BT 630 Physical Cell Biology (3-0-0-6)

[Open Elective]

Preamble:

This course aims to first make students understand biology in a quantitative way. This is followed by developing simple models to explain complexity in biological processes and later refining them to match reality. The focus is to enable students develop quantitative insights by using a small number of fundamental physical models as foundation that find application across a wide range of apparently unrelated biological problems.

Course contents:

Space and time inside a living cell, their scales and hierarchy; Model systems: haemoglobin, bacteriophage, *E. Coli*, yeast, fruit fly and man; Mechanical and chemical equilibrium in a living cell; Applications of entropy and statistical mechanics; Two state systems; Random walks; Protein electrostatics; Beam theory of cellular architecture; Biological membranes: springiness, shape and energetics; Hydrodynamics of water and fluid dynamics of blood; Low Reynolds number world; Diffusion in the cell; Life in the crowded and disordered environments; Rate equations in the cell; Molecular motors, biological electricity and the Hodgkin-Huxley model.

Texts/References:

1. R. Philips, J. Kondev and J. Theriot, *Physical Biology of the Cell*, 1st Edn., Garland Science, 2009.
2. P. Nelson, *Biological Physics*, 1st Edn., W. H. Freeman, 2007.
3. B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts and P. Walter, *Molecular Biology of the Cell*, 5th Edn., Garland Science, 2007.

Annexure-93/4(e) contd…