

HUMAN ONCOLOGY (H ONCOL)

H ONCOL/MED PHYS 410 – RADIOBIOLOGY

2-3 credits.

Effects of ionizing radiations of living cells and organisms, including physical, chemical, and physiological bases of radiation cytotoxicity, mutagenicity, and carcinogenesis; lecture and lab.

Requisites: Graduate/professional standing or (PHYSICS 202 or 208 and ZOOLOGY/BIOLOGY/BOTANY 152 or 153)

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2024

Learning Outcomes: 1. Gain an understanding of the physical, chemical and molecular basis of the action of radiation on biological systems
Audience: Both Grad & Undergrad

2. Describe the radiobiological principles forming the basis for the use of radiation as a cancer therapy
Audience: Both Grad & Undergrad

3. Understand the potential deleterious short and longer-term effects of radiation on normal tissues and organs and on the whole body
Audience: Both Grad & Undergrad

4. Describe how chemotherapy and molecularly targeted agent can alter response of biological systems to radiation.
Audience: Both Grad & Undergrad

5. Understand the principles of radiation protection
Audience: Graduate

H ONCOL/B M E/MED PHYS/PHYSICS 501 – RADIATION PHYSICS AND DOSIMETRY

3 credits.

Interactions and energy deposition by ionizing radiation in matter; concepts, quantities and units in radiological physics; principles and methods of radiation dosimetry.

Requisites: (PHYSICS 323, 449 and MATH 320) or graduate/professional standing or declared in Medical Physics VISP

Course Designation: Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Fall 2024

Learning Outcomes: 1. Use the physics of microscopic structures of nucleus, nuclear decay, electronic structure of atoms to calculate nuclear decay lifespans and solid state energy band structure
Audience: Both Grad & Undergrad

2. Calculate the radiation power spectrum for an accelerating charge particle under different physical conditions
Audience: Both Grad & Undergrad

3. Calculate cross-sections for the following interaction processes between photons and matter: Rayleigh scattering, photoelectric effect, Compton scattering, and pair production
Audience: Both Grad & Undergrad

4. Calculate the scattering cross-section of Coulomb scattering and energy transfer cross-section in collisions processes and radiative energy loss processes
Audience: Both Grad & Undergrad

5. Calculate radiation dose for both external photon beams, neutron beams, and charged particle beams
Audience: Both Grad & Undergrad

6. Identify open research topics in radiation imaging, radiation therapy, and radiation protection fields
Audience: Graduate

H ONCOL 681 – SENIOR HONORS THESIS IN HUMAN ONCOLOGY 1

3-4 credits.

Independent research in the area of human oncology including biology, medical physics, or clinical oncology. A written thesis is required in the final semester.

Requisites: Consent of instructor

Course Designation: Honors - Honors Only Courses (H)

Repeatable for Credit: No

Last Taught: Fall 2023

H ONCOL 682 – SENIOR HONORS THESIS IN HUMAN ONCOLOGY 2

3-4 credits.

Independent research in the area of human oncology including biology, medical physics, or clinical oncology. A written thesis is required in the final semester.

Requisites: Consent of instructor

Course Designation: Honors - Honors Only Courses (H)

Repeatable for Credit: No

Last Taught: Spring 2024

H ONCOL 691 – SENIOR THESIS IN HUMAN ONCOLOGY 1

3-4 credits.

Independent research in the area of human oncology including biology, medical physics, or clinical oncology. A written thesis is required in the final semester.

Requisites: Consent of instructor

Repeatable for Credit: No

Last Taught: Fall 2023

H ONCOL 692 – SENIOR THESIS IN HUMAN ONCOLOGY 2

3-4 credits.

Independent research in the area of human oncology including biology, medical physics, or clinical oncology. A written thesis is required in the final semester.

Requisites: Consent of instructor

Repeatable for Credit: No

Last Taught: Spring 2024

H ONCOL 699 – INDEPENDENT STUDY IN HUMAN CANCER BIOLOGY

1-3 credits.

Tutorial lab/library research and study. Opportunity for learning in depth without a thesis requirement.

Requisites: Consent of instructor

Course Designation: Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Spring 2025

H ONCOL 750 – MULTI-DISCIPLINARY PATIENT-ORIENTED RESEARCH PRESENTATION SKILLS SEMINAR

1 credit.

Learn to value the contributions of oral presentations in developing your career, in convincing audiences of the results of your research, or gaining approval of your proposed research.

Requisites: Graduate/professional standing

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Fall 2024

Learning Outcomes: 1. Understand components of high quality oral presentations and commonly made mistakes
Audience: Graduate

2. Provide constructive feedback to presenters
Audience: Graduate

3. Apply consistent format for oral presentations
Audience: Graduate

H ONCOL 910 – INDEPENDENT READING AND RESEARCH FOR FOURTH YEAR MEDICAL STUDENTS

2-8 credits.

Independent research under the direct supervision of Human Oncology faculty. Each student's research project is individualized to meet student research goals within context of faculty research needs.

Requisites: Graduate/professional standing

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Spring 2025

Learning Outcomes: 1. Formulate a hypothesis or specific objective if study does not involve hypothesis generating research
Audience: Graduate

2. Conduct a thorough literature review of the specific research question
Audience: Graduate

3. Select and apply statistical methodologies appropriate for the proposed analyses
Audience: Graduate

4. Interpret results correctly and in context of previous findings from literature review
Audience: Graduate

H ONCOL 911 – TUMOR IMMUNOLOGY AND CANCER IMMUNOTHERAPY

2 credits.

Gain a greater understanding of the basic and translational science that is fueling the ongoing immuno-oncology revolution in cancer care. Explore the tumor-immune microenvironment and modern approaches to cancer immunotherapy. Evaluate pertinent primary literature in this arena and exposure to the technological resources (e.g. flow cytometry, clinical pathology, cell therapeutics infrastructure) that are critical to implementing immunotherapies in the clinic. Tumor board attendance will highlight the clinical reasoning and toxicity management in the clinical use of immunotherapies for cancer treatment.

Requisites: MED SC-M 810, 811, 812, and 813

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2025

Learning Outcomes: 1. Demonstrate understanding of innate and adaptive immune interactions with tumors

Audience: Graduate

2. Apply understanding of immunology to understand immunotherapeutic approaches in cancer

Audience: Graduate

3. Compare and contrast therapeutic mechanisms of diverse immunotherapies

Audience: Graduate

4. Demonstrate knowledge of the patterns and rates of response to immunotherapies among distinct cancers

Audience: Graduate

5. Demonstrate understanding of immunotherapy toxicities and approaches to treating these

Audience: Graduate

6. Apply and adapt understanding of tumor immunology and current immunotherapies to devise a proposal for next generation approach to cancer immunotherapy

Audience: Graduate

H ONCOL 912 – CHALLENGES IN ONCOLOGY: APPLICATION OF MODERN BIOLOGY AND TECHNOLOGY TO CLINICAL CANCER CARE

2 credits.

Radiation therapy has been used in treatment of cancer and other diseases for over 100 years. Gain a comprehensive overview of how modern technology allows us to precisely target the tumor while maintaining the function of normal tissues (i.e. the physics and biology underlying the use of radiation therapy). Develop a strong foundational knowledge of basic oncology principles, begin to understand the biology and physics underlying radiation oncology treatments, interpret dose/volume histograms and normal-tissue complication probabilities, understand the role of modern imaging in the workup, treatment, and follow-up of cancer patients, and be able to discuss the major financial issues associated with various treatment modalities. It is anticipated that students will incorporate these concepts, knowledge, experiences, and evidence in their future clinical practice.

Requisites: MED SC-M 810, 811, 812, and 813

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2025

Learning Outcomes: 1. Demonstrate knowledge of fundamental principles of oncology

Audience: Graduate

2. Demonstrate understanding of how physics and biology shape modern radiation oncology

Audience: Graduate

3. Perform treatment simulations, target identification, normal tissues using four-dimensional imaging studies

Audience: Graduate

H ONCOL 922 – RADIATION ONCOLOGY

2-4 credits.

Oncology-focused topics including staging, prognosis, and treatment approaches to different cancers. Different radiation modalities, treatment machines, and treatment planning. Opportunity to see patients in clinic and observe procedures (brachytherapy), under direct supervision by residents and attending physicians.

Requisites: Graduate/professional standing

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Spring 2025

Learning Outcomes: 1. Prepare for consults.

Audience: Graduate

2. Improve skills in physical examination.

Audience: Graduate

3. Make a concise, yet thorough presentation to the attending, including your own assessment and plan

Audience: Graduate

4. Describe the staging of neoplastic diseases.

Audience: Graduate

5. Practice decision-making involved in the work-up and treatment planning of oncologic patients.

Audience: Graduate

6. Describe the uses of different types of ionizing radiation in cancer treatment.

Audience: Graduate

7. Demonstrate understanding of the use of radiation toward sparing normal tissues.

Audience: Graduate

8. Observe and participate as allowed in procedures.

Audience: Graduate

H ONCOL 990 – RESEARCH IN HUMAN CANCER BIOLOGY

1-12 credits.

Graduate thesis research.

Requisites: Consent of instructor

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: Yes, unlimited number of completions

Last Taught: Spring 2025