Updated Topic Guide for Physical Biology Module

Course BB101 is comparatively new as part of the undergraduate curriculum at IIT Bombay. This course being taught only since last two years. Unfortunately, there is no single text book which instructors can use to teach module II at the level of undergraduates. This is why instructor has to use following three different text books to teach the Module II

Reference Book 1: Physical Biology of the cell, R. Phillips, J. Kondev, J. Theriot, H. Garcia (Publisher: Garland Science)

Reference Book 2: Biological Physics, Philip Nelson (Publisher: W. H. Freeman)

Reference Book 3: Mechanics of Motor Proteins and the Cytoskeleton, Jonathan Howard (Publisher: Sinauer Associates Inc.)

Below I have listed where one can find topics discuss in lectures

---

Lecture 1

Topics: Physical Properties of a globular protein, force, Forces acting on a protein molecule, Motion of Mechanical element: Mass, spring and dashpot, Motion of combination of mechanical elements

Chapter 2 of Reference Book 3

Topic: Inertia of moving bacterium

Example 2.3 in Chapter 2 of Reference Book 3 or uploaded
"A_Kunwar_BB101_2015_2016_I_L1_Solved_Problem"

Sedimentation of a 100 kDa globular protein

See solution of Tutorial 1 problem 5 and Example 2.1 in Chapter 2 of Reference Book 3

Lecture2

Topic: Viscosity and fluid flow, Newtonian fluid, Viscous Critical Force, Reynolds number

Chapter 5 of Reference Book 2

Topic: Life at low Reynolds number, Symmetry-Breaking (natural microorganisms)

Chapter 5 of Reference Book 2

Other topics: Lecture notes are enough as some of these topics have been taught using research papers

---

Lecture 3

Topics: Relative Importance of Thermal Energy

Section 5.1.1 in Chapter 5 of Reference Book 1

Topics: Thermal motion, Thermal energy

Chapter 4 of Reference Book 3

Topics: Fick's Law, Continuity Equation, Diffusion Equation, Boltzmann's law

Chapter 4 of Reference Book 3

Other topics:

Lecture slides are enough

Lecture 4

Topics: Fick's Law, Continuity Equation, Diffusion Equation, Free diffusion from a point source

Chapter 4 of Reference Book 3

Topic: Einstein and Einstein relation

Lecture slides are enough

Topic: Conformation of polymers as random walk

Section 8.2.1 in Chapter 8 of Reference Book 1

Other topics:

Lecture slides are enough

Lecture 5

Topics: Worm Like Chain model for polymers, Bending stiffness, Energy required to bend DNA in a circle

Section 9.2.2 and 9.2.3 in Chapter 9 of Reference Book 2

Topic: Persistence Length

Section 10.2.2 in Chapter 10 of Reference Book 1

Topic: Microtubule Dynamics

Section 10.5.1 in Chapter 10 of Reference Book 1

Topics: Dynamics Instability and Microtubule Treadmilling

Section 15.4.4 in Chapter 15 of Reference Book 1

Topic: Actin Dynamics

Section 10.5.1 in Chapter 10 of Reference Book 1

Topic: Actin Treadmilling

Lecture slide is enough

Finding the cell center using microtubules?

Section 16.3.2 in Chapter 16 of Reference Book 1

Actin-based crawling of epithelial cells

Section 15.1.2 in Chapter 15 of Reference Book 1

Actin polymerization driven motility of bacteria Listeria monocytogenes

Section 15.1.2 in Chapter 15 of Reference Book 1

Measuring force exerted by microtubule

Section 16.3.2 in Chapter 16 of Reference Book 1

Measuring force exerted by actin network

Section 16.3.2 in Chapter 16 of Reference Book 1

Other topics:

Lecture slides are enough