledge about the analytical techniques which used to be carried out in regular practices during research work.
7.	Course Syllabus	**Spectroscopy Techniques:** Buffers; Methods of cell disintegration; Enzyme assays and controls; Detergents and membrane proteins; Dialysis, Ultrafiltration and other membrane techniques, UV- Visible and Fluorescence Spectroscopy; Theory and application of Circular Dichroism; MS, NMR. **Chromatography Techniques:** TLC and Paper chromatography; Chromatographic methods for macromolecule separation – Gel permeation, Ion exchange, Hydrophobic, Reverse-phase and Affinity chromatography; HPLC and FPLC; Criteria of protein purity **Electrophoretic techniques:** Theory and application of Polyacrylamide and Agarose gel electrophoresis; Capillary electrophoresis; IEF & 2D Electrophoresis; Disc gel electrophoresis; Gradient electrophoresis; Pulsed field gel electrophoresis (PFGE) **Centrifugation:** Basic principles; Mathematics & theory (RCF, Sedimentation coefficient etc); Types of centrifuge - Micro centrifuge, High speed & Ultracentrifuges; Preparative centrifugation; Differential & density gradient centrifugation; Applications (Isolation of cell components); Analytical centrifugation; Determination of molecular weight by sedimentation velocity & sedimentation equilibrium methods **Advanced Techniques:** Protein crystallization; Theory and methods; API-electrospray and MALDI-TOF; Mass spectrometry; Enzyme and cell immobilization techniques; DNA & Peptide Synthesis and sequencing.
8.	Suggested Books	**Text Books** 1. D. Holme & H. Peck; Analytical Biochemistry. Longman, 1983. 2. T.G. Cooper; The Tools of Biochemistry. Wiley Intersciences, 1977. 3. R. Scopes; Protein Purification - Principles & Practices. Springer Verlag, 1982. 4. R.C. Price, Proteins. Lafbax Academic Press 1996. 5. Freifelder D., Physical Biochemistry, Application to Biochemistry and Molecular Biology, 2nd Edition, W.H.Freeman & Company, San Fransisco, 1982 6. Keith Wilson and John Walker, Principles and Techniques of Practical Biochemistry, 5th Edition, Cambridge University Press, 2000. **References** 1. D. Holme & H. Peck, Analytical Biochemistry, 3rd Edition, Longman, 1998. 2. R. Scopes, Protein Purification - Principles & Practices, 3rd Edition, Springer Verlag 1994. 3. Selected readings from Methods in Enzymology, Academic Press.

1.	Course Code	**BSE 604 / IBSE 404**
2.	Title of the Course	**Biomedical Imaging**
3.	Credit Structure	L-T-P-Credits 2-1-0-3
4.	Name of the Concerned Discipline	Biosciences and Biomedical Engineering
5.	Pre–requisite, if any	None
6.	Scope of the Course	This course will give a comprehensive introduction to the fundamental and major aspects of biomedical imaging systems used currently. The fundamental physics and engineering of each imaging modality will be discussed.
7.	Course Syllabus	Radiation and interaction with matter, principle of diagnostic biomedical optical imaging. Radiation dosimetry, risk and protection. Radiography, mammography and fluoroscopy. Principle of ultrasound imaging and current status. Image analysis, image processing, image reconstruction theory, computed tomography system. Magnetic Resonance Imaging (MRI): principle of nuclear magnetic resonance, MR imaging, functional MR imaging, application of MR imaging. Single Photon Emission Computed Tomography (SPECT) principle, Positron Emission Tomography (PET).
8.	Suggested Books	**Text / Reference Books** 1. J. T. Bushberg et al, The essential physics of medical imaging, 2nd edition. [ISBN-10: 0683301187 | ISBN-13: 978-0683301182] 2. Richard R. Carlton, Principle of radiographic imaging: An art and a science. [ISBN-10: 1439058725 | ISBN-13: 978-1439058725] 3. James G. Fujimoto and Daniel Farkas, Biomedical optical imaging, 1st edition. [ISBN-10: 0195150449] 4. Andrew G. Webb, Introduction to biomedical imaging, 1st edition. [ISBN-10: 0471237663 | ISBN-13: 978-0471237662]

1.	Course Code	**BSE 605 / BSE 405**
2.	Title of the Course	**Molecular Biophysics**
3.	Credit Structure	L-T-P-Credits 2-1-0-3
4.	Name of the Concerned Discipline	Biosciences and Biomedical Engineering
5.	Pre–requisite, if any	None
6.	Scope of the Course	This course is designed to teach the basics of Physics, sufficient for BSBE graduate students. The fundamental physics of Biological phenomena will be discussed. It will also prepare students to learn and apply biophysical approaches to understand biochemical, biotechnological and medical problems.
7.	Course Syllabus	Origin and evaluation of life. Discussion about various stages of evolution. Single cell machinery to multi-cellular organs. Structure of biomolecules. Elements of building blocks for macromolecules. Weaker interatomic interactions. Hydrogen bond and hydrophobic interactions. Amphiphilic molecular behavior in aqueous environments. Structures and physics of amino acids and proteins. Conformational transitions of proteins (folding and unfolding of proteins), Ramachandran plot. Physics of nucleic acid, membranes and membrane physics. Dynamics of biomolecules: diffusion, vibrations versus conformational transitions. Interaction of biomolecules with electromagnetic radiation. General characteristic of a cell. Cytoskeletal organizations and constituents molecules and their mechanism. Ion channels and ion pumps, osmotic pressure of cells. Cellular energetics: chloroplast and mitochondria. Cells as thermodynamic machines. Active transport. Bioelectricity, heart dynamics, anatomy of nerve cells, conducting properties of neurons. Structure and function of synapse.
8.	Suggested Books	**Text / Reference Books** 1. Philip Nelson, Biological Physics, 1st edition. [ISBN-10: 0716798972 | ISBN-13: 978-0716798972] 2. William Bialik, Biophysics: Searching for Principles. [ISBN-10: 0691138915 | ISBN-13: 978-0691138916] 3. Jack Tuszynski, Michal Kurzynski, Introduction to Molecular Biophysics. [ISBN-10: 0849300398 | ISBN-13: 978-0849300394] CRC Series in Pure and Applied Physics. 4. Charles R. Cantor and Paul R. Schimmel, Biophysical Chemistry, Part I: The conformation of biological macromolecules (Their Biophysical Chemistry), 1st edition. [ISBN-10: 0716711885 | ISBN-13: 978-0716711889] 5. Charles R. Cantor and Paul R. Schimmel, Biophysical Chemistry, Part 2: Techniques for the study of biological structure and function, 1st edition. [ISBN-10: 0716711907 | ISBN-13: 978-0716711902] 6. Charles R. Cantor and Paul R. Schimmel, Biophysical Chemistry, Part 3: The behavior of biological macromolecules, 1st edition. [ISBN-10: 0716711923 | ISBN-13: 978-0716711926]

1.	**Course Code**	**BSE 606**
2.	**Title of the Course**	**Molecular Virology and Viral Pathogenesis**
3.	Credit Structure	L-T-P-C 2-1-0-3
4.	Name of the Discipline	Biosciences and Biomedical Engineering
5.	Pre–requisite, if any	Basic Biology and Basic Biochemistry (Undergraduate level).
6.	Scope of the Course	The course is designed to provide graduate students a broad background view on virus history, classification, structure, life cycle, virus-host interactions. The course is designed primarily in the context of animal virology. There will be emphasis on viral reverse genetics in designing successful vaccines. The course further aims provide a brief career road map to the students to become a successful virologist.
7.	Course Syllabus	Virus history: Discovery of viruses, Major viral epidemics in human history (Eg. Influenza, HIV, Polio, SARS, Ebola), Milestones in virology research, Emerging infectious viral diseases. Virus classifications. Nano life: A quick view on virus structure and classification: General characteristics of viruses, diversity, shapes, sizes, and components of genomes. Virus life cycle in host cell. Assembly and packaging of virus particles. Strategies how virus packages its genome and exits the living cell. Virus-host interaction: Concepts of co-evolution of viruses and humans. Virus entry, replication. Consequences of virus infection. Mechanisms to invade host defense. Strategies on counter attack. Overview on anti-viral therapy. Reverse Genetics: Reverse genetics in virology: Generation of recombinant virus from cDNA. Focus on negative strand RNA viruses recovery and genome manipulations. Customizing and designing viral vaccine candidates through reverse genetics. Virotherapy: Use of viruses for treatment of diseases. Creating oncolytic virus for cancer treatment. Gene therapy through viral vector mediated gene expression. Viral Immunotherapy: Principles and implications.

8.	Suggested Books	Reference Books 1. B. Fields. Fields virology. Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins Health, 2013. ISBN-13: 978-0781702539, ISBN-10: 0781702534 2. N. Acheson. Fundamentals of molecular virology. Hoboken NJ: John Wiley & Sons, 2011. ISBN-13: 978-0470900598, ISBN-10: 0470900598 3. A. Cann. Principles of molecular virology. Amsterdam: Elsevier Academic Press, 2012. ISBN-13: 978-0123849397, ISBN-10: 012384939X 4. N. Maclachlan. Fenner's veterinary virology. Amsterdam: Elsevier Academic Press, 2010. ISBN-13: 978-0123751584, ISBN-10: 0123751586 5. L. Norkin. Virology : molecular biology and pathogenesis. Washington DC: ASM Press, 2009. ISBN-13: 978-1555814533, ISBN-10: 1555814530. Journal Reference: Journal of Virology: Published by American Society of Microbiology, USA.

1	**Course Code**	**BSE- 607**
2	**Course Title**	**Bioremediation: Principles & Practices**
3	Credit Structure	L-T-P-Credits 2-1-0-3
4	Name of the Concerned Discipline	Biosciences and Biomedical Engineering
5	Pre-requisite, if any	Basic knowledge of biology
6	Scope of the course	This course is designed to introduce students to basic principles of biotechnology to address environmental pollution issues. In addition, this course gives latest applications and development of biotechnology for environmental remediation to simulate students' interest in environmental sustainability.
7	Course Syllabus	Status and scope of biotechnology in environmental protection and management. **Bioremediation:** Introduction, Current bioremediation practices and applications, Factors affecting the process of bioremediation (Environmental, Physical and Chemical factors). **Bioremediation systems, processes and types:** Solid, Liquid and Slurry phase bioremediation; Bioaugmentation and Biostimulation of microbial activities; Microbial systems of bioremediation; Phytoremediation and Root zone treatment; Bioremediation of toxic metal ions, Volatile Organic Compounds (VOCs), Oil spills. **Wastewater treatment:** Sources and classification of water pollutants, Principles of biological treatment, Aerobic and anaerobic biological wastewater treatment systems. **Bioreactors**: Rotating Biological Contactors, Fluidized Bed Reactors, Inverse Fluidized Bed Biofilm Reactor, Membrane Bioreactor, High Rate Algal Ponds, Upflow Anaerobic Sludge Blanket Reactor. **Future perspectives**: Scope and Development of environmentally friendly processes. **Field visit**: Sewage treatment plant/Industrial effluent treatment plant for practical exposure.
8	Suggested Readings	1. Metcalf and Eddy, **Wastewater Engineering: Treatment and Resources Recovery,** Fifth Edition, McGraw Hill Companies Inc., 2013 (ISBN-10: 0073401188 / ISBN-13: 978-0073401188). 2. M. J. Hammer, **Water and wastewater technology,** Seventh Edition, Prentice Hall, 2011 (ISBN-10: 0135114047 / ISBN-13: 978-0135114049). 3. N. F. Gray, **Biology of Wastewater Treatment,** Second Edition, Oxford University Press, 2004 (ISBN 10: 1860943322 / ISBN 13: 9781860943324). 4. I. L. Pepper, C. P. Gerba, T. J. Gentry, R. M. Maier, **Environmental Microbiology,** Second Edition, Academic Press, 2009 (ISBN-10: 0123705193 / ISBN-13: 978-0123705198). 5. Selected articles from Journal Nature Biotechnology, Hazardous Materials, Biodeterioration and Biodegradation, Desalination etc.

1.	Course Code	**BSE 608**
2.	Title of the course	**Advanced Drug Delivery Systems**
3.	Credit Structure	L-T-P-Credits 2-1-0-3
4.	Name of the Department	Biosciences and Biomedical Engineering
5.	Pre–requisite, if any	Basic Biology
6.	Scope of the course	The course will cover newer advances in drug delivery systems and recent trends for development characterization and applications of delivery systems to solve healthcare problems
7.	Course Syllabus	**Introduction to drug delivery systems**, Controlled release systems, Influence of drug properties and routes of drug administration on the delivery **Oral controlled drug delivery** systems and their mechanisms, Examples and Case Studies **Controlled drug delivery systems:** Micro-particles, liposomes, niosomes, polymeric nanoparticles, solid lipid nanoparticles, carbon nanotubes, implants etc., Examples and Case Studies **Transdermal drug delivery systems:** Principles of skin permeation, Factors affecting percutaneous absorption of drugs, Development and evaluation of transdermal devices, Examples and Case Studies **Targeted drug delivery systems:** active and passive targeting, Enhanced permeation and Retention (EPR) effect, receptor mediated endocytosis, prodrug based drug targeting, brain targeting, tumour targeting. Examples and Case Studies
8.	Suggested Reading	1. P.V. Devarajan, S. Jain, Targeted Drug Delivery: Concepts and Design, Springer International Publishing Switzerland, 2015, [ISBN: 978-3-319-11355-5] 2. J. R. Robinson, V. H. L. Lee, Controlled Drug Delivery: Fundamentals and Applications. Taylor and Francis UK, 1987, [ISBN: 978-0824775889] 3. J. Siepmann, R. A. Siegel, M. J. Rathbone, **Fundamentals and Applications of Controlled Release Drug Delivery, Springer Switzerland,** 2012, **[**ISBN 978-1-4614-0880-2] 4. A. S. Narang, R. I. Mahato Targeted Delivery of Small and Macromolecular Drugs, CRC Press USA, 2010, [ISBN: 9781420087727] 5. C. A. Lorenzo, A. Concheiro, Smart Materials for Drug Delivery, RSC Publishing UK, 2013, [ISBN: 978-1-84973-552-0] 6. Selected articles from journals like Journal of Controlled Release, International Journal of Pharmaceutics, Journal of Pharmaceutical Sciences etc.

1.	Course Code	**BSE 702**
2.	Title of the Course	**Applied Genetic Engineering**
3.	Credit Structure	L-T-P-C 2-1-0-3
4.	Name of the Concerned Discipline	Biosciences and Biomedical Engineering
5.	Pre–requisite, if any	Basic knowledge of molecular biology
6.	Scope of the Course	The course is intended to give students an overview of various genetic engineering techniques and its applications.
7.	Course Syllabus	Concept of recombinant DNA technology and purpose, basic methodology, use of plasmids, restriction endonucleases, linkers, adaptors, ligation; Transformation, methods in screening recombinant DNA; methods for labelling DNA, modifying enzymes, hybridization techniques: northern, Southern and colony hybridization; Restriction maps and mapping techniques; PCR technology, primer design; Construction of cDNA libraries in plasmids, Gene amplification, RT-PCR and quantitative RT-PCR; Strategies for maximizing gene expression, prokaryote expression vectors and their applications in expression, quantitation, purification; Inclusion bodies, approaches to solubilisation; Cloning in M13 mp vectors, application to DNA sequencing, site-directed mutagenesis; PCR-based mutations; Vectors: cosmid vectors, yeast artificial chromosome; selection and screening recombinant phage, in vitro packaging, genomic libraries and cDNA cloning; principles and application of di-hybrid systems; Cloning and expression in mammalian cells, methods of selection and screening, application of reporter genes; Applications in mammalian genetic engineering, Biopharmaceuticals, Transgenics in animals and plants, restriction fragment length polymorphism, DNA fingerprinting, human genetic diseases; Gene targeting, human gene therapy, Automated DNA sequencing, Man-made antibodies, phage display; Basic principles of transcriptomics and proteomics.
8.	Suggested Books	**Text Books** 1. W. Old & Primrose; Principles of Gene Manipulation. 6th ed., S. B. University Press, 2001. [ISBN-10: 0632059540 ISBN-13: 978-0632059546] 2. T. Maniatis, E.F. Fritsch & J. Sambrook; Molecular Cloning: A Laboratory Manual. CSHL, 3rd ed., 2002. [ISBN-10: 0879695773 | ISBN-13: 978-0879695774] 3. M.A. Innis, D.H. Gelfand, J.J. Sninsky & T.J. White. PCR Protocols. Academic Press, 1990. [ISBN 0-12-372181-4] **Reference Books or Journals** 1. C Hardin, J Edwards, A Riell, D Presutti, W Miller and D Robertson; Cloning, Gene Expression and Protein Purification: Experimental procedures and process rationale. Oxford University Press, 2001. [ISBN-10: 0195132947 ISBN-13: 978-0195132946] 2. K.E. Davies et al., Genome Analysis - A Practical Approach, 1988. [ISBN-10: 1852211105 ISBN-13: 978-1852211103] 3. Selected articles from the journal Nature, Science, Cell, etc.

1.	Course Code	**BSE 797 (Autumn Semester)** **BSE 798 (Srping Semester)**
2.	Title of the Course	PhD Seminar Course
3.	Credit Structure	L-T-P-Credits 0-2-0-2
4.	Name of the Concerned Discipline	Biosciences and Biomedical Engineering
5.	Pre–requisite, if any	None
6.	Scope of the course	
7.	Course Syllabus	In this course a PhD student has to present seminar/presentation or a series of presentations on a topic(s) chosen by him/her in consultation with his/her PhD Thesis Supervisor/ Faculty Advisor. The frequency of seminar/presentation will be decided by the Course Coordinator.
8.	Textbook	None
9.	Other references	Books and research publications in various journals