

科號	NES5251	學分	3
中文課名	放射治療物理學		
英文課名	Radiation Therapy Physics		
期望上課時間	T5T6T7	上課教室	綠 202

課程大綱

一、課程說明(Course Description) : This course is designed to cover topics in radiation therapy physics with emphasis on the practical details. This course provides both basic radiation physics and physical aspects of dosimetry treatment planning, using photon beams, electron beams, and brachytherapy sources. In addition, the theory of absorbed dose measurements and radiotherapy technologies are also included.

二、指定用書(Text Books) none

三、參考書籍(References) Various published articles, reports and books.

四、教學方式(Teaching Method) classroom power point presentations.

五、教學進度(Syllabus)

units	subjects	contents
0*	Interactions of photons with matter	Photoelectric, compton, pair production, exponential attenuation, linear/mass attenuation coefficients, exposure, kerma, dose
0*	Interactions of charged particles with matter	Excitation/ionization, soft/hard collisions, bremsstrahlung, stopping power, restricted stopping power
0*	Nuclear decay	Nuclear transformations, activity, transient/secular equilibrium
1	External photon beams - basic properties	Medical linear accelerators, spectrum, fluence distributions, Sc, Sp, depth-dose curves, TMR/TPR, dose profiles, surface dose, FFF beams
2	External photon beams - beam modifying devices	Blocks, MLC, wedges (hard, universal. Dynamic)
3	External photon beams - dose	CT calibration curve, Empirical based methods, model based methods

	calculation methods	(convolution/superposition, AAA, Acuros), MU calculation
4	External electron beams	Depth-dose curves, dose distributions, dose calculations, clinical applications
5	Reference dosimetry - air-based	TG-21, chamber theory, calibration factors, $N_k$ , $N_x$ , $N_{gas}$
6	Reference dosimetry - water-based	TG-51, TRS-398, $N_{D,w}$ , quality conversion $k_Q$ .
7	Other dosimeters	Film, TLD, diodes, 2D-array, gamma-index evaluation
8	Intensity-modulated radiation therapy	Optimization, delivery, dose calculation, quality assurance
9	Special techniques, Radiosurgery, SBRT	TBI, TSET, Small field dosimetry, clinical applications, biological dose, cell survival curves, fractionation
10	Image guided radiotherapy	Portal imaging, kV, CBCT, registration - point, surface, image
11	Shielding, QA	Treatment room shielding, tolerances, daily, monthly, annual QA
12	Brachytherapy - basics	Isotopes, source calibration, dose calculation TG-43
13	Brachytherapy - clinical applications	LDR, HDR, Temporary/permanent implants, Prostate, cervical, breast
14	Plan evaluation	Isodose distributions, DVH, TCP/NTCP models, Kaplan-Meier survival curves
15	Proton therapy	Proton physics, accelerators, beam delivery (scanning, scattering), Bragg peak, SOBP
16	Carbon-ion therapy	Carbon ion physics, RBE modeling

\*These are basic concepts important to radiation therapy physics, they are not included here for presumably they have been covered in other courses such as “Radiation Physics” and “Radiation Dosimetry”. However, if deemed helpful to the students, they can also be included in this course.

六、成績考核(Evaluation) Midterm and Final examinations, 50% each.

七、可連結之網頁位址

此科目對應之系所課程規畫所欲培養之核心能力	
百分比	核心能力
( 20)%	務實中英文科技論文閱讀與撰寫、檢索文獻與簡報的訓練 Ability to read and write both Chinese and English technical papers, retrieve references and give presentations.
( )%	強化規劃、領導與執行團隊合作的能力 Ability to plan, lead and collaborate.
( 10)%	發掘與分析工程問題，以及創新思考與研發的能力 Ability to identify and analyze engineering problems, propose innovate thinking and research development.
( 40)%	運用專業核子工程與科學知識的能力 Ability to apply professional nuclear engineering and science knowledge.
( 10)%	認識核能發電的國際發展趨勢，瞭解核能、核子工程與科學技術與輻射對環境、社會 及全球的影響，並培養終身自我學習成長的能力 Knowledge of global development trends of nuclear power; an understanding of the impact of nuclear power, nuclear engineering and science and radiation in environmental, societal and global contexts; and the ability to cultivate habits of life-long learning
( 10)%	增進策劃及執行研究計畫的能力 Ability to plan and execute the research projects.
( 10)%	應用實驗或模擬以探討核子工程與科學問題，以及獨立解決問題的能力 Ability to conduct experiments and simulations to survey nuclear engineering and science problems, and solve them independently.
( )%	體認專業倫理及社會責任之能力 Understanding of professional ethics and social responsibility