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Welcome to Oregon State University (OSU) and the Department of Nuclear Engineering and Radiation Health Physics (NERHP). This handbook is intended to help you get settled and answer some of the questions you might have as a new graduate student in our department. If, after reading the contents, you have unanswered questions, please feel free to ask for help. The staff, faculty, and fellow graduate students in the Radiation Center and in the Department are available and willing to help solve any issues as they arise. Additional information on deadlines, procedures and requirements is provided by the current Oregon State University Catalog and Guide to Success which may be obtained from the Graduate School: http://oregonstate.edu/dept/grad_school/.

Graduate students in NERHP are responsible for complying with the rules of the University, the Graduate School, and the Department. In some instances, the requirements of the Department are more restrictive than those of the Graduate School. In such cases, the departmental requirements specified in this document will apply.

The program requirements that an NERHP student must satisfy for the degree are those contained in the version of the handbook and/or Catalog that is current at the time of your matriculation in the department. The student and graduate advisor should consult the correct handbook version for appropriate guidelines.

The faculty hopes that your time at OSU will be rewarding, memorable, and the beginning of a fruitful career in the nuclear field.

Dr. Andrew C. Klein, Professor and Graduate Committee Chair  
Department of Nuclear Engineering and Radiation Health Physics

**Faculty & Staff Contacts**

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<tr>
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<td>Undergrad Head Advisor &amp; Ecampus Coordinator</td>
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The Department of Nuclear Engineering and Radiation Health Physics (NERHP) resides in the Radiation Center (RC) – the facility that houses OSU’s TRIGA nuclear research reactor. The RC is an instructional and research facility specially designed to accommodate programs involving the use of radiation and radioactive materials. This unique facility was designed and established to accommodate internal and off-campus instructional and research programs involving nuclear engineering, nuclear science, radiation protection, nuclear chemistry, and other related areas.

RADIATION CENTER ORIENTATION PROGRAM
The RC conducts a general occupational and radiation safety orientation and training program for all individuals housed in the RC. You must complete the orientation process in order to obtain keys or an After-Hours Work Permit, which authorizes you to be in the RC outside of normal business hours (8 a.m. – 5 p.m., Monday through Friday).

Please see the RC Administrative Assistant in C100 for more complete instructions on obtaining keys and an After-Hours Work Permit if you miss the orientation session.

The security of your keys is quite important for everyone’s safety in the RC. It is imperative that any loss of keys be reported immediately to C100. You are requested to exercise the utmost care in the use of your keys. Under absolutely no circumstances are keys to be loaned to other individuals. Graduate students who will be absent from the RC during the summer should leave their keys with the RC Administrative Assistant in C100. This will minimize loss and facilitate the summer key inventory. In addition, keys must be returned when you finish your residency at the RC. Let the RC Administrative Assistant in C100 know of your pending departure at least a week in advance so the proper exit procedures can be followed.

Campus Security patrols the RC periodically outside of business hours (5 p.m. – 8 a.m.). Anyone without an After-Hours Work Permit and valid photo ID will be required to leave the building. Office and laboratory doors and windows are to be kept closed and locked when not occupied. Security patrols will lock any open, vacant rooms. Do not let anyone into the building after hours. Individuals who are authorized to be in the building after hours are issued appropriate access codes and keys. Guests or family members are not allowed in the RC after hours. Anyone abusing this system will have his/her After-Hours Work Permit revoked.

GRADUATE STUDENT OFFICES
NERHP graduate student offices are located throughout the RC. Offices are assigned as students arrive on campus. There are limitations to space, therefore not all students will be granted office space. Students on graduate research or graduate teaching assistant appointments will be given preference, with remaining students placed as space permits. Medical Physics (MP) students will be assigned a formal office at the beginning of year 2 (OHSU campus), however office space may be available for study and research during year 1 at the RC. For office assignments, see the Graduate Committee Chair listed in the Welcome section of this book. Once placed, please do not change your office space without the Graduate Committee Chair’s approval.

MAILBOXES
Each graduate student is assigned a mailbox in C corridor at the front of the building. U.S. mail is delivered once a day. Campus mail arrives twice daily at about 10:30 a.m. and 2:30 p.m.
campus mail drops are located in front of A100. Please check your mailbox regularly for notices, telephone messages, departmental circulars, and other information.

**ADVISOR / MAJOR PROFESSOR**
The Departmental Graduate Committee Chairperson will act as or appoint an advisor for all incoming graduate students until a major professor is selected.

Make an initial appointment to see your advisor prior to registering. Your advisor will help you plan your schedule and make sure requirements are fulfilled. You are, however, ultimately responsible for seeing that you have fulfilled all the requirements necessary for graduation. It is the responsibility of each student to propose a viable program and to ask a faculty member to become his/her major professor. A major professor must be chosen before the completion of 18 credits, typically by the end of your second term at OSU. The choice of a major professor should be given considerable thought, since you will have a close working relationship with this individual for the duration of your degree program, and close professional and personal contacts thereafter.

Your major professor will guide your research efforts to completion and oversee all aspects of your graduate studies. The student is also responsible for actively seeking information about individual research projects. Good sources of information are the professors themselves or their graduate students.

**TELEPHONES**

*Telephone Directory*
The RC Telephone Directory is revised annually and lists personnel located in the RC. A directory will be placed in your mailbox when updated.

*Long Distance Calls*
An authorization code is required to make long distance telephone calls. You will be given a code by your major professor if you are expected to make such calls as part of your research work. The authorization code is unique and intended for use by the person to which it is assigned.

Authorization codes must be kept secure and not given to other persons. Codes must not be used for personal calls or purposes other than those intended. Directions on how to make and charge personal calls are provided on the back page of the OSU telephone directory.

**XEROX, OFFICE SUPPLIES, & SCANNER**
The RC provides a copier and scanner in B134. Anyone desiring to make personal copies may purchase a personal copier code from the Business Manager in A102. It is important that the cleanliness of the copy room be maintained; please do your part.

Copies for class or official use must be approved by a faculty member, but generally the class TA will make copies for class use.
Office supplies are for the use of staff members only. A stapler and hole-punch are available in the copy room (B134) for student use.

**VENDING MACHINE**
There is a Pepsi machine located across from B124 between B and D corridors. The student group, Alpha Nu Sigma, has snacks for sale in the RC receptionist’s office.
COMPUTER USE
In general, most of the large computer codes used in the Department have been moved to the UNIX system where their performance is maximized. The UNIX system should be used primarily for solving large-scale problems, software development, and symbolic mathematics. The PC-based computers should be used primarily for word processing, spreadsheet, and Internet connectivity applications.

Departmental computers are supplied to allow you to perform your research activities and course work, and should not be used for games or other personal uses during normal business hours (8:00 a.m. - 5:00 p.m., Monday – Friday). After hours personal use, within reason (as described by University policy), is allowed as long as others do not need the computers for their research or class activities. Computer use supporting funded research takes priority over use for non-funded research.

The undergraduate computer room (A124) is reserved primarily for undergraduate student use for class and project work. Occasional, short-term use by graduate students is permitted on an as-available basis.

If someone is using a computer for an application which is inappropriate, or falls under a low priority, kindly request that they terminate their work in a reasonable period of time. In any case no more than 15 minutes should be needed to terminate the work on a lower priority application. If you are asked to terminate your work on a lower priority application, please stop work as soon as you can (again, in no more than 15 minutes).

Do not copy ANY software onto the Department’s computer hard disks without approval from the Department Head and the Network Administrator. Software licensing and disk space availability are two issues that must be considered. The installation of your own personal copies of software on the Department’s machines without permission exposes the Department to an unacceptable potential liability and therefore cannot be allowed. Please ask permission for the installation and use of your personal software if it is important to your research or course work. Also, please do not copy any software from the Department’s computers without permission. This, again, violates software licensing agreements.

If you have any general questions about using University computers, please contact Chris Thompson in A-114 or at support@engr.orst.edu for assistance, or refer to the University’s Policy on Acceptable Use of University Computing Facilities at these web sites: http://engr.oregonstate.edu/computing/.

PARKING
A valid OSU Zonal Parking permit is required to park in any space on campus. The OSU Zonal Parking system includes seven general use zones (A1, A2, A3, B1, B2, B3, C), and two residence hall parking zones (BR, CR). The Radiation Center parking lot is designated zone B3, while parking on Jefferson Way west of SW 35th Street is designated zone C. Permits can be purchased online at the Parking Services website (parking.oregonstate.edu) or in person at the Parking Services office in 100 Adams Hall. Please refer to the Parking Services website for the Parking and Shuttle Map as well as permit pricing. Parking Services can also be reached by phone at (541) 737-2583.

SMOKING POLICY
Effective September 1, 2012, smoking is no longer allowed on OSU’s Corvallis campus. This includes the Radiation Center. Please consult the map on the following webpage for the campus boundary: http://oregonstate.edu/smokefree/map
RC LIBRARY
The RC Reference Library is located in A124. Materials are not to be checked out and cannot be removed from the library. Please DO NOT reshel a ny materials you use but rather put your books in the designated area with the sign that reads “Please return materials here.” The RC receptionist will reshel f materials to their proper places. If you wish to add books or documents to the library, please give the material to the RC receptionist who will be maintaining the library. The receptionist can catalog the new material and place it in the correct location. Keep the library clean and tidy up after yourself.

GENERAL RC SAFETY GUIDELINES
In order to comply with state and university fire prevention codes, the RC has adopted a policy which prohibits the use of personal coffee pots, hot plates, or other heating devices designed to heat water for coffee, tea, hot chocolate, etc. A refrigerator, coffeepots, hot water dispenser, and a microwave, can be found in the break-room, B134. No one should stay “over night” in the building.

The last person to leave a room after 5:00 p.m. is required to check to see that all windows are closed and that door(s) are locked.

First aid kits and emergency eye wash stations and fire extinguishers are located at various places throughout the Radiation Center on the walls. Names of Radiation Center personnel qualified to administer first aid are also listed as part of the first aid kits. All injury accidents are to be reported to OSU’s Office of Environmental Health and Safety on forms available from the Business Manager in A102.

Building evacuation drills will be conducted during the year. Please familiarize yourself with the evacuation signals and procedures. These are posted at numerous locations throughout the Radiation Center.

If you have questions regarding any of the above or any other safety matters, contact the RC Director.
SPECIAL SERVICES AT OSU

CAMPUS RESOURCE GUIDE
The campus resource guide is a list of services available to students and faculty. For details, please visit http://oregonstate.edu/dept/grad_school/resourceguide.php.

OSU STUDENT BRANCH – AMERICAN NUCLEAR SOCIETY (ANS)
OSU has a very active student branch of the American Nuclear Society (ANS). Officers are elected once each year. Contact the Faculty Advisor (Dr. Haori Yang) for information on the student chapter of the ANS.

National ANS student member dues are currently $28.00 and benefits include:
- Twelve issues of Nuclear News
- ANS News, the newsletter on Society and member activities
- ANS Placement Services
- Special registration rates for ANS meetings
- Opportunity to present papers
- Opportunity to meet with others pursuing similar interests
- Membership in two ANS professional divisions or technical groups
- Various honors and awards

The application form is available online at http://ans.org/

OSU STUDENT BRANCH – HEALTH PHYSICS SOCIETY (HPS)
In 1993, students in the radiation health physics program at OSU organized a student chapter of the National Health Physics Society. The Society’s objective is to develop "scientific knowledge and practical means for protection of man and his environment from the harmful effects of radiation." The organization provides technical information and information about the business of radiation protection in its monthly publication, Health Physics journal and the Health Physics News newsletter. OSU Chapter officers are elected once each year. Contact the Faculty Advisor (Dr. Wade Marcum) for information on the student chapter of the HPS.

National student membership in the Health Physics Society qualifies students for membership in the student chapter as well. National Health Physics Society student membership dues are free for the first year then continue at $10 per year and benefits include:
- 12 issues of Health Physics
- The Health Physics Society’s newsletter
- Health Physics Society job placement services
- Opportunities for fellowships
- Opportunities for registration and travel assistance for HPS meetings
- Chapter social activities

Membership in the student chapter is open to individuals in the RHP and NE programs, as well as
students with an interest in health physics. For a membership application contact the website at http://hps.org.

**AMERICAN ASSOCIATION OF PHYSICISTS IN MEDICINE (AAPM)**

Students enrolled in medical physics graduate programs can join the American Association of Physicists in Medicine (AAPM) at a reduced membership rate of $54.00 ($29.00 annual + $25.00 application fee). Membership applications must be accompanied by a letter from the program director and information can be found at: http://www.aapm.org/memb/newmemb_instructions.asp

As a member of the AAPM, students will have access to:

- Journal articles from *Medical Physics*
- Task Group Reports,
- Webcasts / meeting information,
- Member directories,
- Information on technical meetings and abstract submissions

**AMERICAN CHEMICAL SOCIETY (ACS)**

Students in the Radiochemistry research program are advised to can join the Division of the Nuclear Chemistry and Technology of the American Chemical Society (www.acs.org). It is a nonprofit organization, chartered by Congress, and with more than 161,000 members, ACS is the world’s largest scientific society and one of the world’s leading sources of authoritative scientific information.

The first year graduate student membership is $38.50 USD and covers 12 issues of the *Chemical Engineering News (CEN) magazine* and the *Nuclear Chemistry and Nuclear Technology Division Newsletter*. As a member of the ACS, you will have a free access to:

- **Networking:** Special registration fees for national ACS meetings and regional conference; opportunities for travel assistance for ACS meetings; communicate with other members and finding scientific collaborations, get information about the latest research, participate in the ACS public forums, groups and personal blogs.
- **Internships & Opportunities:** ACS provides its members with the resources and opportunities needed to enrich their programs of study.
- **Research & Publications:** Stay up-to-date in world chemical news and breakthroughs in research with ACS publications.
- **Job:** ACS offers its members a variety of educational and professional development resources to help advance their careers.
OSU NE/RHP/MP FACULTY

Abi T. Farsoni

David M. Hamby

Jack F. Higginbotham (currently on indefinite assignment)
Professor, Director, Oregon Space Grant, Faculty Liaison, Research Office. B.S. Nuclear Engineering (1981), M.S. Nuclear Engineering (1983), Ph.D. Nuclear Engineering (1987), Kansas State University. Member, Health Physics Society, American Nuclear Society. Professional Progress Award, Kansas State University; Elda Anderson Award, Health Physics Society (1997); Loyd Carter Award (1997); Academic Dean, Health Physics Society Summer School; President, Cascade Chapter, Health Physics Society. Registered Professional Engineer (Nuclear). Certified Health Physicist. At Oregon State University since 1987. Fields of interest: radiation shielding, radiation protection, activation analysis, radiation detection, nuclear instrumentation.

Kathryn A. Higley
Andrew C. Klein


Wade R. Marcum


Todd S. Palmer


Alena Paulenova

Produced Radiopharmaca” (1997) and NATO AIW workshop “Applications of Natural Sorbents in Waste Treatment” (1998). Member of American Chemical Society: Division of Nuclear Chemistry and Technology and the ACS Nuclear Chemistry Summer School committee. Distinguished Member of Editorial Board of the Journal of Radioanalytical Nuclear Chemistry and Editorial Board of the International Journal of Nuclear Energy Science and Engineering; reviewer for Inorganic chemistry, Analytical chemistry, Environmental Science and Technology. At Oregon State University since 2003. Fields of interest: Separation and speciation chemistry of actinides and fission products for: fuel cycle and waste forms; production and application of radiotracers, behavior and mobility of radionuclides in natural bio-geochemical systems; nano-radiochemistry in material science; radiation chemistry and post-irradiation processes.

Steven R. Reese

José N. Reyes, Jr. (currently on assignment at NuScale Power Inc.)

Krystina Tack

Brian Woods
At Oregon State University since 2003. **Fields of interest:** reactor thermal hydraulics, reactor safety, high-temperature gas reactor design, experimental fluid dynamics and heat transfer.

**Qiao Wu**  

**Haori Yang**  
*Assistant Professor.* B.S. Engineering Physics (2001), M.S. Engineering Physics (2003), Tsinghua University; Ph.D. Nuclear Engineering and Radiological Sciences (2009), University of Michigan. Assistant Professor, University of Utah (2011-2013). Research Scientist, Canberra Industries (2008-2010). At Oregon State University since 2013. **Fields of interest:** non-destructive interrogation techniques, development of innovative radiation sensors, nuclear material detection, detectors for medical imaging, high-energy physics, and nondestructive testing, and general applications of nuclear engineering.

**OHSU MP Faculty**

The Medical Physics (MP) graduate program is a joint degree program in collaboration with Oregon Health Sciences University (OHSU) in Portland. The following faculty are associated with the MP degree program and located at OHSU.

**Richard Crilly (MP)**  
*Associate Professor Staff Radiation Therapy Physicist.* B.S. Physics (1979), University of Saskatchewan, M.S. Biophysics (1987) University of Alberta (Edmonton), Ph.D. Medical Physics (1995), Wayne State University. Member of: American Association of Physicists in Medicine (AAPM). Certified by ABMP in Radiation Oncology (American Board of Medical Physics). **Fields of interest:** Small Field Dosimetry, Ion Chamber Design, Helical Tomotherapy Planning, Helical Tomotherapy QA.

**Thomas Griglock (MP)**  
*Assistant Professor and Chief Diagnostic Imaging Physicist.* B.S. Physics (2003), University of Scranton; M.S. Physics (2005), Lehigh University; M.S. Medical Physics (2009), University of Florida; Ph.D. Medical Physics (2012), University of Florida. Member of: American Association of Physicists in Medicine (AAPM). Eagle Scout. Diplomate of the American Board of Radiology (DABR). **Fields of interest:** Computed Tomography Dosimetry, practical approaches to radiation dose management.

**Wolfram Laub (MP)**  
*Associate Professor and Director of Medical Physics.* M.S. Physics (1995), Eberhard-Karls-Universitat Tubingen, Germany, Ph.D. Physics, Eberhard-Karls-Universitat Tubingen, Germany, MBA (2007), George Fox University. Member of the American Association of Physicists in Medicine.
AAPM), European Society of Therapeutic Radiology and Oncology (ESTRO), American Society for Radiation Oncology (ASTRO), Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM), editorial board of Radiation Oncology, manuscript reviewer for Medical Physics and Physics in Medicine and Biology. Certified by ABMP in Radiation Oncology (American Board of Medical Physics). Fields of interest: Monte-Carlo dose calculations, Intensity modulated arc therapy QA, in-vivo electronic portal imaging dosimetry.

Lindsay Sinclair (MP)
Assistant Professor & Imaging Physicist. B.S. Nuclear Engineering (2007), University of Florida; M.S. Nuclear Engineering (2009), University of Florida; Ph.D. Medical Physics (2013), University of Florida. Member of: American Association of Physicists in Medicine (AAPM). Fields of interest: Computed Tomography Dosimetry.

James Tanyi (MP)
Associate Professor. Staff Radiation Therapy Physicist. B.S. Physics (with Distinction), United States Naval Academy, M.S.E. Nuclear Engineering and Radiological Sciences (2002), Ph.D. Medical Physics (2005), University of Texas Health Science Center at San Antonio. Member of: American Association of Physicians in Medicine (AAPM), European Society of Therapeutic Radiology and Oncology (ESTRO), American Society for Radiation Oncology (ASTRO), American Association for Cancer Research, Radiological Society of North American (RSNA), Golden Key International Honor Society, Alpha Nu Sigma Society, American Nuclear Society (ANS), International Foreign Language Honor Society (Phi Sigma Iota), National Physics Honor Society (Sigma Pi Sigma). Diplomate of the American Board of Radiology (DABR). Fields of interest: Non-invasive methods of treatment response detection, motion correction in radiotherapy, stereotactic image-guidance, and deformable image registration (DIR) for adaptive radiotherapy (ART).

Charles Thomas MD (MP)
Professor and Chairman Department of Radiation Oncology OHSU. B.A. Biology (1979), Dartmouth College, M.D. Education Medicine (1985), Dartmouth College, Internal Medicine Residency (1988), University of Illinois, Fellowship Medical Oncology (1991), Baylor College of Medicine, Residency Radiation Oncology (1997), University of Washington. Member of many professional medical societies including: AACR Radiation Oncology Subcommittee, Editorial Board of Gastrointestinal Cancer Research (GCR), Oral Examiner for the American Board of Radiology (ABR), American Society for Radiation Oncology (ASTRO). Fields of interest: Combined-modality clinical trials.

Junan Zhang (MP)
CLINICAL TEACHING FACULTY AT OHSU

Monica Kishore (MP)

Brandon Merz (MP)
Assistant Professor. Staff Radiation Therapy Physicist. B.S. Physics (2006), University of Hawai’i at Manoa, M.S. Medical Physics (2008), University of Toledo. Member of: American Association of Physicists in Medicine (AAPM). Diplomate of the American Board of Radiology (DABR). Fields of interest: Applications of Electronic Portal Imaging Devices (EPID), Eye Plaque Brachytherapy, and the use of Optical Coherence Tomography to assess radiation damage to the retina.

Susha Pillai (MP)
Assistant Professor. Staff Radiation Therapy Physicist. M.S. Physics (1996), M.G. University, Kerala, India, M.S. Nuclear Engineering (1999), University of Missouri-Columbia. Member of: American Association of Physicists in Medicine (AAPM), American Society of Therapeutic Radiology and Oncology (ASTRO). Diplomate of the American Board of Radiology (DABR). Fields of Interest: Developing innovative treatment delivery techniques, Heterogeneity correction algorithms for treatment planning systems, In Vivo dosimetry, Intraoperative Radiation Therapy, Total Marrow Irradiation.
Faculty research evolves over time and is generally dictated by the availability of funding. Current research in the Department of Nuclear Engineering and Radiation Health Physics covers a wide range of topics. Areas of research focus exist in nuclear engineering, radiation health physics, medical physics and radiochemistry. The following is a general description of the many different areas possible within the Department.

**Nuclear Reactor Thermal Hydraulics:** A wide variety of nuclear reactor thermal hydraulics problems have been investigated at Oregon State University. These include the development of a library of best estimate thermal hydraulic computer codes for nuclear reactor safety analysis, experimental studies of the mixing of reactor fluids in reactor relevant geometries, experimental studies to characterize a variety of two-phase flow patterns, the analysis of countercurrent flooding behavior in reactor geometries, the analysis of condensation induced water hammers, and a study of the effects of fluid particle interactions on interfacial transfer and flow structure. (see Dr. Wu)

**Advanced Plant Experiment:** The Department of Nuclear Engineering and Radiation Health Physics has constructed a 1/4 scale test facility to assess the performance of the new passive safety systems incorporated into Westinghouse’s next generation of nuclear power plant, the AP1000. The test facility includes all of the design features of the actual AP1000 with the exception that electric heater rods, rather than nuclear fuel, are used to generate core heat. The OSU AP1000 is capable of continuous operation at 600 kW and includes over 600 scientific instruments for data collection. A state-of-the-art control system and data acquisition system are used to control, monitor and record the performance of the various gravity driven safety systems. Engineers from the US Nuclear Regulatory Commission, the US Department of Energy, Westinghouse, the Idaho National Engineering and Environmental Laboratory, and the Electric Power Research Institute have been on site at the Radiation Center during different phases of testing. OSU nuclear engineering researchers have also participated in designing tests performed in Italy and Japan. The OSU tests are the only AP1000 integral system tests to be performed in the United States. (see Dr. Woods)

**Hydro-Mechanical Fuel Test Facility Research:** The Department of Nuclear Engineering and Radiation Health Physics has constructed a large scale thermal hydraulic separate effects test loop. The HMFTF is designed to hydraulically test in-core and auxiliary nuclear reactor components under extreme hydraulic loading conditions. The HMFTF is currently being utilized to support the qualification of a new, prototypic fuel material to be employed within a variety of U.S. and foreign research reactors as well as potentially utilized within inherently safe nuclear power plant designs. The HMFTF operates over a wide range of thermal hydraulic conditions in an isothermal, subcooled state including flow rates ranging from 0 – 101 liters per second, system pressures ranging from atmospheric to 4.2 MPa, and fluid temperatures ranging from atmospheric to 240 degrees Celsius. (see Dr. Marcum)

**Flow Visualization:** The Department of Nuclear Engineering and Radiation Health Physics is actively supporting the newly spawned efforts to develop quality bench-top scale experiments for the purpose of validating and verifying computational fluid dynamics tools. A group of faculty and students are working within the Laser Imaging of Fluids and Thermal (LIFT) laboratory, utilizing a time-resolved particle image velocimetry system to provide full flow-field information in controlled experiments for various sponsoring organizations. (see Dr. Marcum)

**Computational Multiphysics:** Continuing advancements in computational methods and tools enable more rigorous and sophisticated component design and safety analyses accessible to users that operate through personal desktop workstations, whereas traditionally these tools have been limited to only those that have
access to supercomputers or clusters. The Department of Nuclear Engineering and Radiation Health Physics is actively participating within the field of computational multiphysics to further advance this ever-expanding field. Specific emphasis within the research group center on thermal-structure and fluid-structure interactions while utilizing COMSOL as well as ABAQUUS & Start CCM+. (see Dr. Marcum)

**Skin Dosimetry:** A team of faculty and students are currently revising the dosimetry models for the VARSKIN computer code. VARSKIN is maintained by the Nuclear Regulatory Commission; a research contract was recently awarded to the Department to modify and improve the photon and beta dosimetry models for estimating the dose to skin as function of penetration depth. The software infrastructure is also being updated to incorporate a more appropriate program language and easier to use graphical user interfaces. (see Dr. Hamby)

**Multi-Application Small Light Water Reactor (MASLWR) Test Facility Research:** The Department has constructed a test facility to test the performance of the “Multi-Application Small Light Water” (MASLWR). MASLWR is a next generation nuclear power plant that is being examined for future commercial employment. The Test Facility is constructed of all stainless steel components and is capable of operation at full system pressure (1500 psia), and full system temperature (600F). All components are 1/3 scale height and 1/254.7 volume scale. The current testing program is examining methods for natural circulation startup, helical steam generator heat transfer performance, and a wide range of design basis, and beyond design basis, accident conditions. In addition, the MASLWR Test Facility is currently the focus of an international collaborative standard problem exploring the operation and safety of advanced natural circulations reactor concepts. Over 15 international organizations are involved in this standard problem at OSU. (see Dr. Wu)

**Nuclear Reactor Systems Design:** This area examines the overall design features of existing and advanced nuclear power generation systems, including the examination of light water reactor nuclear fuel, core cooling systems, main steam systems, power generation equipment, process instrumentation, containment, and active and passive engineered safety features. General studies of the neutronics of nuclear reactors include the theory of steady state and transient behavior of nuclear reactors, including reactivity effects of control rods and fuel, determination of nuclear reaction cross sections, and steady state and transient reactor behavior. Thermal hydraulic studies related to nuclear reactor design include hydrodynamics, convective, and radiative heat transfer in nuclear reactor systems, core heat removal design, and single and two-phase flow behavior. Nuclear criticality safety studies include design and neutronic analysis of storage and transportation facilities for spent fuel and weapons materials. Analysis of vented fuel nuclear systems seeks to understand the fission product movement from the fuel, to the removal gas, and out to the coupled fission product collection system. The transport of fission products are quantified analytically from theory and current experimental data and a modern safety analysis using probabilistic risk assessment is applied to the fission product venting and removal system. (see Dr. Woods and Dr. Klein)

**Very High Temperature Reactor (VHTR) System Design:** The Very High Temperature Reactor is a helium cooled nuclear reactor operating at an outlet temperature of 1000°C. This design has been selected as the lead US design for the Next Generation Nuclear Plant. OSU has been tasked by the US Nuclear Regulatory Commission with the development, design and testing of a reduced scale model of the VHTR reference design (both a prismatic and a pebble bed version). It is envisioned that this test facility will be used to obtain high quality data on thermal fluid behavior in the VHTR for the areas that have been identified as challenges to the VHTR design. Design and development activities for the test facility are underway with construction set to completed in 2012. (see Dr. Woods)

**Advanced Nuclear System Analysis:** Nuclear science and technology is applied in a number of power and non-power applications. These include terrestrial as well as space systems that are designed to take
advantage of the special nature of nuclear technologies. Fully understanding these systems through advanced analytical techniques is the goal of research on this area. One specific example is the analysis of an exciting fast gas cooled reactor design that utilizes fuel that is vented to allow fission products to be removed from the reactor core during operation, thus reducing the source term in an accident situation. Analysis includes modeling to enhance the release of fission products from the fuel and modeling the fission product cleanup system to understand any particular vulnerabilities. Another example is the prospective utilization of advanced computing platforms and simulation tools to provide advanced information to reactor control rooms. A final example is related to space power applications including a radioisotope powered Mars hopper and a fission surface power ground test facility design study. (See Dr. Klein)

**Numerical Methods Development**: Ongoing research projects include reactor simulations for antineutrino source characterization, radiation transport through stochastic mixtures, analysis of curvilinear geometry characteristic transport methods, and the use of deterministic transport algorithms in radiation detection and medical physics simulations. Other research areas encompass the development of improved iterative techniques and discretizations for unstructured mesh transport and diffusion, and parallel algorithms for particle transport. (see Dr. Palmer)

**Nuclear Forensics**: The NE/RHP Department has received funding from US Department of Homeland Security to develop a research focused, interdisciplinary emphasis in nuclear forensic science incorporating the technical areas of radiochemistry, nuclear materials, nuclear fuel cycles, and radiation detection. Nuclear forensics is focused on obtaining, characterizing, and interpreting data resulting from intercepted nuclear or radioactive materials with the objective of providing technical evidence to support attribution in a legal context. The attribution process can help identify nuclear threats, either state or non-state actors, and ultimately help deter the use of nuclear weapons. (see Dr. Palmer)

**Research Reactor Operations and Management**: Research reactor management in a highly regulated environment with a limited budget presents many challenges, yet the OSU TRIGA reactor (OSTR) has been widely recognized as a national leader in professionalism and quality. The OSU Department of Nuclear Engineering and Radiation Health Physics is one of only a few programs in the country with onsite access to an operating research reactor. Students are encouraged to be involved in reactor operations. OSU is also currently working on the experimental quantification of the thermal-hydraulic behavior of low enriched uranium (LEU) based fuels for use in high performance research reactors. (see Dr. Reese)

**Radiation Instrumentation Development**: A number of research projects involving the development of radiation detectors and digital readout electronics are ongoing. These projects include the development of beta/gamma coincidence spectrometers for measuring the concentration of xenon radioisotopes in the atmosphere to monitor atmospheric or underground nuclear weapons tests. We are also designing our customized digital pulse processor systems. Comparing with traditional analog pulse processors, digital systems bring several benefits to our experiments; they are more accurate, inexpensive, compact, and more flexible. (see Dr. Farsoni)

**Therapeutic Medical Physics**: Therapeutic medical physics is characterized as the clinical application of radiation to treat disease. Research is comprised of issues related to generating and delivering radiation to the patient, as well as determining the corresponding radiation dose and biologic tissue response. Research is conducted to improve the precision and accuracy of both brachytherapy (sealed source) and external beam treatment modalities in order to optimize damage to the tumor volume while reducing doses to critical organs. Specific projects include the advancement of dosimetry for radiation treatment planning for both Monte-Carlo and deterministic calculations, development of ultra-low powered wireless in-vivo dosimeters for treatment verification, and assessment of accuracy associated with 4D respiratory gating techniques.
Overall, this continually changing field presents exciting, interdisciplinary opportunities in radiation physics, medicine, computer science and mathematics, as well as other specialties of science and engineering. (see Drs. Tack and Laub)

**Uncertainties in Environmental Dose Assessments**: A number of areas of environmental dosimetry are being examined using Monte Carlo methods to assess their contribution to dose estimate uncertainties and to determine the most sensitive parameters in environmental dosimetry models. Estimates are then integrated to evaluate our overall understanding of dose estimates to members of the general public resulting from releases of radioactive materials from nuclear facilities. (see Dr. Hamby)

**The Use of Uncertainty in Decision-Making**: A recent grant for the Defense Threat Reduction Agency (DTRA) is allowing researchers in Health Physics to work with the OSU Department of Psychology on a study of how decision-makers utilize uncertainty information in making their decisions. The study focuses on nuclear events and the use of resources, risk assessment, and uncertainty to track and determine the best means of presenting graphical uncertainty products to those charged with incident command following a nuclear release. (see Dr. Hamby)

**Hanford-Related Issues**: A number of issues relating to the Hanford Nuclear Reservation are of interest to Oregonians and Oregon state agencies. Those currently under investigation include the transport of radioactive material into and out of the site, and off-site releases of radioactive material via pathways which could impact Oregon. Such pathways include groundwater to the Columbia River and incidents involving airborne releases. (see Dr. Higley)

**Radioecological Benchmarks**: Recent changes in regulations regarding cleanup of radioactive and hazardous waste sites have focused attention on the impact to non-human biota. Staff are investigating methods to adapt existing environmental contaminant transport models to evaluate impacts of cleanup on ecosystems. (see Dr. Higley)

**Neutron Radiography**: Research into the application of radiographic techniques as tools for evaluating in situ contaminant distribution has recently been initiated. (see Dr. Reese)

**Emergency Response**: Work is being conducted in atmospheric modeling, environmental sampling, and pathway analysis for emergency management support with the state of Oregon. A sophisticated transport model is utilized for hazard assessment and models are being developed for remediation management. (see Dr. Higley)

**Radiochemistry**: Radiochemistry is an interdisciplinary option within both the NE and RHP majors. Students take the core courses required for their major (either NE or RHP), adding elective courses selected from the graduate courses offered by the Department of Chemistry (Chemical Engineering, Environmental Engineering or Soil Sciences) to address their thesis project needs. The experimental work is performed mainly in the Laboratory of Transuranic Elements in Radiation Center; sometimes multiuser facilities on campus are also utilized (ICP-MS, XRD and others). Most radiochemistry students spend their summer terms at national laboratories where specialized equipment is available, working with leading experts in the country. Research in the radiochemistry group is focused on radioanalytical and separation chemistry of actinides and important metal fission products and application of radiotracers to solution of industrial, medical, environmental and nuclear forensic problems. Complexation of these metals with natural and man-made ligands; their reduction-oxidation reactions, sorption, effects of radiolysis and hydrolysis greatly affect their behavior in natural environment or in separation processes of the used nuclear fuel. Projects are oriented toward the development of new separation methods and materials (compounds, resins) for the recovery of
desired radionuclides. These methods also have applications in the remediation of contaminated sites and environmental barriers. (see Dr. Paulenova) Major radiochemistry research areas include:

**Fuel Cycle Chemistry:** Recovery of actinides, lanthanides and other fission products produced by the nuclear reaction not only minimizes the residual radioactive waste but also allows for recycling of useful fuel components (U, Pu, Am) for further power generation in mixed-oxide fuels. The future of the industry relies on the advancement of separation and transmutation technology to ensure environmental protection, criticality-safety and non-proliferation (i.e., security) of radioactive materials by reducing their long-term radiological hazard.

**Nuclear Forensics and Radioanalysis:** Development of radiochemical sensors for rapid analysis (preparation of counting samples, minimization of procedures and automation) are important for first response and nuclear forensics.

**Radiation Chemistry:** Research focused on the behavior of materials under the influence of a strong radiation environment. Breaking bonds in materials and creating new ones significantly affects their stability and behavior. The post-irradiation changes in materials caused by gamma irradiation (Co-60 source in Radiation Center) are quantified spectroscopically (XRD, Vis-NIR, FTIR) and microscopically and related to the applied radiation dose.

**Environmental Radiochemistry:** A key part of radioecology as the understanding the chemical behavior of radionuclides in the natural bio-geochemical system is essential to assessing potential environmental risks reliably. Chemistry of actinides and fission products in the natural environment, including and the impact of natural organic matter on their migration is studied and principles of geochemical modeling coupled sorption, colloidal transport and radiological properties are applied to assessment of geological repositories performance and remediation concepts for contaminated sites.
Facilities

The Department of Nuclear Engineering and Radiation Health Physics is housed in the Radiation Center, an instructional and research facility established specifically to accommodate research programs involving nuclear science and engineering, to provide a location for the use of radionuclides and ionizing radiation sources, and to provide sources of fast and thermal neutrons and gamma rays. Major facilities at the OSU Radiation Center include: a 1.1 MW TRIGA research reactor and associated facilities, including a rotating sample rack, a pneumatic transfer irradiation system, a thermal column, in-core irradiation tubes (with and without cadmium), and four beam port facilities; a cobalt-60 gamma-ray irradiator; state-of-the-art digital gamma-ray spectrometers and associated germanium detectors; and various radiochemistry laboratories.

The Department of Nuclear Engineering and Radiation Health Physics is equipped with state-of-the-art nuclear and radiation protection instrumentation and computing facilities. Computers include a number of PC and UNIX based workstations. The department’s computers also provide access through networking to larger computers, such as supercomputing facilities, on and off campus. In addition to radiation facilities, there are laboratories dedicated to the investigation of other phenomena important to the study of Nuclear Science and Engineering, including a number of large-scale experimental test facilities. The major facilities and laboratories are:

1. **1.1 MW TRIGA Mark II Pulsing Research Reactor** is a water-cooled, swimming pool type of research reactor which uses uranium/zirconium hydride fuel elements in a circular grid array. The reactor is licensed by the U.S. Nuclear Regulatory Commission to operate at maximum steady state power of 1.1 MW, and can also be pulsed up to a peak power of about 3000 MW. The reactor has a variety of irradiation facilities available.

2. **ATHRL - Advanced Thermal Hydraulic Research Facilities** incorporates two facilities: Advanced Plant Experiment (APEX), a three story test facility that assess the safety systems of Westinghouse’s next generation of nuclear power plants (AP600, APEX-CE, and AP1000), and the Multi-Application Small Light Water Reactor (MASLWR) test facility, a Generation IV design concept. ATHRL offers excellent opportunities for student research and training in instrumentation, quality assurance, safety, operations, and nuclear and mechanical design.

3. **ANSEL - The Advanced Nuclear Systems Engineering Laboratory** is the home to two major thermal-hydraulic test facilities—the High Temperature Test Facility (HTTF) and the Hydro-mechanical Fuel Test Facility (HMFTF). The HTTF is a 1/4 scale model of the Modular High Temperature Gas Reactor. The vessel has a ceramic lined upper head and shroud capable of operation at 850°C (well mixed helium). The design will allow for a maximum operating pressure of 1.0MPa and a maximum core ceramic temperature of 1600°C. The nominal working fluid will be helium with a core power of approximately 600 kW (note that electrical heaters are used to simulate the core power). The test facility also includes a scaled reactor cavity cooling system, a circulator and a heat sink in order to complete the cycle. The HTTF can be used to simulate a wide range of accident scenarios in gas reactors to include the depressurized conduction cooldown and pressurized conduction cooldown events. The HMFTF is a testing facility which will be used to produce a database of hydro-mechanical information to supplement the qualification of the prototypic ultrahigh density U-Mo Low Enriched Uranium fuel which will be implemented into the U.S. High Performance Research Reactors upon their conversion to low enriched fuel. This data in turn will be used to verify current theoretical hydro- and thermo-mechanical codes being used during safety analyses. The maximum operational pressure of the HMFTF is 600 psig with a maximum operational temperature of 450°F.
TRUELAB - Laboratory of Transuranic Elements is a state-of-art radiochemical research laboratory, equipped with a variety of instrumentation for characterization of actinides and fission products and their chemical reactivity with organic and inorganic ligands and evaluation of postirradiation changes in solutions: Vibrational spectroscopy (Nicolet Fourier Transformation Infrared and Raman and FTIR and Raman spectroscopy) which allow to characterization of solid and liquid samples, Microcalorimetry (quantification of chemical thermodynamics of studied processes); UV-Vis and NIR spectroscopy (speciation of irradiated solutions, complexation of actinides in aqueous and organic matrices) with the stop-flow cell and syringe titrator; Dionex Ion-exchange and Finnigan liquid chromatography, potentiometric titration, glove box, electrochemistry (cyclic voltammetry). Preparation of samples for LSC and alpha-and gamma spectrometry.

Other Labs and Facilities: Cobalt-60 Gamma Irradiator; Neutron Radiography facility; Neutron Activation facility, Gamma and Alpha Spectrometry laboratory; Liquid Scintillation Counter (LSC Perkin Elmer); Radiological Instrument Calibration facilities; Thermoluminescent Dosimetry systems; large inventory of radiation detection instrumentation; student computer laboratory; student nuclear instrumentation laboratory; green house and wet chemistry laboratories.

OHSU Radiation Medicine: At OHSU four Varian linear accelerators (one Tomo HD, two Trilogy and one NovalisTX with high definition MLC), one Elekta Synergy and one Varian 2100 are used to provide external beam electron and photon radiotherapy. Image guidance consists of on-board imagers at all LINACs with both kV-kV and cone beam CT capabilities. Calypso radio frequency beacon localization, BrainLab ExacTrac fluoroscopy and VisionRT optical guidance imaging is utilized as part of a full service image guidance program. An in-room diagnostic quality CT scanner is located and mates with NovalisTX table. The department has a Philips Brilliance BigBore CT scanner with respiratory gating capabilities for 4D CT based simulation. The department also has available a 4D PET CT scanner that can be utilized for biologic functional treatment planning. External beam treatment systems consist of Philips Pinnacle 3, Varian Eclipse, Nomos Corvus, BrainLab iPlan and Monaco system. These systems are used for CT-based 3D treatment planning, inverse modulated radiation therapy (IMRT), dynamic conformal arc therapy, stereotactic body radiotherapy, RapidArc, VMAT and Linac-based radiosurgery. The department uses high-dose rate (HDR) Iridium-192 for the majority of its brachytherapy needs. In addition, brachytherapy sources, and a strontium applicator are kept in the department. Radioactive Iodine-125 seeds and Iridium-192 are ordered for individual cases as needed. We have an active I-125 eye plaque brachytherapy program for choroidal melanomas with the Casey Eye Institute using the BeBig treatment planning system. We have an interstitial brachytherapy program which includes therapy for prostate cancer, soft tissue sarcoma and even for lung cancers participating in an ACOSOG multi-institutional protocol. We use the Varian Variseed treatment planning system. Intra-operative breast treatments are also offered with the Zeiss Intrabeam device.
ACADEMICS

GENERAL INFORMATION
Graduate students are expected to read the academic policies governing graduate students listed on university websites, which include but are not limited to the OSU Catalog, the Graduate School’s website and the Student Conduct Regulations. The information herein addresses only a few topics regarding those policies.

ACADEMIC PERFORMANCE
A graduate student is expected to maintain a grade point average of 3.00 or better in (1) each registered quarter, (2) each major or minor field in his/her program, and (3) in his/her overall cumulative graduate program at Oregon State University. Grades below “C” (2.00) cannot be used on a graduate program of study. Failure to maintain these standards is considered grounds for terminating a student’s program and/or financial support. See the Dismissal From Graduate School section below for more details.

Note that a cumulative GPA of 3.00 is required before the final oral or written exam may be undertaken.

GRADUATE ASSISTANTSHIPS
Graduate research or teaching assistants may be appointed on a term-by-term basis (3 months), an academic-year (9-month) basis or a full-year (12-month) basis. No appointment can be for less than 0.20 FTE (“full-time equivalence”) or more than 0.49 FTE. All graduate assistants are required to carry out the duties assigned by their faculty supervisor to justify their stipend. For example, graduate assistants on a 0.40 FTE appointment are expected to provide an average of 16 hours of service per week. This service may be in addition to the time required to complete the thesis research. Graduate assistants at other FTE levels would provide proportional levels of service.

University policy dictates that a graduate assistant must be enrolled for no less than 12 credit hours in any term in which he or she is supported, except for summer term which requires a minimum of 9 credit hours.

Additionally, students who hold multiple jobs on campus may not work more than a total of 20 hours per week or 255 hours per term for all positions held. Maintaining a GPA of 3.00 or better is required in order for continued financial support.

REGISTRATION
Students register for courses online at the Student Online Services site. For convenience, students should have their proposed schedule (including CRNs) in front of them at the time of registration. The OSU ID number and GAP are required for registration.

Minimum Registration Requirements
- **EVERY** student must register for a minimum of 3 credits, including
  - Any Summer term in which a student enrolls.
  - The term in which a thesis or dissertation (MS or PhD) is defended or comprehensive oral exam (MHP or MEng) is taken.
  - Any term a student uses university space and facilities or requires supervision of the major professor, regardless of the student’s location (on-campus or Ecampus).
- **TAs / RAs must register for at least 12 credits** (Fall – Spring terms).
• Auditing a class or enrolling in Continuing Higher Education, Ecampus classes, and other self-support programs may not be used to satisfy enrollment requirements for graduate assistant tuition remission.

• **Students receiving financial aid** must contact the Financial Aid Office for specific registration requirements per term. Students must notify Financial Aid if they plan on enrolling less than full time.

**Maximum Registration Requirements**

• Grad students can register for a maximum of 16 credits each term without needing permission. Students should always consult with the major professor about class schedules to ensure proper progression toward the degree.

• Students must receive permission from their major professor and the Grad School to register beyond 16 credits.

**Full-Time and Part-Time Enrollment**

• Full-time status is an enrollment of 9 credits per term (including Summer).

• Financial Aid for part-time graduate students is evaluated on the basis of their part-time enrollment; students must contact Financial Aid for specific requirements.

**TUITION BILLS**

Students are sent an email to their ONID email account when their statement is ready to view and can then view their eBill statement online at http://mybill.oregonstate.edu. All billing for currently enrolled students is processed electronically through eBill on the 5th of each month.

Unpaid balances as of the 1st of the month following the eBill statement are considered past due, and will be assessed interest at the rate of 1% per month (12% APR). Students are financially responsible for all courses for which they register. Students are responsible for paying fees by the deadline even if they do not receive a bill.

Medical physics (MP) students taking courses at OHSU (years 2), will register for classes through OSU, but will pay student health fees and OHSU campus-specific fees to OHSU by using their U Number and login provided by OHSU at orientation. Students are responsible for paying outstanding balances to OHSU prior to final defense.

Please direct any questions about tuition, fees, and financial aid to the Business Affairs Office.

**HEALTH INSURANCE / DENTAL INSURANCE (Medical Physics Student Requirement)**

As of July 1, 2013, graduate students in medical physics in the Oregon Medical Physics Program will be required to purchase OHSU Health & Dental Insurance during the whole of their tenure in the program. Information on the plans can be found at:

http://www.ohsu.edu/xd/education/student-services/joseph-trainer-health-wellness-center/form-policies-resources.cfm

The policy is through AETNA and provides excellent coverage.

Students will review and pay these OHSU health insurance bills online using their “U number” and login
information (provided at orientation or immediately prior to Fall Term of Year 1).

In the event a medical physics student withdraws or changes majors, it is the sole responsibility of this student to contact OHSU regarding this change of student status to avoid continuing health insurance and campus fee charges.

**Proof of Insurance Coverage (submit to OHSU) – WAIVER PROCESS**

In the event a student has coverage believed to be equivalent to that provided by the required OHSU plans, they must submit proof of insurance coverage to OHSU **by the process and deadlines** set forth by OHSU. Successful waiver submissions will remove the mandatory charges from your OHSU bill. The forms can be found at:

http://www.ohsu.edu/xd/education/student-services/joseph-trainer-health-wellness-center/form-policies-resources.cfm

**LEAVE OF ABSENCE**

You must fill out a Leave of Absence form and have it approved by the Graduate School (at least 15 business days prior to the start of the term) if you need to take off a term (Fall, Winter, or Spring) for any reason.

- You are limited to three leaves of absence during your program. Some students (e.g. military students called to duty) have more flexibility in the number of leaves allowed by the Graduate School.
- Notify the department secretary if you need to take a leave.
- You never need to fill out a leave form for Summer term.
- If you do NOT fill out a leave form, you will have to reapply (including paying the application fee) AND register for 3 graduate credits for each term of the unauthorized break in registration and register for at least 3 credits for the term you are readmitted, e.g., 6 credits for one missed term.

- For more information about the Graduate School’s policies,
  - See the OSU Catalog under “Policies Governing All Graduate Programs” and “Registration Requirements” OR
  - Contact the OSU Graduate School at 541-737-4881.

**SUMMER TERM**

The University requires that graduate students who occupy labs, office space, or utilize University facilities during the summer quarter register and pay fees. Graduate Assistants on appointment during the summer term must register for a minimum of 9 credits (full-time enrollment).

**DISMISSAL FROM GRADUATE SCHOOL**

It is imperative that all students read the Student Conduct Regulations to be aware of actions that may lead to the dismissal process: [http://catalog.oregonstate.edu/ChapterDetail.aspx?key=38](http://catalog.oregonstate.edu/ChapterDetail.aspx?key=38)

Medical physics (MP) students must additionally observe OHSU’s policies, which address dismissive actions:

[http://www.ohsu.edu/xd/education/schools/school-of-medicine/academic-programs/graduate-](http://www.ohsu.edu/xd/education/schools/school-of-medicine/academic-programs/graduate-...
This additional MP requirement is in large part due to the medical nature of the practice of medical physics in a hospital / research setting.

**BASIC REQUIREMENTS FOR ALL GRADUATE DEGREES**

**Department Seminar:** All graduate students are expected to take a departmental seminar course (NE/RHP/MP 507/607) each enrolled term; this is intended to develop your understanding of the profession and to develop presentation skills. Additional requirements may be set by the student’s major or minor professor, by the Department, or by the student’s advisory committee as needed to strengthen his or her background.

**Graduate Minor:** OSU does not require graduate students in engineering to pursue a minor. However, if desired, a minor may be selected. The minor may be a recognized department minor, a recognized integrated minor, or a student-designed/committee-approved minor. Speak with your major professor for more details on minors.

**Program of Study:** All students are required to complete a Program of Study outlining the courses they will take to complete their degree requirements. The Program of Study is a contract between the student, the Department, and the University (the Graduate School). For degrees within the Master’s Program, students must consult and receive approval (signature) from the individual major professor and minor professor. In the case of Doctoral Program degree seeking students, all committee members must approve the Program of Study. Students must then receive the signature of the Department Head prior to submitting the form to the Grad School (see Sections: Master’s Program and Doctoral Program). The Program form must be completed before you complete 18 credit hours.

Visit the Grad School’s “Forms” website for a blank form and instructions on how to fill out the Program of Study. You may need to reference the Graduate School website for further details.
http://oregonstate.edu/dept/grad_school/forms.php

**RESEARCH INTEGRITY**

The conduct of research is a central educational component for the Masters of Science or Doctor of Philosophy degree. The conduct of research bears with it certain ethical and legal responsibilities. It is the expectation of the Department that you conduct your research activities with the highest standards of integrity, including compliance with all ethical, regulatory and University requirements. To support you in this, you will receive mentoring from your academic advisor pertaining to research integrity. On the Graduate School Program of Study form, your Ethical Research Training can be documented using the following statement: “Training conducted by advisor as per the departmental assessment plan”.

Further information concerning Research Integrity including University policy can be found at the following website: http://oregonstate.edu/research/ori/index.htm

**GRAD 511 – DESIGNING A PATH FOR SUCCESS**

This class is a one-credit course taught by members of the Graduate School Leadership Team and other OSU faculty that will help students navigate the path toward degree completion and success. They will receive foundational knowledge about graduate school requirements, effective mentor/mentee relationships, financing their education, research integrity and professional conduct, innovation and commercialization, and other soft skills essential for their progress through a graduate program. The course also gives the student an opportunity to build community with other first-year graduate
students.
The Nuclear Engineering and Radiation Health Physics Department (NE/RHP) is made up of three programs: Nuclear Engineering, Radiation Health Physics, and Medical Physics. The Department offers the following Masters degrees:

- Masters of Science (MS);
- Masters of Engineering (MEng);
- Masters of Health Physics (MHP); and
- Masters of Medical Physics (MMP).

The NE and RHP degrees require a minimum of 45 credits to graduate; 24 credits must be graded graduate level NE or RHP courses. Additional credits above 45 may be required depending on the educational background of the student. Medical Physics degrees require a minimum of 60 credits to graduate; 39 credits must be didactic classroom and laboratory instruction, as well as either a full-time clinical practicum or a ten–week rotation depending on whether students choose to pursue a Radiation Therapy or Diagnostic Imaging specialty. All students must complete a Program of Study form (see Graduate School website) before completing 18 credits. All work must be completed within seven years, including transfer credits, course work, and the thesis / oral exam.

In addition to the formal requirements listed in the OSU Catalog (http://catalog.oregonstate.edu/), the NERHP Department has policies listed below with regard to the course of study for each Master’s degree.

As with all policy matters, students have the right to petition for deviation from departmental policies to the NERHP Department Graduate Committee. Such petitions must be made in writing, indicating the policy deviation requested and the reason(s) for the request. The decisions of the Department Graduate Committee are final.

**Masters of Science (NE, RHP, or MP)**

A thesis in the major area is required for the MS degree, and the thesis format is bound by the rules of the Graduate School. Visit the Graduate School’s website for details. Six of the required 45 graded credit hours must be Thesis credits; Ecampus MS students must register for on campus Thesis as an Ecampus version of the course does not exist at this time.

**Masters of Engineering (NE only) and Masters of Health Physics (RHP only)**

The MEng and MHP degree options provide students the opportunity to pursue advanced-level study without the requirement for a research thesis. A comprehensive oral exam is taken in lieu of the thesis requirement and course requirements are the same as for the MS degree. These degrees are intended as terminal degrees, not as preparation for a doctorate, and will emphasize job-related knowledge and skills. Although not required, students wishing to pursue a PhD one day are advised to pursue an MS degree, not the MEng or MHP.

**Minor (NE or RHP)**

A minor field of study is optional. If a minor is declared, however, the minor requirement specified by the Graduate School is 15 hours minimum. Master’s students are expected to take 18 hours or more of minor subject courses if the minor is “integrated”; i.e. it spans two or more departments. The NERHP Departmental Graduate Committee may apply suitable NE courses to such an integrated minor
requirement as long as the NE courses are not in your major area of concentration and they comprise less than one-half of the credits in the minor.

**MASTER’S THESIS**

The thesis demonstrates the student’s mastery of professional knowledge in a particular subject area of his/her chosen field. It must present innovative research or a novel application of a known methodology to appropriate problems. A conscientious survey of pertinent literature is a prerequisite to an acceptable thesis. The research topic must be approved by the major professor, and the research title must be registered with the Graduate School.

Since the thesis results from a significant body of work, the student is encouraged to publish the results of the thesis in the open literature. The student cannot schedule a defense exam with the Graduate School until the major professor approves the thesis for distribution to all committee members. Once approved, the student must submit a copy of the thesis to each committee member and complete the Event Scheduling Form with the Graduate School at least two weeks prior to the intended defense date. See your major professor for any other rules regarding thesis defense preparation requirements.

An MS candidate will be subjected to a two-hour final oral comprehensive examination, which includes a thesis research presentation and defense and questions on major, minor, and other pertinent academic subjects.

**Thesis Guide**

The Graduate School’s website has a complete guide to the thesis paper and the university requirements associated with the thesis. Students are encouraged to review the site, listed below, before starting to write the thesis to ensure understanding of the formatting, procedures, and deadlines. [http://oregonstate.edu/dept/grad_school/thesis.php](http://oregonstate.edu/dept/grad_school/thesis.php)

Medical physics (MP) students in this joint OSU / OHSU program may utilize either the OSU or OHSU formats, but must choose one with their advisor’s approval, at the beginning of research efforts. The OHSU thesis formatting found at:


If this format is chosen, all procedures of the OHSU MS process must be followed (i.e. must meet the OHSU deadlines, requirements, with associated form submissions).

**BOOKBINDING SERVICES IN CORVALLIS**

The department requires two bound copies of each thesis. Our students, including distance students, frequently use the following bookbinding company:

B & J Bookbinding
108 SW 3rd Street
Corvallis, OR 97333
Phone: 541-757-9861  E-mail: info@bjbookbinding.com
Fax: 541-757-6144  Website: [www.bjbookbinding.com](http://www.bjbookbinding.com)

**THESIS DEFENSE COMMITTEES (MS STUDENTS)**

1. The principal authority over a student’s program resides with the student’s Master’s Committee. This committee is responsible for:
   - assuring that University and Departmental requirements are satisfied; and
• administering the final oral examination.

2. The Committee consists of at least 4 members:
• the student’s major professor;
• one other NERHP faculty member;
• the student’s minor professor, or if no minor is selected, committee member may be from graduate faculty at-large; and
• the Graduate Council Representative.

Note that the composition of a student’s Master’s Committee MUST be approved by the major professor.

3. The committee is originally formed, with approval from the major professor, at the student’s invitation. The Graduate Council Representative is selected from a list provided by the Graduate School. The Graduate Council Representative is required to attend the final examination (thesis defense). Information on the GCR can be found at: http://oregonstate.edu/dept/grad_school/degreecommittee.php#council

NON-THESIS COMPREHENSIVE ORAL EXAM (MENG, MHP AND MMP STUDENTS)
The following guidelines are written to help the student prepare for the oral exam. In addition to these guidelines all rules of the Graduate School pertaining to final master’s oral exams must be adhered to.

1. The exam committee shall consist of the following:
• the student’s major professor;
• one other NERHP faculty member; and
• the student’s minor professor, or if no minor is selected, committee member must be from the department.

   Note: No Graduate Council Representative is required for the MHP or MEng oral exam.

2. The makeup of the exam committee must be approved by the student’s major professor.

3. The exam shall be scheduled by the student, after consultation with all committee members, for a two-hour period. Scheduling shall be done in accordance with rules of the Grad School.

4. The student shall be given the option of selecting an area of concentration for the exam. The majority of exam questions will then be derived from material in that area. Exam concentration areas must be discussed with the student’s major professor. The student must declare, to all committee members, his/her concentration choice at least one week prior to the exam.

5. Masters candidates who fail the oral examination on the first attempt may be given the opportunity, by the exam committee, to retake the exam (only once) or may be asked to leave the program without receiving the degree. Students are allowed to retake the exam one time only. Any student failing the second attempt will be dismissed from the program without receiving the degree.
MS / MENG IN NUCLEAR ENGINEERING

a. At a minimum, the student’s program shall contain the courses below (or be able to show equivalency);
b. Students without an NE background should take all of the courses below (or be able to show equivalency); and
c. The remainder of the student’s major program can be a compilation of any other 500 or 600 level classes as APPROVED by the major professor. Note that at least 24 credits must be graded graduate level NE or RHP courses.

<table>
<thead>
<tr>
<th>Major Core Courses For All NE Students</th>
<th>Number of Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE 553 Advanced Reactor Physics</td>
<td>3</td>
</tr>
<tr>
<td>NE 535 Radiation Shielding and External Dosimetry</td>
<td>4</td>
</tr>
<tr>
<td>NE 568 Nuclear Reactor Safety</td>
<td>3</td>
</tr>
<tr>
<td>NE 536 Advanced Instrumentation</td>
<td>4</td>
</tr>
<tr>
<td>NE 507 Seminar (three terms required)</td>
<td>3 (1 each)</td>
</tr>
</tbody>
</table>

Major Core Total (for all) 17

<table>
<thead>
<tr>
<th>Additional Requirements for Students w/o an NE Background</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NE 515 Nuclear Rules and Regulations</td>
<td>2</td>
</tr>
<tr>
<td>NE 531 Radiophysics</td>
<td>3</td>
</tr>
<tr>
<td>NE 551 Neutronics Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>NE 552 Neutronics Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>NE 567 Reactor Thermal Hydraulics</td>
<td>4</td>
</tr>
<tr>
<td>NE 573 Nuclear Reactor Systems Analysis</td>
<td>3</td>
</tr>
<tr>
<td>NE 557 Advanced Nuclear Reactor Lab</td>
<td>2</td>
</tr>
</tbody>
</table>

Total Additional Requirements 21

<table>
<thead>
<tr>
<th>Other Requirements / Electives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NE 503 Thesis (MS students)</td>
<td>6</td>
</tr>
<tr>
<td>500 or 600 level courses (electives) as approved by major professor</td>
<td>varies</td>
</tr>
</tbody>
</table>

Other Requirements / Electives Total varies

Minimum Required Credits for the Degree 45

NOTE: Term offerings may be subject to change. Consult the OSU Catalog each term.
**MS / MHP IN RADIATION HEALTH PHYSICS**

a. At a minimum, the student’s program shall contain the courses below (or be able to show equivalency);

b. These courses should be taken as soon as possible in preparation for the thesis. It is noted that not all courses shown below are offered every year.

c. The remainder of the student’s major program can be a compilation of any other 500 or 600 level classes as APPROVED by the major professor. Note that at least 24 credits must be graded graduate level NE or RHP courses.

d. E-Campus students are required to complete laboratory work on campus; this includes RHP 536 (and possibly Radiochemistry) which are normally held early summer. Additionally E-Campus students are required to complete their final oral exam on campus.

<table>
<thead>
<tr>
<th>Major Core Courses</th>
<th>Number of Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHP 515 Nuclear Rules &amp; Regulations</td>
<td>2</td>
</tr>
<tr>
<td>RHP 516 Radiochemistry OR RHP 519 Radiochemical Analytical Methods</td>
<td>4</td>
</tr>
<tr>
<td>RHP 531 Radiophysics</td>
<td>3</td>
</tr>
<tr>
<td>RHP 535 Radiation Shielding and External Dosimetry</td>
<td>4</td>
</tr>
<tr>
<td>RHP 536 Advanced Radiation Detection</td>
<td>4</td>
</tr>
<tr>
<td>RHP 582 Applied Radiation Safety</td>
<td>4</td>
</tr>
<tr>
<td>RHP 583 Radiation Biology</td>
<td>3</td>
</tr>
<tr>
<td>RHP 588 Radioecology</td>
<td>3</td>
</tr>
<tr>
<td>RHP 590 Internal Dosimetry</td>
<td>3</td>
</tr>
<tr>
<td>RHP 507 Seminar (three terms required)</td>
<td>3 (1 each)</td>
</tr>
</tbody>
</table>

**Major Core Total** 34

<table>
<thead>
<tr>
<th>Other Requirements / Electives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RHP 503 Thesis (MS students)</td>
<td>6</td>
</tr>
<tr>
<td>500 or 600 level courses (electives) as approved by major professor</td>
<td>varies</td>
</tr>
</tbody>
</table>

**Other Requirements / Electives Total** varies

**Minimum Required Credits for the Degree** 45

**Note:** Term offerings may be subject to change. Consult the OSU Catalog each term.
MS IN MEDICAL PHYSICS

a. At a minimum, the student’s program shall contain the courses below (or be able to show equivalency);
b. These courses should be taken as soon as possible in preparation for the thesis. It is noted that not all courses shown below are offered every year;
c. Beginning in 2014, after their first year of coursework, medical physics students will choose to pursue a track either in Radiation Therapy or in Diagnostic Imaging. Each track is laid out below, showing the courses required for all Medical Physics graduate students followed by the courses required specifically for the designated specialization.
d. Courses designated “(OHSU Campus)” will be offered only at OHSU in Portland. Students should assume all other courses will be offered at OSU in Corvallis.

<table>
<thead>
<tr>
<th>Major Core Courses; Required for All MP Students</th>
<th>Number of Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHP 521 Radiological Anatomy &amp; Physiology</td>
<td>4</td>
</tr>
<tr>
<td>RHP 531 Radiophysics</td>
<td>3</td>
</tr>
<tr>
<td>MP 535 Radiation Shielding &amp; External Dosimetry</td>
<td>4</td>
</tr>
<tr>
<td>MP 536 Advanced Radiation Detection</td>
<td>4</td>
</tr>
<tr>
<td>MP 583 Radiation Biology I</td>
<td>3</td>
</tr>
<tr>
<td>MP 584 Radiation Biology II</td>
<td>3</td>
</tr>
<tr>
<td>MP 562 Radiation Therapy Physics (OHSU Campus)</td>
<td>3</td>
</tr>
<tr>
<td>MP 541 Diagnostic Imaging Physics I (OHSU Campus)</td>
<td>3</td>
</tr>
<tr>
<td>MP 542 Diagnostic Imaging Physics II (OHSU Campus)</td>
<td>3</td>
</tr>
<tr>
<td>MP 507 Seminar Medical Physics (1 credit)</td>
<td>3 (total)</td>
</tr>
<tr>
<td><strong>AND</strong></td>
<td></td>
</tr>
<tr>
<td>MP 507 Seminar / Journal Club (1 credit/each; 2 credits needed)</td>
<td></td>
</tr>
<tr>
<td>ST 511 Methods of Data Analysis</td>
<td>4</td>
</tr>
<tr>
<td>PHL 544 Biomedical Ethics</td>
<td>4</td>
</tr>
<tr>
<td>MP 503 Thesis</td>
<td>6 (minimum)</td>
</tr>
<tr>
<td>Specialized Courses; Required for Radiation Therapy MP Students</td>
<td>Number of Credits</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>MP 563 Applied Radiation Therapy Physics Lab I (OHSU Campus)</td>
<td>3</td>
</tr>
<tr>
<td>MP 564 Applied Radiation Therapy Physics Lab II (OHSU Campus)</td>
<td>3</td>
</tr>
<tr>
<td>MP 510 Clinical Practice; 400 hours required (OHSU Campus)</td>
<td>3-12</td>
</tr>
<tr>
<td>Minimum Required Credits for the Degree</td>
<td>60</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specialized Courses; Required for Diagnostic Imaging MP Students</th>
<th>Number of Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 543 Advanced Diagnostic Imaging Physics (OHSU Campus)</td>
<td>3</td>
</tr>
<tr>
<td>MP 544 Nuclear Medicine Imaging (OHSU Campus)</td>
<td>3</td>
</tr>
<tr>
<td>MP 545 Diagnostic Imaging Physics Practicum (OHSU Campus)</td>
<td>3</td>
</tr>
<tr>
<td>Minimum Required Credits for the Degree</td>
<td>60</td>
</tr>
</tbody>
</table>

NOTE: Term offerings may be subject to change. Consult the OSU Catalog each term.

The following courses may be taken as electives (this is not a comprehensive list):
RHP 590 – Internal Dosimetry
RHP 513 – Radiation Chemistry
RHP 537 – Digital Radiation Measurements & Spectroscopy
<table>
<thead>
<tr>
<th>Check Box</th>
<th>Item #</th>
<th>Step</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Choose a major professor and a general thesis topic</td>
<td>By the end of your second term</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>File a Masters Program of Study form (Grad School website)</td>
<td>Before completing 18 credit hours</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Read the Thesis Guide on the Grad School’s website</td>
<td>Prior to starting your thesis</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Notify your major professor of your intended graduation term</td>
<td>AT LEAST 1 term before your intended graduation term</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Compare Program form and transcripts for consistency</td>
<td>1 term before your intended graduation term</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>File Petition to Change Program form if needed.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>File final Program of Study with Graduate School</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>File a Diploma Application (Grad School website)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>Generate Grad Council Rep (GCR) list (Grad School website) and contact those people until you find someone willing to serve as your GCR</td>
<td>15 weeks prior to final oral examination</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>Appoint Masters Committee w/approval of your major professor</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>11</td>
<td>Complete final draft of your thesis and submit it to your major professor for review and approval</td>
<td>By the start of your last term</td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>Decide on a day / time (2 hrs) with all Committee members (faculty &amp; Grad Council Rep)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>Reserve a room with the RC receptionist (Ecampus students need to contact the student liaison)</td>
<td>AT LEAST 2 weeks prior to final oral examination</td>
</tr>
<tr>
<td>14</td>
<td>14</td>
<td>Pick up copies of final oral examination scoring guide from student liaison</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>Fill out Exam Scheduling Form (Grad School website)</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>Submit thesis pretext pages to the Graduate School</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>17</td>
<td>Submit a final draft of the thesis to all committee members (with advisor’s approval)</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>18</td>
<td>Confirm final oral examination appointment with the Grad School (make sure it’s on their calendar!)</td>
<td>1 week after submitting exam scheduling form</td>
</tr>
<tr>
<td>19</td>
<td>19</td>
<td>Post fliers of your defense (day, time, room, topic, your name, etc.) around the RC E students must e-mail the Student Liaison about this</td>
<td>AT LEAST 1 week prior to final oral examination</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>Remind (e-mail) Committee of the final oral examination</td>
<td>2 days prior to final oral examination</td>
</tr>
<tr>
<td>21</td>
<td>21</td>
<td><strong>Final oral examination</strong></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>22</td>
<td>Complete thesis revisions, have major professor approve &amp; sign final version, and get 2 copies bound for the Department</td>
<td>Within 6 weeks of the exam or by the first day of the next term, whichever is first: if you miss the deadline, you will be required to register for an additional 3 credits, no exceptions!</td>
</tr>
<tr>
<td>23</td>
<td>23</td>
<td>Submit final copies (library, Grad School, and Department)</td>
<td></td>
</tr>
</tbody>
</table>
### Procedures for MEng, MMP and MHP Students

<table>
<thead>
<tr>
<th>Check Box</th>
<th>Item #</th>
<th>Step</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Choose a major professor (your advisor)</td>
<td>By the end of your second term</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>File a Masters Program of Study form (Grad School website)</td>
<td>Before completing 18 credit hours</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Notify your major professor of your intended graduation term</td>
<td>AT LEAST 1 term before your intended graduation term</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Choose an area of specialization within your major and notify your major professor of the area</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Compare Program form and transcripts for consistency</td>
<td>1 term before your intended graduation term</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>File Petition to Change Program form if needed.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>File final Program of Study with Graduate School</td>
<td>15 weeks prior to final oral examination</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>File a Diploma Application (Grad School website)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>Appoint Masters Committee w/approval of your major professor</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>Decide on a day / time (2 hrs) with all Committee members (faculty &amp; Grad Council Rep)</td>
<td>AT LEAST 2 weeks prior to final oral examination</td>
</tr>
<tr>
<td>11</td>
<td>11</td>
<td>Reserve a room with the RC receptionist (Ecampus students need to contact the student liaison)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>Pick up copies of final oral examination scoring guide from student liaison</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>Fill out Exam Scheduling Form (Grad School website)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>15</td>
<td>Confirm final oral examination appointment with the Grad School (make sure it’s on their calendar!)</td>
<td>1 week after submitting exam scheduling form</td>
</tr>
<tr>
<td>16</td>
<td>16</td>
<td>Remind (e-mail) Committee of the final oral examination</td>
<td>2 days prior to final oral examination</td>
</tr>
<tr>
<td>17</td>
<td>17</td>
<td>Final oral examination</td>
<td></td>
</tr>
</tbody>
</table>

**PROCEDURES LEADING TO A MASTER’S DEGREE**

Above is an outline of the steps required to obtain the Master’s degree. You should become familiar with the specific and detailed information contained in the Graduate School website as well as Departmental requirements. Final oral exams may be scheduled only during periods when classes are in session (including finals week).
The Nuclear Engineering and Radiation Health Physics Department (NE/RHP) offers Doctoral Degrees in the following programs:

- Nuclear Engineering (NE);
- Radiation Health Physics (RHP); and
- Medical Physics (MP).

**COURSE OF STUDY**

1. The university requirements for the doctorate include the following:
   a. at least 108 graduate credits beyond the bachelor’s degree;
   b. at least 50% of the course work must be graduate stand-alone courses;
   c. a presentation of an original dissertation for which a minimum of 36 credit hours of dissertation research (thesis course) has been accumulated;
   d. a minimum of one year of residence, continuously, at OSU (i.e., three consecutive quarters as a full-time student);
   e. passing a preliminary oral examination in the major subject; and
   f. successfully defending the dissertation in an oral presentation to a panel of experts.

For other regulations, see the OSU Catalog and Graduate School website.

2. In addition, departmental requirements include:
   a. passing a written qualifying examination for candidacy;
   b. on assignment from the student’s doctoral committee, taking and passing (B average or higher) such courses as judged desirable by the doctoral committee for satisfactory progress in doctoral research;
   c. calling regular (every 6 months recommended, but at least annual) meetings of the Doctoral Committee so that the student’s progress can be evaluated and guidance offered; and
   d. preparation and presentation of a written dissertation proposal - this paper will include a thorough literature review, outline of the proposed research project, and a description of the importance of the research with a perspective on the current state of the area of specialty. This written dissertation proposal will be delivered to the student’s committee a minimum of two weeks prior to the student’s Preliminary Oral Examination.

3. As noted above, the student’s principal direction in the course of study comes from the doctoral committee, in which the major professor has final approval. The NERHP Department members on the doctoral committee will generally expect to see:
   a. a minimum of 36 thesis credits; and
   b. total course work credit of 72 hours or more, not including thesis. The minimum Graduate School requirement is 108 hours, including thesis.

However, these are guidelines and the doctoral committee can change them at its discretion.
DOCTORAL COMMITTEES
1. The principal authority over a student’s program resides with the student’s Doctoral Committee. This committee is responsible for:
   - assuring that University and Departmental requirements are satisfied;
   - monitoring student progress;
   - assigning and approving courses of study;
   - approving dissertation topics and paths–forward; and
   - administering preliminary and final oral examinations.

2. The committee must include at least 5 members:
   - the student’s major professor;
   - two other NERHP faculty members;
   - the student’s minor professor, or if no minor is selected, committee member may be selected from the graduate faculty at–large; and
   - one Graduate Council Representative.

A student’s Doctoral Committee may contain more than 5 members. Any additional members beyond the required 5 must be chosen from the Approved Graduate Faculty List for NERHP maintained by the OSU Graduate School.

Note that the composition of a student’s Doctoral Committee MUST be approved by the major professor.

3. The committee is originally formed, with approval from the major professor, at the student’s invitation. The Graduate Council Representative is selected from a list provided by the Graduate School. The Graduate Council Representative is a permanent member of the committee and attends all committee meetings, including the preliminary program committee meeting, the oral preliminary exam, and the final examination (dissertation defense). Information on the GCR can be found at:

   http://oregonstate.edu/dept/grad_school/degreecommittee.php#council

4. The Committee should be appointed in the first term of attendance (matriculation).

MATRICULATION / CANDIDACY
1. Matriculation (first term of attendance) qualifies the student to:
   a. select a general area of dissertation research;
   b. form a doctoral committee with the major professor’s guidance and approval; and
   c. hold the initial doctoral program meeting (prior to completing 18 credit hours or sitting for the qualifying exam, whichever is earlier).

2. After matriculation, the student must pass a written qualifying examination (described below). This examination must be taken before the end of the first 18 months as a PhD student.

WRITTEN QUALIFYING EXAMINATIONS FOR DOCTORAL STUDENTS
1. A written exam (“the qualifier”) is required of all Ph.D. students. Upon passing the exam, the student is categorized as a Ph.D. “candidate.” An overall grade of 80% is required to pass the exam
2. The examination is offered once each year in Fall. Additional or alternate examination periods may be scheduled at the discretion of the Departmental Graduate Committee Chair.

3. The examination will be supervised and evaluated by an examination committee chosen from the departmental graduate faculty. The Chair of the Departmental Graduate Committee will chair the examination committee. If the Graduate Committee Chair has one of his/her students sitting for the qualifier, an alternate will be named to chair the exam committee.

4. All students entering the doctoral program are required to take the qualifying examination within 18 months of matriculation as a PhD student. Typically, those students entering without a Master’s degree in Medical Physics, Nuclear Engineering, or Radiation Health Physics from OSU will take the examination in the Fall term of their second year. Students continuing for the Ph.D. after receiving a Master’s degree in Medical Physics, Nuclear Engineering, or Radiation Health Physics at OSU generally will take the qualifying exam the next time it is offered after completion of their master’s final examination and thesis.

5. The examination will require two working days and will be divided into three subject areas with weights toward the total score as indicated:
   a. Basic Nuclear Interactions (35%), this section is common to all degrees (NE, RHP, or MP) and consisting of one, three-hour, closed-book written examination covering material typical to undergraduate degrees and/or graduate courses in nuclear interaction physics, etc. OSU Dept of Nuclear Engineering graduate courses covered in this part of the exam include:
      NE/RHP/MP 531 Radiophysics
      NE/RHP/MP 536 Advanced Radiation Detection and Measurement
   b. Core Nuclear Engineering, Radiation Health Physics or Medical Physics (40%), consisting of one, three-hour, closed-book written examination covering material typically found in the set of identified “core” graduate courses in NE, RHP or MP. OSU Dept of Nuclear Engineering courses covered in this part of the exam include:
      Medical Physics Core Courses
      MP 562 Radiation Therapy
      MP 541 Diagnostic Imaging Physics I
      MP 542 Diagnostic Imaging Physics II
      AND EITHER (Dependent on MP Track):
      MP 563 Applied Radiation Therapy Lab I
      OR
      MP 564 Applied Radiation Therapy Lab II
      OR
      MP 543 Advanced Imaging
      MP 544 Nuclear Medicine Imaging
   Nuclear Engineering Core Courses
      NE 551/552/553 Neutronics Analysis & Laboratory
      NE 567 Advanced Nuclear Reactor Thermal Hydraulics
NE 573 Nuclear Reactor Systems Analysis

Radiation Health Physics Core Courses
RHP 535 Radiation Shielding and External Dosimetry
RHP 582 Applied Radiation Safety
RHP 583 Radiation Biology
RHP 588 Radioecology
RHP 590 Internal Dosimetry

c. Nuclear Engineering, Radiation Health Physics, or Medical Physics Selected Topics (25%), consisting of one three-hour, closed-book written examination in specialized topics within each student’s approved graduate program of study. Student choice of topics will be solicited, but must be approved by the examination committee.

6. The student passes the qualifying exam with a total score of at least 80% and partial scores (in each of the three subject areas described in No. 5 above) of at least 70%. A student earning a total score between 70% and 80% or any partial score between 60% and 70%, shall stand for an oral examination by a committee of three faculty, appointed by the Chair of the examination committee. This oral examination shall take place within two weeks following student notification of any deficiency. Following this oral examination, the three-member committee will report the results to the examination committee where a decision will be made as to whether or not the student has passed the qualifier.

7. Prospective doctoral candidates failing the qualifying exam may retake the test the next time it is offered, and then only with the following privileges and exceptions:

   a. The student may retake the exam only once.

   b. If the student’s total score on the first exam is over 60%, re-examination need only be taken on those portions of the test (e.g. Basic Nuclear Interactions, Core Nuclear Engineer or Radiation Health Physics, individually selected topics) for which he/she received partial scores below 70%. The original scores above 70% will be considered when calculating the re-examination score. The recalculated total score must be greater than 80%.

8. Prospective doctoral candidates whose total grade falls below 60% on their first examination, may be dismissed from the program, or may at the discretion of the Departmental Graduate Committee, be given the opportunity to retake the entire exam.

9. Students should begin preparing for and complete the oral preliminary exam within six months after having passed the qualifying exam

PRELIMINARY ORAL EXAMINATION

Ph.D. candidates will present their proposed dissertation research as part of their preliminary exam. This formal seminar should be given within six months of passing the departmental qualifying examination and is to be a presentation of their planned research and a review of the literature supporting this plan. In preparation for the Preliminary Oral Examination, the student will prepare a written dissertation proposal and present this written proposal to their doctoral committee at least two
weeks prior to the Preliminary Oral Examination. This proposal will include a thorough literature review, an outline of the proposed research project, and a description of the importance of the research with a perspective on the current state of the area of specialty.

As a means for giving the student’s committee an early chance to help direct the doctoral research, the preliminary examination will start with the student presenting their written dissertation proposal and their proposed research direction. This will be a 30 minute (or amount of time determined by the major professor) presentation by the student on his/her proposed research. The committee will then discuss this research proposal with the student. The discussion is meant to identify strengths and weaknesses within the student’s preparation and proposal. It is intended to be a constructive critique of the progress achieved to date, as well as to provide focus for the student’s research. The oral preliminary examination will be scheduled for a minimum of two hours.

The remaining portion of the examination will focus on the student’s basic understanding of Medical Physics, Nuclear Engineering, or Radiation Health Physics (as covered in the qualifying examination) and the minor area(s), as well as all of the courses that the student has taken at OSU.

At least one complete academic term must elapse between the time of the preliminary oral examination and the final oral examination. If more than five years elapse between these two examinations, the candidate will be required to take another preliminary oral examination.

DOCTORAL DISSERTATION
The dissertation should be a significant research contribution publishable in a recognized professional journal and should demonstrate the student’s competence in conducting fundamental research. It must represent a significant contribution to the existing body of knowledge in Medical Physics, Nuclear Engineering, or Radiation Health Physics. The research topic must be approved by the student’s Graduate Committee and the dissertation title must be approved by the Graduate School. The dissertation must be based on the candidate’s own investigation, show a mastery of the literature of the subject, and be written in credible literary form. In order to have the efforts of the student recognized outside of OSU, the student must, in addition to dissertation requirements, prepare a paper which is suitable for submission to a recognized, scientific peer-reviewed journal. With your major professor’s approval, this requirement can be satisfied by utilizing the “manuscript format” for the dissertation. A final draft of this paper for submission must be presented to the major professor at least two weeks prior to the final oral examination. A thesis guide is available at the Graduate School website.

FINAL ORAL EXAMINATIONS
The dissertation defense will be scheduled for two hours at a minimum. The student is expected to display a mastery of knowledge in his/her field and professional maturity as a Medical Physicist, Nuclear Engineer, or Health Physicist.

PROCEDURES LEADING TO THE DOCTORAL DEGREE
Below is a brief list of the steps required to obtain the Ph.D. degree. You should also become familiar with the specific and detailed information contained in the OSU Catalog and the Graduate School website as well as Departmental requirements. Program meetings, preliminary oral exams, and final oral exams may be scheduled only during periods when classes are in session (including finals week).
# Procedures for PhD Students

<table>
<thead>
<tr>
<th>Item #</th>
<th>Step</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Generate Grad Council Rep (GCR) list (Grad School website) and contact those people until you find someone willing to serve as your GCR</td>
<td>During first term</td>
</tr>
<tr>
<td>1</td>
<td>Form Doctoral Committee in consultation with major professor</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Schedule doctoral program meeting with all committee members; reserve a RC room w/the RC receptionist</td>
<td>Before completing 18 hours; or, before taking qualifying exam (whichever is earliest)</td>
</tr>
<tr>
<td>3</td>
<td><strong>Doctoral program meeting</strong></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>File Doctoral Program of Study</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Take written qualifying exam; a notice will be sent regarding the exam days/times. Upon passing, the student becomes a PhD “Candidate”</td>
<td>Prior to 18 months after matriculation</td>
</tr>
<tr>
<td>6</td>
<td>Schedule the preliminary oral examination w/your committee</td>
<td>AT LEAST 2 weeks prior to preliminary oral examination</td>
</tr>
<tr>
<td>7</td>
<td>Reserve a room in the RC w/the receptionist for the preliminary oral examination</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Pick up copies of final oral examination scoring guide from student liaison</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Fill out Exam Scheduling Form (Grad School website)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Submit written dissertation research proposal to the entire Committee (with advisor’s approval)</td>
<td></td>
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<tr>
<td>11</td>
<td><strong>Preliminary oral examination</strong></td>
<td>NO LATER THAN 6 months after passing qualifying exam</td>
</tr>
<tr>
<td>12</td>
<td>Hold regular meetings with your Committee to keep them updated on your progress</td>
<td>Throughout your degree progression (at least once a year)</td>
</tr>
<tr>
<td>13</td>
<td>Read the Thesis Guide on the Grad School’s website</td>
<td>Prior to starting your dissertation</td>
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<tr>
<td>14</td>
<td>Compare Doctoral Program of Study form and transcripts for consistency</td>
<td>1 term before your intended graduation term</td>
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<tr>
<td>15</td>
<td>File Petition to Change Program form if needed</td>
<td>15 weeks prior to final oral examination</td>
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<tr>
<td>16</td>
<td>File a Diploma Application (Grad School website)</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Complete final draft of your dissertation and submit it to your major professor for review and approval</td>
<td>By the start of your last term</td>
</tr>
<tr>
<td>18</td>
<td>Schedule the final oral examination w/your committee</td>
<td>AT LEAST 2 weeks prior to final oral examination</td>
</tr>
<tr>
<td>19</td>
<td>Pick up copies of final oral examination scoring guide from student liaison</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Fill out Exam Scheduling Form (Grad School website)</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Submit thesis pretext pages to the Graduate School</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Submit a final draft dissertation to all committee members (with advisor’s approval)</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Confirm final oral examination appointment with the Grad School (make sure it’s on their calendar!)</td>
<td>1 week after submitting exam scheduling form</td>
</tr>
</tbody>
</table>
Post fliers of your defense (day, time, room, topic, your name, etc.) around the RC AT LEAST 1 week prior to final oral examination

<table>
<thead>
<tr>
<th>Procedures for PhD Students (continued)</th>
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<tbody>
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<td>28</td>
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<td>29</td>
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<td>30</td>
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NOTES ABOUT THE CHECKSHEET

The **Doctoral Program of Study** form is located on the Graduate School’s website. You should work with your advisor to fill out the Program of Study form before you hold your doctoral program meeting because your committee needs to approve the Program of Study before you can submit it to the Graduate School.

The **Written Qualifying exam** is offered only in the Fall term. Students who need to take the exam are notified of the exam dates near the beginning of the Fall term. Upon passing the exam, the student becomes a PhD ‘Candidate.’

For various reasons, changes often occur with the classes you plan to take and what you actually end up taking to earn your degree. When you graduate, the Program of Study must be 100% accurate. You should compare the program on file with your transcripts, which can be viewed by logging into Student Online Services. Make corrections by filling out the **Petition to Change the Program of Study form** at least one term before you plan to defend. You do not have to fill it out each time you deviate from your original program; however, you need to keep your committee informed of any and all changes since they are the ones who must approve your Program.

Give yourself and your committee members a lot of time to plan for the defense date. Sometimes committee members will be on sabbatical leave during the term in which you plan to defend. You should check with your committee members about such leaves far in advance to better plan, especially if you need to change a committee member for any reason.

The **Diploma Application** must be filed no later than week two of the term in which you defend. However, it is okay to fill out the form a term or two early. If you need to change your end term after you fill out the Diploma Application, just fill out the application again.

When you confirm your defense exam date with the Graduate School, you are making sure your exam is on their calendar. If they are not aware of your defense date, even if you filled out all the paperwork, you will not be able to defend and will have to reschedule.

The Graduate School has a **Thesis Guide** on their website, which explains the specific criteria for library copies of the dissertation. Students are encouraged to review the site, listed below, before starting to write the thesis to ensure understanding of the formatting, procedures, and deadlines. [http://oregonstate.edu/dept/grad_school/thesis.php](http://oregonstate.edu/dept/grad_school/thesis.php)
BOOKBINDING SERVICES IN CORVALLIS
The Department requires two bound copies of each thesis (an additional copy will be required for MP students for the OHSU Radiation Medicine Department). Our students, including distance students, frequently use the following bookbinding company:

B & J Bookbinding
108 SW 3rd Street
Corvallis, OR 97333
Phone: 541-757-9861 E-mail: info@bjbookbinding.com
Fax: 541-757-6144 Website: www.bjbookbinding.com