



**School of Interdisciplinary Engineering & Sciences (SINES)**  
**National University of Sciences & Technology**

**Course Title:** Cancer Genetics

**Course Code:** HCB-811

**Course Objectives:**

The course objective is to introduce the students to important and current concepts in Cancer Biology and Cancer Genetics. The main focus of the course is to introduce students about genetic and molecular basis of cancers, their causative agents and malignant transformation of cancer cells

**Course Outcomes:**

By the end of this course students will be able to evaluate the contribution of genetics to the development of cancer. Critically analyze the significance of family history as a risk factor for cancer and will be able to analyze the psychological, social and cultural impact on the individual who has a family history of cancer. Evaluate the impact of cancer genetics for the family and family dynamics.

**Course Contents:**

- Introduction
- Essential Alterations for malignant transformation
- Onco-genes, Proto-onco-genes and Onco-proteins
- Proto-oncogene
  - Viral oncogene and RNA tumor virus
  - v-oncvs c-onc
  - DNA tumor virus
- Tumor Suppression Genes
  - Discovery of the first Tumor suppressor gene
  - The RB and p53 genes
    - Loss of function of the RB protein
    - The p53 gene
  - Other Tumor suppressor genes
- Development of sustained angiogenesis
- Tumor progression
  - Precancerous stage
  - The noninvasive stage
  - Invasion and dissemination
- Metastasis
- Invasion of extracellular matrix
- Molecular genetics of metastasis development
- Dysregulation of cancer and its associated genes
- Growth factors and their receptors

- Non-receptor tyrosine kinases
- Nuclear signaling
- Transcriptional activation
- Mechanisms of Oncogene activation
- Carcinogens and oncogene activation
- Oncogene cooperation
- Normal cells suppress tumor growth
- Angiogenesis and tumor development
- Tumor Suppressor genes
  - The *Rb* locus
  - *p53* suppressor gene
  - Other tumor suppressors
    - Apoptosis and its role in growth regulation
  - Senescence
- Chromosomal changes
  - Gene amplification
  - Epigenetic changes
- Molecular profiles of cancer cells
- Cancer-causing agents
  - Oncogenic viruses
    - DNA viruses
    - Human papillomaviruses
    - Epstein-Barr virus
    - Hepatitis B virus
    - RNA viruses
  - Chemicals
    - Initiators
    - Promoters
  - Radiation
    - Ultraviolet radiation
    - Ionizing radiation

### **Recommended / Reference**

#### **Books:**

- The Biological Basis of Cancer by Robert G. McKinnell, Ralph E. Parchment, Alan O. Perantoni, G. Barry Pierce, Ivan Damjanov
- Molecular Biology of the cell by Alberts et al. 2005
- The Biology of Cancer by Robert A. Weinberg.