**IMPORTANT: This syllabus form should be submitted to OAA (gsbs_academic_affairs@uth.tmc.edu) a week before the start of each semester.**

**NOTE to STUDENTS:** If you need any accommodations related to attending/enrolling in this course, please contact one of the Graduate School's 504 Coordinators, Cheryl Spitzenberger or Natalie Sirisaengtaksin. We ask that you notify GSBS in advance (preferably at least 3 days before the start of the semester) so we can make appropriate arrangements.

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| Term and Year: **Fall 2024**<br><br>Course Number and Course Title: **GS02 1132 Proton Therapy Physics**<br><br>**Credit Hours: 2**<br><br>Meeting Location: **MD AndersonCancer Center**<br><br>Building/Room#: **Pickens Tower/TBD for lectures and examinations, Proton Therapy Center for Dosimetry and QA measurements** | Program Required Course: **No**<br><br>Approval Code: **No**<br><br>Audit Permitted: **Yes**<br><br>Classes Begin: **August 26, 2024**<br><br>Classes End: **December 7, 2024**<br><br>Final Exam Week: **December 9-13, 2024** |

**Class Meeting Schedule (Preliminary, can be changed)**

| Day | Time |
|---|---|
| **Monday (Lectures)** | **3:00 - 4:30 p.m.** |
| **Saturday (Dosimetry and QA measurements)** | **9 AM – 2 PM** |

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| **Course Director**<br><br>Name and Degree: **Narayan Sahoo, PhD**<br><br>Title: **Professor**<br><br>Department: **Radiation Physics**<br><br>Institution: **MDACC**<br><br>Email Address: NSahoo@mdanderson.org<br><br>Contact Number: **713-563-2551**<br><br>**NOTE:** Office hours are available by request. Please email me to arrange a time to meet. | **Instructor/s**<br><br>1. **Narayan Sahoo, PhD**<br>Institution: MDACC<br>Email Address : NSahoo@mdanderson.org<br><br>2. **Xiaorong Zhu, PhD**<br>Institution: MDACC<br>Email Address : XRZhu@mdanderson.org<br><br>3. **Uwe Titt, PhD**<br>Institution: MDACC<br>Email Address: UTitt@mdanderson.org<br><br>4. **Yoshifumi Hojo, PhD.**<br>Institution: MDACC<br>Email Address: YHojo@mdanderson.org |

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| | 5. **Fahed Alsanea, PhD**<br>Institution: MDACC<br>Email Address: FMAlsanea@mdanderson.org<br><br>6. **Falk Poenisch, PhD**<br>Institution: MDACC<br>Email Address: FPoenisch@mdanderson.org<br><br>7. **Yuting Li, PhD**<br>Institution: MDACC<br>Email Address: YLi30@mdanderson.org<br><br>8. **Ming Yang, PhD**<br>Institution: MDACC<br>Email Address: MYang1@mdanderson.org<br><br>9. **Thomas J. Whitaker, PhD**<br>Institution: MDACC<br>Email Address: TJWhitaker@mdanderson.org<br><br>10. **Sherif Gadoue, PhD**<br>Institution: MDACC<br>Email Address: SGadoue@mdanderson.org<br><br>11. **Xiaodong Zhang, PhD**<br>Institution: MDACC<br>Email Address: XIZhang@mdanderson.org<br><br>12. **Susan L. McGovern, MD, PhD**<br>Institution: MDACC<br>Email Address: SLMcgove@mdanderson.org<br><br>12. **Lawrence Bronk, PhD**<br>Institution: MDACC<br>Email Address: LBronk@mdanderson.org |

**Course Description**:
The proton therapy physics course will provide students knowledge about proton beam dose deposition in different media, radiobiology of proton beams, clinical proton beam generation and delivery, commissioning proton therapy delivery systems, quality assurance, simulation and treatment planning for proton therapy, uncertainties in proton beam therapy, clinical indications for proton therapy, image guidance for proton therapy, treatment delivery and clinical outcome. In addition to lectures, practical hands on sessions will be held for dosimetric measurements, beam calibration, quality assurance checks and treatment planning for different disease sites.

**Justification for the proposed course:** Proton therapy is a specialized treatment procedure. Details of physics of proton therapy is not included in any of the current GSBS courses for Medical Physics students. This course will teach the students all aspects of proton therapy physics.

**Overlap:** This course has minimal overlap with other GSBS courses for Medical Physics students.

**Textbook/Supplemental Reading Materials:**

- ICRU Report No. 78 (2007). Prescribing, Recording, and reporting Proton-Beam Therapy
- Proton Therapy Physics, Edited by Harald Paganetti, CRC Press, Boca Raton, FL (2012)
- Principles and Practice of Proton Beam Therapy, Edited by Indra J. Das and Harald Paganetti, AAPM Medical Physics Monograph No. 17, Medical Physics Publishing, Madison, WI (201

**Course Objective/s:**

Upon successful completion of this course, students will have a good understanding of all aspects of physics of proton beam therapry and will be able both to conduct research in proton therapy related areas and to provide clincal physics service under the supervision of a qualified medical physicist.

***Specific Learning Objectives*:**

1. Learn about the physics and radiobiology of therapeutic proton beams.
2. Learn about the proton therapy delivery system.
3. Learn about clinical commissioning of proton therapy delivery systems.
4. Learn about dosimetry, treatment planning, and quality assurance aspects of proton therapy.
5. Learn about the uncertainties in proton beam therapy and recent deleopments in proton beam therapy.

**Student responsibilities and expectations:**

1. Read, process, and review material from the lectures and suggested references.
2. Participate in and contribute to course discussions during lectures.
3. Participate in the hands on sessions on dosimetry and quality assurance measurements, and treatment planning.
4. Prepare for midterm and final examinations.
5. Review literature to prepare and submit one report on potential and challenges for improving therapeutic efficacy of proton therapy.

Students are expected to attend all classes in person. Remote attendance and absence from the scheduled class sessions are allowed under special circumstances with the permission from the course director. Students are expected to complete all assigned reading material (reviews and research literature) prior to class. While you may work and discuss all course materials and assignments in groups, all writing assignments must be your own. Plagiarism and failure to properly cite scientific literature and other sources will not be tolerated

and are grounds for dismissal from the course and further GSBS disciplinary action. Cheating or engaging in unethical behavior during examinations (quizzes and final) will be grounds for dismissal from the course without credit and further GSBS disciplinary action.

**Grading System: Pass/Fail** (Pass: 70% or above on weighted average of midterm (40%), Final (40%) and Report (20%)

**Student Assessment and Grading Criteria**: *(May include the following:)*

| Percentage | Description |
|---|---|
| **Midterm Exams ( 40 %)** | This will be a multiple choice questions examination for 45 minutes based on the contents of lectures and reference reading materials on the topics discussed in the lectures **before** the midterm examination. |
| **Final Exam ( 40 %)** | This will be a multiple choice questions examination for 45 minutes based on the contents of lectures and reference reading materials on the topics discussed in the lectures **after** the midterm examination. |
| **Review report ( 20 %)** | This will be a review paper based on literature survey and the topics discussed in the classes. Numerical grades out of 100 will be given by the reviewer. |

**CLASS SCHEDULE – Fall 2024**

| Date | Duration (Hour(s) taught by lecturer) | Lecture Topic | Lecturer/s |
|---|---|---|---|
| 8/26/24 | 1.5 | Physics of proton interaction with matter | Uwe Titt, Ph.D. |
| 9/9/24 | 1.5 | Radiation biology of proton beams | Lawrence Bronk, Ph.D. |
| 9/16/24 | 1.5 | Proton Therapy Machines | Yushifumi Hojo, Ph.D. |
| 9/23/24 | 1.5 | Radiation Safety for proton therapy and dosimetry of proton beams | Thomas J. Whitaker, Ph.D. |
| 9/30/24 | 1.5 | Clinical Proton Beams | Xiaorong Zhu, Ph.D. |
| 10/7/2024 | 1.5 | Commissioning of proton beams | Falk Poenisch, Ph.D. |
| 10/14/24 | 1.5 | Treatment Planning for passively scattered proton beams | Yuting Li, Ph.D. |
| 10/21/24 | 1.5 | Treatment planning for scanning proton pencil beam | Ming Yang, Ph.D. |
| 10/28/24 | 1.5 | Clinical indication for proton therapy Midterm examination | Susan L. McGovern, MD, Ph.D. Narayan Sahoo, Ph.D. |
| 11/4/2024 | 1.5 | Uncertainties in proton therapy and adaptive proton therapy | Sherif Gadoue, Ph. D. |
| 11/11/24 | 1.5 | Image guidance for proton therapy and motion management for proton therapy | Fahed Alsanea, Ph.D. |
| 11/18/24 | 1.5 | Proton therapy treatment planning demonstration | Yuting Li, Ph.D. |
| 11/25/24 | 1.5 | New Developments in proton therapy | Xiaodong Zhang, Ph.D. |
| 12/02/24 | 1.5 | Quality assurance for proton therapy | Narayan Sahoo, Ph.D. |
| 12/07/24 | 5 | Dosimetry and QA measurements | Narayan Sahoo, Ph.D. , Fahed Alsanea, Ph.D., Yuting Li, Ph.D. |
| 12/09/24 | 1 | Final examination and review report submission | Narayan Sahoo, Ph.D. |

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