

## **SYLLABUS**

**Stability:** Continuous population models: stability, bifurcations. [Drazin, 1.3-1.5.] Hysteresis, non-dimensionalisation. Discrete models: stability, chaos. Harvesting: optimal strategies.

**Oscillations:** Lotka-Volterra model. [Jordan and Smith, 2.1-2.3.] Predator-prey systems. Limit cycles.

**Enzyme reactions:** Michaelis-Menten kinetics: pseudo-steady state hypothesis. Allosteric enzymes. Glycolysis. Glycolytic oscillations. Calcium dynamics.

**Waves:** Fisher equation. Excitable media. Signal propagation in nerve cells. Hodgkin-Huxley model.

**Pattern formation:** Reaction-diffusion. Turing instability. Spiral waves. Cardiac instability.

**Respiratory control:** The Mackey-Glass model. The Grodins model.

### **Prime Text/s:**

- 1.J.D. Murray, Mathematical biology. Springer-Verlag, 2nd ed., 1993.
- 2.F. Hoppensteadt, Mathematical theories of populations: demographics, genetics and epidemics. SIAM, Philadelphia, 1975 (reprinted 1993).
- 3.L.A. Segel, Modeling dynamic phenomena in molecular and cellular biology. C.U.P., 1984.
- 4.S.I. Rubinow, Introduction to mathematical biology. John Wiley, 1975.
- 5.A. Goldbeter, Biochemical oscillations and cellular rhythms. C.U.P., 1996.
- 6.E. Renshaw, Modelling biological populations in space and time. C.U.P., 1991.
- 7.J. Keener and J. Sneyd 1998 Mathematical physiology. Springer-Verlag.
- 8.L. Glass and M.C. Mackey 1988 From clocks to chaos. Princeton University Press.
- 9.A.C. Guyton and J. E. Hall 2000 Textbook of medical physiology, 10th ed. W. B. Saunders Co., Philadelphia.

### **Other relevant texts:**

- 1.P.G. Drazin, Nonlinear systems. C.U.P., 1992.
- 2.D.W. Jordan and P. Smith, Nonlinear ordinary differential equations, 2nd ed. O.U.P., 1987.
- 3.P. Grindrod 1991 Patterns and waves. Oxford University Press.
- 4.R.M. Berne and M.N. Levy 1996 Principles of physiology, 2nd ed. Mosby, St. Louis.
- 5.J.R. Levick 2000 An introduction to cardiovascular physiology, 3rd ed. Butterworth-Heinemann, Oxford.