

Semester	AUG 2022
Open to semester	5,7,11,13,21
Course code	BI3144/BI6134
Course title	Cellular Biophysics I
Credits	4 /4
Course Coordinator & participating faculty (if any)	Chaitanya Athale
Nature of Course	Lectures and Tutorials
Pre-requisites	Cell biology, First-year level of physics and biology
Objectives (goals, type of students for whom useful, outcome etc)	<ol style="list-style-type: none"> 1) Learn to applying the very successful methods of thinking from classical and statistical-mechanics in physics to unravel problems in biology at the cellular scale. 2) Understand the applicability and limits of standard results from classical mechanics (springs, rods and pendula) for biological systems. 3) The Random Walk model and its application to polymers 4) Application of polymer theory to DNA and cytoskeletal structures 5) Membrane biophysics 6) How Boltzmann statistics can be used to derive theoretical results that connect energetics with the bulk-biochemistry. 7) Discussion of the number-scales and experimental techniques related to these themes
Course contents (details of topics /sections with no. of lectures for each)	<p>Topic No. Of lectures</p> <p>Order of magnitude estimates and the value of quantification (2), Mechanical forces and energetics: equilibrium approach to cells (2)</p> <p>Mass, stiffness and the damping of proteins (1)</p> <p>Thermal energy and relative energy scales (3)</p> <p>Polymer mechanics (7)</p> <p>Molecular motor stepping (2)</p> <p>Membrane mechanics: bending and undulations (3)</p> <p>Simplest models of cell shape (3)</p> <p>Force spectroscopy of proteins and nucleic acids (2)</p> <p>Cytoskeleton: Actin and microtubules (3)</p>

	<p>Motor proteins (2) Protein diffusion, ligand-receptor binding and effect of crowding (3) Biomembrane mechanics (3) Cell adhesion and migration (2) Tutorials of computational exercises that complement theoretical concepts (4) Total Lectures 42</p>
<p>Evaluation /assessment</p>	<p>End-Sem Examination-30% Mid-Sem Examination-20% Others-50% assignments, quizzes, paper reading and presentations%</p>
<p>Suggested readings (with full list of authors, publisher, year, edn etc.)</p>	<p>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 Cytoskeleton, Sinauer Associates</p>