**Title: Mitosis: The Process of Cell Division**

**Course Objectives**

* Understand the stages and significance of mitosis.
* Identify key events and structures involved in the mitotic process.
* Explore the regulation of the cell cycle and the implications of mitotic errors.

**Course Outline**

**I. Introduction to Mitosis**

* A. Definition and purpose of mitosis
* B. Importance of mitosis in growth, repair, and asexual reproduction
* C. Comparison of mitosis and meiosis

**II. Overview of the Cell Cycle**

* A. Phases of the cell cycle: Interphase and M phase
* B. Interphase stages: G1, S, and G2
* C. Role of checkpoints in regulating the cell cycle

**III. Stages of Mitosis**

* A. Prophase
  + Chromatin condensation into visible chromosomes
  + Formation of the mitotic spindle
  + Breakdown of the nuclear envelope
* B. Metaphase
  + Alignment of chromosomes at the metaphase plate
  + Role of spindle fibers in chromosome positioning
* C. Anaphase
  + Separation of sister chromatids
  + Movement of chromatids toward opposite poles
* D. Telophase
  + Reformation of the nuclear envelope
  + Decondensation of chromosomes
  + Preparation for cytokinesis

**IV. Cytokinesis**

* A. Definition and importance in cell division
* B. Mechanisms of cytokinesis in animal vs. plant cells
* C. Role of the contractile ring in animal cells and cell plate formation in plant cells

**V. Regulation of Mitosis**

* A. Role of cyclins and cyclin-dependent kinases (CDKs)
* B. Importance of checkpoints in the cell cycle (G1, G2, and M checkpoints)
* C. Consequences of deregulation (e.g., cancer)

**VI. Errors in Mitosis**

* A. Types of mitotic errors (e.g., aneuploidy, polyploidy)
* B. Impact of errors on cell function and organism health
* C. Examples of diseases associated with mitotic errors (e.g., cancer)

**VII. Techniques for Studying Mitosis**

* A. Microscopy techniques for observing mitosis
* B. Staining methods (e.g., DAPI, fluorescent markers)
* C. Live-cell imaging technologies

**Conclusion**

* Summary of key concepts
* The importance of mitosis in development, health, and disease