**CELL SIGNALING** **CREDIT HOURS 3+0**

**LEARNING OUTCOMES:**

**Students will be able to:**

1. Describe the major mechanisms of cell-cell signaling.
2. Identify the major receptor types, their localization and function in response to the signaling molecules.
3. List the molecular events which occur within the cell in response to the major groups of signaling molecules and their overall physiological outcomes.

**COURSE CONTENTS:**

General principles of cell communication (Ligands and Receptors, Cellular Junctions and direct cell to cell communication, Specificity of ligands and receptors and signal amplification, Feedback loops), Signaling through G-Protein-Coupled receptors, Signaling through enzyme-coupled cell surface receptors (Receptor Tyrosine Kinases, Ras family of G-proteins, MAP Kinase signaling, PI3K signaling, Rho family of GTPases, JAK-STAT signaling, TGF-β superfamily), Signaling pathways dependent upon regulated proteolysis of distinct proteins (Notch Signaling, Wnt-β-Catenin, Hedgehog-Smoothened signaling, NF-κB-Dependent signaling pathway), Role of secondary messenger in signaling (Ca, Nitrous oxide, ROS), and Signaling in plants.

**RECOMMENDED BOOKS:**

1. Karp, J. H. 2016. Cell and Molecular Biology. John Willey and Sons, Inc. New York. USA.
2. Kramer, I. M., 2015. Signal Transduction. Elsevier Science, Academy Press, London.
3. Cantley, L. C., Hunter, T., Sever, R. and Thorner, J. W., 2014. Signal Transduction: Principles, Pathways, and Processes. Cold Spring Harbor Laboratory Press, New York, USA.
4. Gomperts, B. D., Kramer, I. M. and Tatham, P. E. R., 2009. Signal Transduction; Elsevier Science. Academy Press, London, UK.
5. Alberts, B., Johnson, A., Lewis, J., Morgan, D., Raff, M., Roberts, K. and Walter, P. 2014. Molecular Biology of the Cell; 6th Edition, Garland Sciences, New York, USA.
6. Wilson, J. and Hunt, T., 2014. Molecular Biology of the Cell, 6th Edition, Garland Sciences, New York, USA.
7. Marks, F., Klingm-Ùller, U. and Müller-Decker, K., 2008. Cellular signal processing: An Introduction to the Molecular Mechanisms of Signal Transduction. Garland Science, New York, USA.
8. Cooper, G. M., & Hausman, R. E. 2013. The cell: A molecular approach. Sunderland, MA: Sinauer Associates.
9. Botella, J. R., & Botella, M. A. 2016. Plant signal transduction: Methods and protocols. New York: Humana Press.