

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Biosciences and Bioengineering

Subject Code: BEC-108

Course Title: Bioinformatics

L-T-P: 2-0-0

Credits: 2

Subject Area: PCC

Course Outlines:

S.No.	Particulars	Contact Hours
1.	Introduction, Databases, Data mining, Data storage and retrieval, querying in database and tools for querying-BLAST, FASTA.	4
2.	Gene finding, Hidden Markov Models (HMM), Protein sequence annotation, substitution matrices, local, global, multiple sequence alignment, clustering, prediction.	6
3.	Protein-protein and protein-ligand interaction, binding site prediction, phylogenetic tree analysis, structural database - protein structure database, homology modelling, comparison and superposition of structures	6
4.	Molecular visualization, structure comparison and alignment, searching for patterns and motifs. Evolution of protein structure and sequences by comparing different organisms.	6
5.	Docking methods, ligand design and validating data sets in structural genomics era and molecular dynamics.	6
Total		28

Suggested books:

S.No.	Name of Authors/ Books/Publishers	Year of Publication/Reprint
1.	Gusfield, D., "Algorithm on Strings, Trees and Sequences: Computer Science and Computational Biology", Cambridge University Press.	1997
2.	Arthur M. Lesk, "Introduction to Bioinformatics" Oxford University Press. (5th Edition)	2019
3.	Mount, D. W., "Bioinformatics: Sequence and Genome analysis", Cold Spring Harbor Laboratory Press. (2nd Edition)	2004
4.	Sensen C.W., "Essentials of Genomics and Bioinformatics", John Wiley and Sons	2019

INDIAN INSTITUTE OF TECHNOLOGY, ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Biosciences and Bioengineering

Subject Code: BEE-105

Course Title: Introduction to Biophotonics

L-T-P: 3-0-0

Credits: 3

Subject Area: ESC

Course Outlines:

S.No.	Particulars	Contact Hours
1.	Light – matter interaction, fundamental nature of light, Basics of structure and function of living materials, Process of light interaction with matter.	5
2.	Interaction of light with cells and tissues- Components that interact with light, light absorption in cells, light induced cellular processes, Interaction of light with tissues- absorption, scattering, tissue optical properties.	6
3.	Optical Spectroscopy: Absorption spectroscopy, Fluorescence spectroscopy, Raman spectroscopy, Infrared spectroscopy	8
4.	Fluorescence detection and quantification of nucleic acids, proteins and cells, fluorescence quenching studies, Fluorescence anisotropy, Single molecule detection, Optical activity and circular dichroism., mass spectrometry, applications in biology.	8
5.	Basic principles of lasers, Lasers relevant to biophotonics, Optical imaging, Different optical imaging techniques, confocal microscopy, Optical tomography, Spectral and time resolved imaging- fluorescence resonance energy transfer (FRET), fluorescence life time imaging (FLIM), Fluorescence Correlation Spectroscopy(FCS).	8
6.	Light for therapy and treatment, optical tweezer, laser scissor, surface Plasmon resonance biosensors, Applications of Bioimaging- endogenous and exogenous fluorophores.	7
Total		42

Suggested books:

S.No.	Name of Authors/ Books/Publishers	Year of Publication/Reprint
1.	Paras N. Prasad, "Introduction to Biophotonics" Wiley & Sons	2003
2.	Bahaa Saleh and Malvin Teich, "Fundamentals of Photonics" Wiley & Sons	2007
3.	Joseph R Lakowicz, "Principles of fluorescence spectroscopy" Springer	2006
4.	Kevin K Tsia (Ed.), "Understanding Biophotonics Fundamentals, Advances, and Applications", CRC Press, Taylor and Francis	2015
5.	Gerd Keiser, Biophotonics: Concepts to Applications, Springer	2016
6.	Splinter R, and Hooper BA, "An Introduction to Biomedical Optics" CRC Press, Taylor and Francis	2007
7.	Charles R Cantor and Schimmel, Biophysical Chemistry Part II "Techniques for the study of biological structure and function" Academic Press	1980

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**NAME OF DEPARTMENT/CENTRE/SCHOOL:** Department of Biosciences and Bioengineering**Subject Code:** BEC-104**Course Title:** Biochemistry and Biophysics**L-T-P:** 3-0-2**Credits:** 4**Subject Area:** PCC**Course Outlines:** Biomolecules; Protein structure and conformation; Ramachandran map; Energy calculations; Enzymes; Kinetics; Catalysis; Nucleic acids conformations; Stabilizing forces; Membrane equilibria; Lipids; Lipid bilayer; Metabolism of carbohydrates.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTRE/SCHOOL: Department of Biosciences and Bioengineering

Subject Code: BEC-191

Course Title: Technical Communication

L-T-P: 2-0-0

Credits: 2

Subject Area: PCC

Course Outlines: Principles of Scientific/ Technical Communication; Literature survey for information and sources for subject matter, bias and desired effect; Effective communication in a non-digital and digital way; Principles of document design and appropriate technologies in the preparing written and digital documents; Effective use of charts, graphs, and tables for effective communication for power point slides in a professional way; Answering questions, argumentation skills, cohesion and emphasis, critical thinking, competence; Think before you speak: Avoiding pitfalls; Revised and edit oral presentation in response to peer feedback.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTER/SCHOOL: Department of Biosciences and Bioengineering

Subject code: BEC-201

Course Title: Transport phenomenon in Biological system

L-T-P: 3-0-0

Credits: 3

Subject Area: PCC

Course Outlines: Physiological transport system; momentum balance; fluid kinematics; laminar and turbulent flow; Navier Stokes equation; Boundary layer; mass transfer; convective mass transfer; dimensional analysis; interphase mass transfer.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTER/SCHOOL: Department of Biosciences and Bioengineering

Subject code: BEC-203

Course Title: Cell Biology and Genetics

L-T-P: 3-0-0

Credits: 3

Subject Area: PCC

Course Outline: Introduction to Cell Science, Structural and Functional components of Cell, Cell Division and Cell Death, Introduction and history of genetics, Genetic recombination and prokaryotes and eukaryotes, Mechanism of sex determination.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTER/SCHOOL: Department of Biosciences and Bioengineering

Subject code: BEL-418

Course Title: Biotherapeutics

L-T-P: 3-1-0

Credits: 4

Subject Area: PEC

Course Outline: Molecular advances in the discovery of protein and other biomolecular drug candidates and their development into biotherapeutics. Understanding of the development of biotherapeutics, beginning with pre-clinical modelling and target identification together with antibody engineering, biochemical and biophysical characterisation, and development issues for bioprocessing.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/CENTER/SCHOOL: Department of Biosciences and Bioengineering

Subject code: BEL-457

Course Title: Plant design and Economics

L-T-P: 3-1-0

Credits: 4

Subject Area: PEC

Course Outlines: Introduction to process and plant design, General design considerations, Flowsheet synthesis and Development, Costing and Project Evaluation, Material of Construction, Equipment selection, specification and design, Separation process design and economics.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT/ CENTRE/SCHOOL: Department of Biosciences and Bioengineering

Subject Code: BEL-479

Course Title: X-Ray Crystallography

L-T-P: 3-1-0

Credits: 4

Subject Area: PEC

Course Outlines: Explore the fundamentals of X-ray crystallography, covering macromolecular crystallization principles, crystal preparation techniques, X-ray diffraction fundamentals, crystal symmetry, data collection, data processing using software packages.

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE**NAME OF DEPARTMENT/ CENTRE/SCHOOL:** Department of Biosciences and Bioengineering**Subject Code:** BEB-102**Course Title:** Biosciences for Engineers**L-T-P:** 3-1-0**Credits:** 4**Subject Area:** BSC**Course Outlines:** Essential biological principles, cellular structure, molecular machinery, cell communication, convergence of biosciences, engineering, and technology, biomimicry, microbiome applications, quantum biology.