IISER Pune - Course Content

Semester	AUG 2024
Open to Semester	5,7,11,13,21
Course Code	BI3144
Course title	Cellular Biophysics I
Nature of Course	LE - Lecture
Credit	4
Coordinator and participating faculty (if any)	**Dr. Chaitanya Athale**
Pre-requisites	Molecular and cellular biology, biochemistry and 1st year maths and physics.
Objectives	1) Feeling for size, time and energy scales in cellular biology 2) Applicability and limits of standard mechanical models (springs, rods and pendula) for cell biology 3) Applying random walk statistics to molecular biology 4) Thinking about the statistics of DNA and cytoskeletal polymers 5) Principles of mechanics of biomembranes 6) Boltzmann statistics to connect energetics with the bulk-biochemistry. 7) Experimental techniques to test the theories
Course content	Topic,No. of lectures Order of magnitude estimates and the value of quantification,2 Mechanical forces and energetics: equilibrium approach to cells,2 Mass, stiffness and the damping of proteins,1 Thermal energy and relative energy scales,3 Polymer mechanics,7 Molecular motor stepping,2 Membrane mechanics: bending and undulations ,3 Simplest models of cell shape,3 Force spectroscopy of proteins and nucleic acids,2 Cytoskeleton: Actin and microtubules,3 Motor proteins ,2 Protein diffusion, ligand-receptor binding and effect of crowding*,3 Biomembrane mechanics ,3 Cell adhesion and migration,2 Python based computational exercises that complement theoretical concepts,4

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	GoogleClassroom will be used to collate assignments and scores. Some information will also be shared on the instructor*s website.
Evaluation / Assessment	40% End-Sem Examination 20% Mid-Sem Examination 40%, Assignments, quizzes, paper reading and programming (all individual) * Missed exams will NOT be pro-rated, but require RE-EXAMINATION. Continuous assessment MAY be PRORATED IF the number of submitted assignments within deadline is equal to or greater than 75%. Else an I (incomplete) grade will be allocated. The decision of the instructor is binding.
Suggested readings	1) Philips, R., Kondev, J., Theriot, J. (2008) Physical Biology of the Cell. Garland Sciences. 2) Nelson, P. (2003) Biological Physics: Energy, Information, Life. Freeman 3) David Boal (2001) Mechanics of the Cell. Cambridge University Press. 4) Howard Jonathon (2001) Mechanics of Motor Proteins and the Cytosokeleton, Sinauer Associates 5) Roland Glaser, Biophysics, Springer Books
When Next	2025-August
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