Medical Dosimetry Program
Student Handbook
2022-2023

Southern Illinois University Carbondale

Master of Science, Medical Dosimetry Program
Class Schedule 2022-2023

Fall Semester 2022- 20 weeks plus holiday break.
RAD 510- 2 hours- Simulation and Cross Sectional Anatomy in Medical Dosimetry
RAD 515- 4 hours- Medical Dosimetry Clinical I
RAD 520- 3 hours- The Physics of Medical Dosimetry
RAD 525- 3 hours- Seminar in Medical Dosimetry I
Semester Starts- August 15, 2022
Holiday Break- December 23, 2022 to January 2, 2023. Return to clinical January 3, 2023.
Semester Ends- January 8, 2023

Spring Semester 2023- 20 weeks
RAD 530- 2 hours- The Essentials of Medical Dosimetry
RAD 535- 4 hours- Medical Dosimetry Clinical II
RAD 540- 3 hours- The Physics of Medical Dosimetry II
RAD 545- 3 hours- Seminar in Medical Dosimetry II
Semester Starts- January 9, 2023
Semester Ends- May 26, 2023

Summer Semester 2023- 10 weeks which includes one week to make up time.
RAD 550- 2 hours- Medical Dosimetry Clinical III
RAD 555- 2 hours- The Physics of Medical Dosimetry III
RAD 560- 2 hours- Seminar in Medical Dosimetry III
Semester Starts- May 29, 2023
Semester Ends- August 4, 2023
Last day in clinic if no makeup time July 28, 2023
Make-up Week- July 31 – August 4, 2023

Holidays
Students will not have class or clinical practicum on the following holidays:
New Year's Day, Martin Luther King Day, Memorial Day, 4th of July, Labor Day, Veteran's Day, Day before Thanksgiving, Thanksgiving, Day after Thanksgiving, Christmas Eve, and Christmas.
Students must be present on all other holidays unless pre-approved by program director.

Southern Illinois University Carbondale
Medical Dosimetry Program

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Southern Illinois University Carbondale
Medical Dosimetry Program
Mission, Goals and Description

Mission

The mission of the Medical Dosimetry Program through Southern Illinois University Carbondale is to provide a quality program integrating education, research, and service in order to meet the needs of the profession and improve health care of the people and communities we serve.

Program Goals

1. Prepare the student to practice as a competent entry level professional Medical Dosimetrist by offering a comprehensive curriculum and quality didactic/clinical instruction
2. Provide didactic and clinical experiences that lead to research in educational, professional, or health care issues relating to medical dosimetry
3. Provide avenues to students for professional development and growth within the profession.
4. Provide avenues for students to develop and apply skills in effective communication necessary for successful medical dosimetry practice
5. Provide avenues for students to develop and apply skills in critical thinking and problem-solving necessary for successful medical dosimetry practice
6. Provide a clinical and didactic environment which leads to the development of clinical skills and competence appropriate to an entry level medical dosimetrist.

Program Description

The Medical Dosimetrist is a member of Allied Health and Radiation Oncology Team. The Program is located at Southern Illinois University Carbondale with clinic sites spread out at a distance.

Course material and practicum covers radiation physics, radiation protection, dose calculations, tumor localization, external beam treatment planning, brachytherapy, quality assurance, medical imaging/anatomy, clinical radiation oncology, and radiobiology. Clinical practicum includes external beam treatment planning, brachytherapy treatment, preparation and planning, chart reviews and dose calculations, record and verify system data entry, simulation (conventional and CT-simulation), treatment aid fabrication, treatment machine quality assurance, stereotactic treatment planning, gamma knife, IMRT planning and treatment. Special project assignments, conference attendance and presentation, and journal article reviews are also part of the curriculum.

The program is accredited by the Joint Review Committee on Education in Radiologic Technology (JRCERT). It meets the formal education eligibility criteria for the national certification exam as required by the Medical Dosimetry Certification Board.

Medical Dosimetry Educational Program
Student Policies and Contact Information

Program Director Contact Information
Scott Collins
Medical Dosimetry Program Director
School of Allied Health, MC 6615
College of Applied Sciences and Arts
Southern Illinois University Carbondale
Carbondale, Illinois 62901
Office: 618-453-8800
Fax: 618-453-7020

Clinic Coordinator Contact Information
Rick McKinnies
Medical Dosimetry Clinic Coordinator
School of Allied Health, MC 6615
College of Applied Sciences and Arts
Southern Illinois University Carbondale
Carbondale, Illinois 62901
Office: 618-453-7260
Fax: 618-453-7020

Hours
7:30am – 4:30pm
Hours vary depending upon the clinical rotation requirements. Students may need to remain in clinic beyond the normal hours in order to complete a project related to their learning.

Clinic Site	Phone Number	Clinical Instructors
Alexian Brothers Medical Center 820 Biesterfield Elk Grove Village	847-956-5143	Caulie Stricker and Karen Carden
Allegheny General Hospital, Allegheny Health Network 320 E. North Ave. Pittsburg, PA		Lori Slack and Matthew Goss
Altru Cancer Center PO Box 6002, 960 Columbia Rd. S. Grand Forks, ND 58206-6002	701-780-5835 and 701-780-5418	Kent Perrin, Aaron Kempenich
Arch Cancer Care 12855 N. Forty Dr. St. Louis, MO 63141	314-523-5444	Chad Gerber and Megan Speth
Avera Cancer Institute 1000 E 23rd St. Suite 100 Sioux Falls, SD	606-430-1109	Jamie Harris, Grant Foster, and Katie Van Beek
Baptist Health Paducah 2501 Kentucky Ave Paducah, KY 42003	270-575-2724	Dana Noles and Robert Gandy
Baptist Health South Florida-Miami Cancer Institute (MCI) 8900 N. Kendall Drive Miami, FL	786-527-7631	Alonso Gutierrez, Nicole McAllister, and Zachary Fellows
Barnes-Jewish Hospital Siteman Cancer Center Mailstop 90-38-635, 4921 Parkview Place St. Louis, Missouri 63110	Ext. Beam: 314- 362-2117 Brachy: 314-362-7872	Rudi Bertrand, Andrew Lindsay, Lisa Westfall, and Tami Jamruk
Bothwell Regional Health Center 601 E. 14th Street Sedalia, MO 65301	660-827-9442	Russ Gerber, Jonathan Monsan, Lisa Wells, and Peter Situ
Butler Cancer Center-Allegheny Health Network 160 Hollywood Dr. Butler, PA		Matthew Goss and Valerie DeMartino
Cancer Care Center of O'Fallon-Radiation Oncology HSHS St. Elizabeth's 321 Regency Park O'Fallon, IL		Chad Gerber and Sue Haselhorst
Chancellor Center for Oncology 4055 Gateway Boulevard Newburgh, IN	812-858-2264	Wesley Groves
CHI Health Bergan Mercy Hospital 7500 Mercy Rd. Omaha, NE 68124	402-398-5902	Rodney Tjeerdsma, Rick Zastera, and Kristin Kirlin
CHI Health Good Samaritan 10 E 31st St Kearny, NE 68847	308-627-6866	Dale Brummer and Brian Hill
CHI Health Immanuel Hospital 6901 N. 72nd Street Omaha, NE 68122	402-330-4367	Mark Cipolla and Jason Revers
CHI Health Lakeside Hospital 16901 Lakeside Hills Ct Omaha, NE 68130	402-717-8000	Tracy Brown, Colville Osborne, and Kassia Ulffers
Christus Health Southwestern 524 Dr. Michael DeBakey Drive Lake Charles, LA	337-491-7569	Todd Herbert, Sherry Campbell, Danny Landry, and Travis Zalman
Cox Medical Center Branson 525 Branson Landing Blvd Branson, MO 65616	417-348-8912	Diana Sharp, Randall Moore, and Benjamin Morris

Emory-Grady Memorial Hospital 80 Jesse Hill Jr Dr. Atlanta, GA		Christie Jarrio, Marian Axente, Jon Wolf, and Sean Dresser
Emory-St. Joseph Hospital 5665 Peachtree Dunwoody Rd. Atlanta, GA		Ernesto Gutierrez, Saleem Abdullah, Jon Wolf, and Sean Dresser
Emory Clinic Department of Radiation Oncology at Emory University Hospital Midtown 550 Peachtree St. NE Atlanta, GA 30308	404-778-3871 or 404-686-4427	Oluwatosin Kayode, Daisy Whitaker, Jon Wolf, and Christie Shackelford Jarrio
Emory Clinic 1365 Clifton Road NE Atlanta, GA 30322	404-778-3892	Oluwatosin Kayode, Daisy Whitaker, Jon Wolf, and Christie Shackelford Jarrio
Emory Decatur Hospital 2701 N. Decatur Rd. Decatur, GA		Amanda Knight, Jason Savarese, and Sean Dresser
Emory Proton Therapy Center 615 Peachtree St. NE. Atlanta, GA		Katja Langen, Mingyao Zhu, Jon Wolf, and Mosa Pasha
Essentia Health, South University Clinic 1702 South University Drive Fargo, ND 58103	701-364-6223	Jesse Belschner
Evansville Cancer Center 700 N. Burkhardt Road Evansville, IN 47715	812-550-0381	Joshua Hayes
Freeman Hospital East 932 E 34th Street Joplin, MO 64804	417-347-6661	Russ Gerber
Health First Corporation 1130 S. Hickory St. Building A. Melbourne, FL 32901	321-745-5251	Richard Clements and Linda Johnson
Henry Ford Health System 2799 W. Grand Blvd Detroit, MI 48202	313-556-8450	Indrin Chetty, Samer Delly, and Anthony Doemer
Hultson Cancer Center of Cox Health 3850 South National Avenue Springfield, MO 65807	417-269-5309	William Clouse, Niam Ozturk, and Jeff Robinson
June E. Nylen Cancer Center 230 Nebraska St. Sioux City, IA 51101	712-252-0088	Brian Hill and Andrea Hessenius
Kansas City Cancer Center (University of Kansas Health System) 8700 N. Greenhills Road Kansas City, MO 64154	913-541-4623	Seth Rhodes and Valerie Radice
Kansas City Cancer Center (University of Kansas Health System) 4881 NE Goodview Circle Lee's Summit, MO 64064	913-574-2396	Jacqueline Smith
Kansas City Cancer Center (University of Kansas Health System) 12200 W. 110th Street Overland Park, KS 66210	913-749-4447 or 816-350-5866	Jeanine Turner and Seth Rhodes
Lake Charles Memorial Hospital 1701 Oak Park Boulevard Lake Charles, LA 70601	337-494-2121	Dave Quinn
Lake Regional Health System 54 Hospital Drive Osage Beach, MO 65065	573-302-2777	Russ Gerber, Stacy Anstine, and Marcy Maxwell
Marry Bird Perkins Cancer Center – Baton Rouge 4950 Essen Ln Baton Rouge, LA 70809	225-215-1146	Jonas Fontenot and Eddie Singleton
Mary Bird Perkins Cancer Center – St. Tammany Parish Hospital 1203 S. Tyler St. Covington, LA 70433	225-215-1146	Janis Mayfield and Eddie Singleton
McLaren Port Huron Karmanos 1221 Pine Grove Ave Port Huron, MI	810-989-1020	Pete Girimonte and Ben Catt
Memorial Medical Center 701 North First ST. Springfield, IL		Brindy Rogers and Neelu Soni
Mercy Hospital 2055 S. Fremont Springfield, MO 65804	417-820-2000	Neelu Soni and Christine Drennan
MidMichigan Medical Center-Midland 4005 Orchard Drive Midland, MI 48670	989-839-1319	Tiffany Smith, Courtney Szelesi, Carol Brines, and Victor Hosfeld
Minneapolis Radiation oncology-Brainerd Radiation Therapy 215 Ivy St. Brainerd, MN		Barbara J. Murphy and Michael Staryszak
Minneapolis Radiation Oncology – North Radiation Therapy Center 3435 West Broadway Robbinsdale, MN 55433	763-521-1426	Sara Way and Greg Klein
Minneapolis Radiation Oncology – Radiation Therapy Fairview Southdale 6401 France Ave. South Edina, MN 55435	952-920-8477	Mary Fox and Mary Rosene

Minneapolis Radiation Oncology – Ridges Radiation Therapy Center 201 E. Nicollet Blvd Burnsville, MN 55337	952-435-8668	Sally Lee
Minneapolis Radiation Oncology – Ridgeview Regional Rad Onc 560 S. Maple, Ste 10 Waconia, MN 55387	954-442-6000	Barb Murphy, Scott Prader, and Ryan Malmin
Minneapolis Radiation Oncology – Unity Radiation Therapy Center 550 Osborne Rd. Fridley, MN 55432	763-784-1182	Raj Varadahan and Barb Murphy
North Alabama Cancer Care-Singing River Cancer Center 180 Cox Creek Parkway Florence, AL		Andrew Minetree and Michael Biddy
North Kansas City Hospital 2800 Clay Edwards Drive North Kansas City, MO 64116	913-234-0501	John Otis
North Macomb Radiation Oncology Center 17900 23 Mile Road, Suite 103 Macomb Township, MI 48044	313-647-3126	Kimberly Taylor, Martha Phillips, Gayle Vesco, Kimberly Secor, Rachel Powell, Lorraine Carroll, Allan Reyes, Jeff Colvin, Roy Taylor, and Carol Hackenberger
Northwestern Memorial Hospital Dept. of Radiation Oncology 251 E Huron St Galter Pavilion, LC-178 Chicago, IL 60610	312-926-3974	Natasha Murphy and Matthew Wozniak
Nova Scotia Health Authority 5820 University Avenue Halifax, NS B3H 1V7	902-473-6020	James Robar, Lucy Ward, and Cheryl Anderson
OHSU Knight Cancer Clinic 15700 SW Greystone CT Beaverton, OR 97006	971-235-6402	Wolfram Laub and Barbara Agrimson
Oklahoma Cancer Specialists and Research Institute 12697 E 51st Street South Tulsa, OK 74146	918-499-2130	Jeanne Bailey
Oncology Hematology Associates of Southwest Indiana AKA St. Vincent 3699 Epworth Road Newburgh, IN 47630	812-471-1200	John Zhang and Tammy Frazier
Oregon Health and Science University (OHSU) Dept of Radiation Medicine, KPV4 3181 S.W. Sam Jackson Park Road, L337 Portland, OR 97239	971-235-6402	James Tanyi and Barbara Agrimson
ProMedica Flower Hospital DBA 5200 Harroun Rd. Sylvania, OH	419-824-8823, 419-824-1017	Ladonna Hartsing, Qin-Sheng Chen, and Sharon Nugent
Rhode Island Hospital 593 Eddy St. Providence, RI 02903	401-606-4283	Eric Klein and Michelle Schwer
Rohnert Park Cancer Center 301 Professional Center Drive Rohnert Park, CA 94928	615-491-2704	Chis Scarfone and Michelle Tate
Rush University Medical Center 500 S. Paulina Street Chicago, IL 60612	312-563-5751	Julius Turian and James Chu
Sacred Heart Health System, Inc. 5151 North Ninth Avenue Pensacola, FL	850-416-1791	Rachel Dency, Teresa Sweatt, and Jeremy Whitford
Siteman Cancer Center at Barnes-Jewish St. Peter's Hospital 150 Entrance Way St. Peters, Missouri 63376	636- 916-9941	Bruce Gu, Megan Brown, and Sarah Mitchell
South Broward Hospital DBA Memorial Healthcare 3501 Johnson St. Hollywood, FL 33021	954-987-2000	Yunkai Zang and Vidia Nathasingh
Southeast Missouri Hospital 1701 Lacey Street Cape Girardeau, MO 63701	573-519-4700	Mark Mayhew, Dr. Samuel Hancock
Cancer Partners of Nebraska – PKA Southeast Nebraska Cancer Center 3901 Pine Lake Road, Suite 111 Lincoln, NE 68516	402-481-6090	Stacie Paul
SSM DePaul Health Center 12303 DePaul Drive St. Louis, Missouri 63044-2588	314- 344-6092 Ext. 2847	Patricia Karfs
SSM St. Clare Hospital 1011 Bowles Ave. Suite G50 Fenton, MO 63026	636-496-4616	Jeff Anderson and Mark Pohlman
SSM St. Joseph Medical Park 1475 Kisker Rd. Saint Charles, MO 63304	314-941-1030	Julie Hammond
SSM St. Mary's Health Center 6420 Clayton Road Richmond Heights, MO 63117-1872	636-496-4616	Lindsey Launius and Adam Gage
St. Alexius Medical Center 1555 Barrington Rd. Hoffman Estates, IL 60169	847-981-2058	Karen Carden

St. Francis Hospital 6161 South Yale Tulsa, Oklahoma 74136	918-494-1585	Russell L. Gerber
St. John Hospital, Van Elslander Cancer Center 19229 Mack Ave, Suite 10 Grosse Pointe Woods, MI 48236	586-573-5863 or 313-547-3125	Allan Reyes, Lorraine Carroll, Carol Hackenberger, Jeff Colvin, Roy Taylor, and Jim Boyland
Ascension Macomb-Oakland Hospital – Warren Campus (previously St. John's Macomb) Webber Cancer Center 11800 E. 12 Mile Road Warren, MI 48093	586-573-5863	Kimberly Secor, Rachel Powell, Martha Phillips, Jeff Colvin, Jim Boyland, and Carol Hackenberger
St. John Providence Health System Providence & Providence Park Hospitals 47601 Grand River Ave Novi, MI 48075	248-849-8619	Eric Short and Vrinda Narayana
St. Mary's Hospital 400 North Pleasant Avenue Centralia, IL 62801	618-436-8000	Jeffrey Raines
SUNY Upstate Cancer Center 750 E. Adams St. Syracuse, NY		Katrina Stellingwerf and SaRena Eves
University of Cincinnati Medical Center 234 Goodman Street Cincinnati, OH 45219	513-584-2810	Michael Davis and Max Richardson
The University of Kansas Hospital (University of Kansas Health System) Radiation Oncology, Bldg 58 3901 Rainbow Blvd Kansas City, Kansas 66160	913-588-3600	Rajeev Badku, Megan Smith, Seth Rhodes, and Danielle Stevenson
University of Texas Southwestern Medical Center 2280 Inwood Road Dallas, TX 75235	214-648-4927 – Romona 214-648-8026 - Jeff	Mu-Han Lin, Andrew Godley, Nincent Lanza, Jeffery Dubas, Romona Duncan, John "Chris" Brooks, and Catie Wallace
US Cancer Management-Rohnert Park Cancer Center 301 Professional Center Drive Rohnert Park, CA 94928	615-491-2704	Chis Scarfone and Kyle Johnson
Via Christi Hospitals Wichita AKA Ascencion 929 N. St. Francis Street Wichita, KS 67214	316-268-6023	Jeffrey Barry and Christopher Limes
West Michigan Cancer Center 200 North Park Street Kalamazoo, MI 49007	269-373-7407	Dr. Paul Jursinic and Wayne Kersley
Wexford Health & Wellness Pavilion-Allegheny Health Network 12311 Perry Highway Wexford, PA		Danielle Waters and Matthew Goss

Emergency/Safety Orientation
The first day of attending a new clinical facility a student will participate in an emergency procedures/safety orientation specific to the facility. This at a minimum must address hazards (fire, electrical, chemical), emergency preparedness, medical emergencies, HIPAA, and Standard Precautions. Radiation safety should also be discussed.

Attendance
Students must report to assigned class or clinical rotation for the duration of hours specified by schedule, unless pre-approved by program director for absence or tardiness. If a student misses 4 days throughout the program their clinical grade will be lowered one letter grade. If a student missed six or more days during the year, the student can be removed from the program.

The student is expected to report to the clinical facility at the designated time. Tardiness is not considered responsible, professional behavior. Three late arrivals, each in excess of 10 minutes, will be considered the equivalent of one absence for grade determination. It is the student's responsibility to call the Clinical Instructor within 30 minutes **prior** of the beginning of the clinical time period if you are not going to be present or if you are going to be late. Failure to do this will result in two points being deducted from the final clinical grade average for <u>each</u> infraction.

Vacation
Students receive ten days of vacation, which must be taken during the one year program. One of the weeks will be taken around the Christmas and New Year break and the other will be at the end of the program year. Students are allowed one personal day and two interview days while in the program. The interview days require documentation and may only be taken during the spring or summer semesters.

Holiday
Students will not have class or clinical practicum on hospital holidays:
New Year's Day, Martin Luther King Day, Memorial Day, 4th of July, Labor Day, Veteran's Day, Day before Thanksgiving, Thanksgiving, Day after Thanksgiving, Christmas Eve, and Christmas. Students must be present on all other holidays unless pre-approved by program director.

Sick Time
Student must contact clinic instructor/program director in all cases if sick, by 7:45 a.m. that morning. Any time missed by student due to calling in sick must made up. If student misses class time, he/she is responsible to contact instructor and make up missed information – notes, quiz, or exam. If student misses clinical rotation he/she must make up time within scheduled dates of particular clinical rotation – extra hours/day - early and late. Students may also make up time during scheduled vacations. Student may not exceed more than 40 hours/week. If a prolonged illness or injury occurs which would not allow a student to make up the time prior to the end of the current semester, SIU's "Incomplete" policy will be followed.

Inclement Weather Policy
If bad weather (snow, ice, flooding, tornado, earthquake, etc.) occurs on a clinical day, the student is responsible for finding out if the local university in the clinical site area is closed. Make sure to coordinate which university to use with your clinic instructor. If they are closed due to hazardous road conditions, then the student is excused from going to clinical even though SIUC may be open. The student must write "Snow Day" on this/her Time Sheet, and this absence will be verified by the Clinical Supervisor. If the local university is open but the student cannot get to his/her clinical site, then he/she must make up the day.

Please note: All unexcused "snow days" must be made-up. If the public elementary schools are closed due to temperature extremes (frigid cold, oppressive heat, etc.) the student is still expected to go to clinical as originally scheduled.

Dress Code
All clothing and jewelry must be consistent with professional/business dress standards applicable to the work responsibilities involved, and must be appropriate for reasonably anticipated public contact. Students should wear a white mid length lab coat at all times. Students dress clothes should be neatly pressed for a professional appearance. Males should also wear a tie. Dress shoes should also be worn however no open toe dress shoes are allowed.

All students must wear the SIU student name badge each clinical day. For facilities that supply the student with a separate badge, the identification badge must be worn so that the picture, name and department are easily visible at all times.

Hair, including beards and mustaches, must be clean, neatly groomed, and kept in such a way as not to interfere with student duties or safety. Hair that is longer than the collar on males, or longer than the shoulder on females, is to be pulled back and fastened to prevent contamination and to decrease the spread of microorganisms such as pseudomonas and staphylococcus. Only natural hair colors are allowed. Beards and mustaches cannot be longer than ¼ inch.

Make up, perfume and cologne are to be moderately applied.

Fingernails are to be clean, trimmed, and extend no further than 1/4" beyond fingertips. Clear or conservative light-colored nail polish may be worn.

No visible tattoos area allowed. Piercings are limited to ears only (one set of earrings).

Disability, Illness, Pregnancy
The Program Faculty will work with SIU's Disability Office to determine if a student may continue the Program should illness or disability arise. The decision will be made on an individual basis, taking into account the nature and degree of the disability, as well as a physician's recommendation that the student may continue the program.

If a student becomes pregnant while in the program the pregnancy policy in this handbook will be followed.

Students must make up all missed clinic and class time. Students unable to complete assigned time commitment by end of program, will not graduate until they successfully complete class and clinical rotations.

Health Insurance – Emergency Situation
If a SIU student has an emergency they are to go to a local hospital ER or Urgent Care clinic.

Student Resources
For a complete list of student resources to include counseling, testing, and financial aid services visit:
https://gradschool.siu.edu/student-resources/

Radiation Monitoring
All students must wear a personnel monitoring device at all times in the clinic. Exposure reports will be available for review once processed via Desire2Learn. If a dose reading exceeds normal limits (≥0.125 Rem or ≥1.25 mSv per quarter) the student will be contacted by SIUC's RSO or the program personnel. In the event an accidental exposure occurs, the student must notify the Program Director regarding the incident. The Program Director will work with the Radiation Safety Officer and make a plan of action for the event. If the badge is lost, damaged, or any other concerns, please contact the Program Director.

Direct Supervision Policy
All procedures performed by a student while at clinical must be directly supervised by a qualified practitioner. This individual will review the procedure in relation to the student's achievement, evaluates the condition of the patient in relation to the student's knowledge, is present during the procedure, and reviews and approves the procedure. All clinical work performed by a student must be checked prior to clinical implementation. Anytime a student is having direct contact with a patient, facility personnel must be present. This is applicable to simulation, fabrication immobilization devices and all other activities related to patient care.

Corrective Action and Grievance Process
The Medical Dosimetry Program Director must address issues in which the student fails to follow dosimetry program curriculum guidelines or university policies.

If issue is related to curriculum or clinical policy,

- Program Director determines necessary course of action and presents to student.
- If student wishes to appeal the Program Director's decision, the student may contact the Director of the School of Health Sciences at 618-453-8860. Grievance procedures are possible through the College of Applied Sciences and Arts Grievance Committee.

If the student wishes to contact the Joint Review Committee Education in Radiologic Technology (JRCERT) regarding a situation they may do so with the following information: All JRCERT Standards for Accreditation are listed on their website as well.

JRCERT	Phone: (312) 704-5300
20 N. Wacker Drive	Fax: (312) 704-5304
Suite 2850	E-mail: mail@jrcert.org
Chicago, IL 60606-3182	Website: www.jrcert.org

Distance Learning
All didactic instruction will be via distance learning technology (DL). The lectures will be recorded and posted to SIUC's Desire2Learn Learning system. This will allow the students to watch the lectures at a later date if they want to review the material or in case there is a network problem.

Students will need to register with the Desire2Learn system at the following web address: https://online.siu.edu

Students will be responsible for posting all assignments through Desire2Learn. All quizzes and tests will be administered via this system as well. Students will use the Desire2Learn software while taking these quizzes/tests.

Classroom behavior/Conduct Code:
The classroom is a "safe" environment for students. The focus will be on learning. Causing disruptions, harassment of other students, foul language, disrespect for others, or entertaining at someone else's expense will not be tolerated. For a detailed explanation of Student Code, consult "Student Conduct Code" found in Important information for siuc students, faculty, and staff. pp. 22-32. All other rules of the code must be followed. The Student Conduct Code is available at: http://www.siuc.edu/~policies/policies/conduct.html

Workplace Hazards, Harassment, Communicable Disease, and Substance Abuse
In the event that a student is concerned with workplace hazards, harassment, communicable diseases, or substance abuse, he/she should contact the Program Director or faculty immediately. The Program Director will work with the facility to ensure the safety of the student.

Academic Honesty:
All students are expected to adhere to a strict code of academic honesty. Academic dishonesty will be addressed according to the "Policies and Procedures Applicable to Academic Dishonesty" as stated in the "Important Information for Students, Faculty, & Staff" booklet.

From the "Student Conduct Code", section II, article A:

Acts of Academic Dishonesty:

1. Plagiarism, representing the work of another as one's own work;
2. Preparing work for another that is to be used as that person's own work;
3. Cheating by any method or means;
4. Knowingly and willfully falsifying or manufacturing scientific or educational data and representing the same to be the result of scientific or scholarly experiment or research;
5. Knowingly furnishing false information to a university official relative to academic matters;
6. Soliciting, aiding, abetting, concealing, or attempting conduct in violation of this code.

Sanctions will be imposed for violations of this policy in accordance with the Student Conduct Code. A copy of the "Important Information for Students, Faculty & Staff" booklet can be obtained from the Office of the Vice Chancellor for Student Affairs, Mailcode 4308, Southern Illinois University, Carbondale, IL 62901-4308.

Master of Science Curriculum

Fall Semester

RAD 510-2 Simulation and Cross Sectional Anatomy in Medical Dosimetry - This course covers the conventional and CT simulation techniques used in initiating radiation therapy for cancer patients. Identification of cross-sectional anatomy at different anatomical locations within the human body is also reviewed. This course is twenty weeks in length. Prerequisite: Admission to the Medical Dosimetry Program.

RAD 515-4 Medical Dosimetry Clinical I - This is the first course of a three course sequence. During the three course sequence, students will complete eight clinical rotations including Brachytherapy, Simulation, Gamma Knife, Treatment Aids, IMRT, External Beam, Physics, Special Measurements and QA. The length of these rotations varies from one to eleven weeks. During this course students will perform two to four of these rotations depending on the rotation schedule. While in the clinical setting students will observe and work directly with a medical dosimetrist. Emphasis is given on learning and understanding the role and responsibilities of a medical dosimetrist in the clinical setting. This course is twenty weeks in length. Prerequisite: Admission to the Medical Dosimetry Program.

RAD 520-3 The Physics of Medical Dosimetry I- This course covers the following topics: Radiologic Physics, production of x-rays, radiation treatment and simulation machines, interactions of ionizing radiation, radiation measurements, dose calculations, computerized treatment planning, dose calculation algorithms, electron beam characteristics, and brachytherapy physics and procedures. This course is twenty weeks in length. Prerequisite: Admission to the Medical Dosimetry Program.

RAD 525-3 Seminars in Medical Dosimetry I - This course consists of various seminars/literature reviews associated with radiation oncology. Topics include treatment techniques for various cancers, technological advances in cancer treatment, cancer treatment trends, and the role of a medical dosimetrist. This course is twenty weeks in length. Prerequisite: Admission to the Medical Dosimetry Program.

Spring Semester

RAD 530-2 The Essentials of Medical Dosimetry - This course covers the various quality assurance procedures performed in a radiation oncology department. Also included are various statistics topics to educate the student in becoming a good consumer of medical dosimetry research literature. Professional development, billing/coding, HIPAA, and professional service are also addressed. This course is twenty weeks in length. Prerequisite: A grade of "C" or better in RAD 510, RAD 515, RAD 520, and RAD 525.

RAD 535-4 Medical Dosimetry Clinical II - This is the second of a three course sequence. During the three course sequence, students will complete eight clinical rotations including Brachytherapy, Simulation, Gamma Knife, Treatment Aids, IMRT, External Beam, Physics, Special Measurements and QA. The length of these rotations varies from one to eleven weeks. During this course students will perform two to four of these rotations depending on the rotation schedule. While in the clinical setting students will observe and work directly with a medical dosimetrist. Emphasis is given on learning and understanding the role and responsibilities of a medical dosimetrist in the clinical setting. This course is twenty weeks in length. Prerequisite: A grade of "C" or better in RAD 515.

RAD 540-3 The Physics of Medical Dosimetry II – This course covers the following topics: imaging for radiation oncology, IMRT, stereotactic radiosurgery, special procedures, particle therapy, hyperthermia, and radiation safety. This course is twenty weeks in length. Prerequisite: A grade of "C" or better in RAD 520.

RAD 545-3 Seminar in Medical Dosimetry II - This course consists of various seminars/literature reviews associated with radiation oncology. Topics include treatment techniques for various cancers, technological advances in cancer treatment, cancer treatment trends, and the role of a medical dosimetrist. Prerequisite: This course is twenty weeks in length. Prerequisite: A grade of "C" or better in RAD 525.

Summer Semester

RAD 550-2 Medical Dosimetry Clinical III - This is the third course of a three course sequence. During the three course sequence, students will complete eight clinical rotations including Brachytherapy, Simulation, Gamma Knife, Treatment Aids, IMRT, External Beam, Physics, Special Measurements and QA. The length of these rotations varies from one to ten weeks. During this course students will perform one to two of these rotations depending on the rotation schedule. While in the clinical setting students will observe and work directly with a medical dosimetrist. Emphasis is given on learning and understanding the role and responsibilities of a medical dosimetrist in the clinical setting. This course is ten weeks in length. Prerequisite: Prerequisite: A grade of "C" or better in RAD 535.

RAD 555-2 The Physics of Medical Dosimetry III – This course covers the following topics: Monitor Unit (MU) calculations, point dose calculations and radiation biology. This course is ten weeks in length. Prerequisite: A grade of "C" or better in RAD 540.

RAD 560-2 Seminar in Medical Dosimetry III - This course consists of various seminars/literature reviews associated with radiation oncology. Topics include treatment techniques for various cancers, technological advances in cancer treatment, cancer treatment trends, and the role of a medical dosimetrist. This course is ten weeks in length. Prerequisite: A grade of "C" or better in RAD 545.

RAD 510
Simulation and Cross Sectional Anatomy in Medical Dosimetry
Fall Semester Syllabus

COURSE DEFINITION:
RAD 510-2 Simulation and Cross Sectional Anatomy in Medical Dosimetry - This course covers the conventional and CT simulation techniques used in initiating radiation therapy for cancer patients. Identification of cross-sectional anatomy at different anatomical locations within the human body is also reviewed. This course is twenty weeks in length. Prerequisite: Admission to the Medical Dosimetry Program.

COURSE OBJECTIVES:

1. Demonstrate an understanding of Radiation Safety.
2. Demonstrate an understanding of CT simulation procedures.
2. Demonstrate an understanding of conventional simulation procedures.
3. Demonstrate an understanding of the cross sectional anatomy of the human body.
4. Demonstrate an understanding of the role of a medical dosimetrist.

COURSE OUTLINE:

Topics
1. Radiation Safety
2. CT simulation procedures
3. Conventional simulation procedures
4. Cranial cross sectional anatomy
4. Thorax cross sectional anatomy
5. Abdominal cross sectional anatomy
6. Pelvic cross sectional anatomy

COURSE REQUIREMENTS:

Purchase all texts, attend all lectures, and complete required examinations and quizzes. Participate in clinical internship. Purchase a T130XA scientific calculator.

PREREQUISITES: Admittance to the Medical Dosimetry Program.

TEXTBOOKS:

Required:
- Khan, F. M. (2020). *The physics of radiation therapy* (6th ed.). Philadelphia: Wolters Kluwer
- Khan, F.M. (2016). *Treatment planning in radiation oncology* (4th ed.). Philadelphia: Wolters Kluwer
- Washington, C. M., & Leaver, D. T. (2019). *Principles and practices of radiation therapy* (5th Ed). St. Louis: Mosby.

Optional: (Students typically use clinical sites' copy)
- Bentel, G. C. (1992). *Radiation therapy planning* (2nd ed.). New York: McGraw-Hill.
- Vann, A. M., et. al. (2013). *Portal design in radiation therapy* (3rd ed.). Augusta, Georgia: DMV Enterprises.
- Students should reference the nccn.org website for information. You will have to create a username and login.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Test Performance	70%
Quizzes/Homework's/Presentations	30%

Late work will not be accepted. No credit will be awarded for work submitted after the deadline.

Note: An overall GPA of 3.0 or greater in all graduate coursework is required to successfully complete the Medical Dosimetry Program. This is a SIUC Graduate School Policy.

RAD 515
Medical Dosimetry Clinical I
Fall Semester Syllabus

COURSE DEFINITION:
RAD 515-4 Medical Dosimetry Clinical I - This is the first course of a three course sequence. During the three course sequence, students will complete eight clinical rotations including Brachytherapy, Simulation, Gamma Knife, Treatment Aids, IMRT, External Beam, Physics, Special Measurements and QA. The length of these rotations varies from one to eleven weeks. During this course students will perform two to four of these rotations depending on the rotation schedule. While in the clinical setting students will observe and work directly with a medical dosimetrist. Emphasis is given on learning and understanding the role and responsibilities of a medical dosimetrist in the clinical setting. This course is twenty weeks in length. Prerequisite: Admission to the Medical Dosimetry Program.

COURSE OBJECTIVES:

1. Demonstrate an understanding of the basic clinical concepts of medical dosimetry.
2. Demonstrate an understanding of theory and principles of operation of treatment planning computers.
3. Demonstrate an understanding of the different types of radiation production.
4. Understand and calculate radiation attenuation and decay.
5. Demonstrate an understanding of the different types of radiation detectors.
6. Demonstrate a basic understanding of treatment planning.
7. Demonstrate an understanding of the role of a medical dosimetrist.

COURSE OUTLINE:

Topics
1. Clinical rotations
2. Perform clinical competencies
3. External beam calculations
4. Brachytherapy calculations
5. Physics procedures

COURSE REQUIREMENTS:

Purchase all texts. Participate in clinical internship and purchase a T130XA scientific calculator.

PREREQUISITES: Admittance to the Medical Dosimetry Program.

TEXTBOOKS:

Required:
- Khan, F. M. (2020). *The physics of radiation therapy* (6th ed.). Philadelphia: Wolters Kluwer
- Khan, F.M. (2016). *Treatment planning in radiation oncology* (4th ed.). Philadelphia: Wolters Kluwer
- Washington, C. M., & Leaver, D. T. (2019). *Principles and practices of radiation therapy* (5th Ed). St. Louis: Mosby.

Optional: (Students typically use clinical sites' copy)
- Bentel, G. C. (1992). *Radiation therapy planning* (2nd ed.). New York: McGraw-Hill.
- Vann, A. M., et. al. (2013). *Portal design in radiation therapy* (3rd ed.). Augusta, Georgia: DMV Enterprises.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Growth Evaluations	50%
Clinical Competencies & Reports	40%
Weekly Journal	10%

Late work will not be accepted. No credit will be awarded for work submitted after the deadline.

Note: An overall GPA of 3.0 or greater in all graduate coursework is required to successfully complete the Medical Dosimetry Program. This is a SIUC Graduate School Policy.

If a student receives two or more Growth Evaluations that are an 80% or below during one semester; their continuation in the Medical Dosimetry Program is at the discretion of the Program Director and Clinical Instructor. It is expected that all students consistently show "normal progress" in the development of their dosimetry skills and always demonstrate a positive attitude. Not meeting the normal progress guidelines justifies removal from the program as well. A grade of an "F" will be given for the semester in which the student is removed from the program.

If a student is removed from a clinical site for behavioral reasons, they must leave immediately and will not be allowed to continue the Medical Dosimetry Program. A grade of an "F" will be given for the semester they are removed.

All students must meet the minimum number of clinical competencies and show normal progress per rotation to continue with the program as there is no time available to go back and retake a specific clinical rotation. **By the end of the Fall semester, a student must have completed and posted 40 competencies and reports to meet normal progress guidelines.** All clinical competencies must be completed by the end of the summer semester to successfully complete the program. If has 7 total failed competencies (throughout entire program) or fails a particular competency 4 times, a student will be removed from the program. A grade of an "F" will be given for the semester in which the student does not fulfill the competency requirements.

If a student misses 4 days throughout the program their clinical grade will be lowered one letter grade. If a student misses six or more days during the year, the student can be removed from the program.

RAD 520
The Physics of Medical Dosimetry I
Fall Semester Syllabus

COURSE DEFINITION:
RAD 520-3 The Physics of Medical Dosimetry I- This course covers the following topics: Radiologic Physics, production of x-rays, radiation treatment and simulation machines, interactions of ionizing radiation, radiation measurements, dose calculations, computerized treatment planning, dose calculation algorithms, electron beam characteristics, and brachytherapy physics and procedures. This course is twenty weeks in length. Prerequisite: Admission to the Medical Dosimetry Program.

COURSE OBJECTIVES:

1. Demonstrate an understanding of radiation physics for photons and electrons.
2. Demonstrate an understanding of the different types of radiation production.
3. Demonstrate an understanding of radiation dose calculations and algorithms.
4. Understand brachytherapy procedures and calculate radiation attenuation and decay.
5. Demonstrate an understanding of the different types of radiation detectors.
6. Demonstrate an understanding of general treatment planning.

COURSE OUTLINE:

Topics
1. Radiation physics
2. Radiation generators
3. External beam calculations
4. Brachytherapy calculations
5. Treatment planning
6. Electron beam physics

COURSE REQUIREMENTS:

Purchase all texts, attend all lectures, and complete required examinations, quizzes, and homeworks. Purchase a T130XA scientific calculator.

PREREQUISITES: Admittance to the Medical Dosimetry Program.

TEXTBOOKS:

Required:
- Khan, F. M. (2020). *The physics of radiation therapy* (6th ed.). Philadelphia: Wolters Kluwer
- Khan, F.M. (2016). *Treatment planning in radiation oncology* (4th ed.). Philadelphia: Wolters Kluwer
- Washington, C. M., & Leaver, D. T. (2019). *Principles and practices of radiation therapy* (5th Ed). St. Louis: Mosby.

Optional: (Students typically use clinical sites' copy)
- Bentel, G. C. (1992). *Radiation therapy planning* (2nd ed.). New York: McGraw-Hill.
- Vann, A. M., et. al. (2013). *Portal design in radiation therapy* (3rd ed.). Augusta, Georgia: DMV Enterprises.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Test Performance	65%
Quizzes/Homework	35%

Late work will not be accepted. No credit will be awarded for work submitted after the deadline.

Note: An overall GPA of 3.0 or greater in all graduate coursework is required to successfully complete the Medical Dosimetry Program. This is a SIUC Graduate School Policy.

RAD 525
Seminars in Medical Dosimetry I
Fall Semester Syllabus

COURSE DEFINITION:
RAD 525-3 Seminars in Medical Dosimetry I - This course consists of various seminars/literature reviews associated with radiation oncology. Topics include treatment techniques for various cancers, technological advances in cancer treatment, cancer treatment trends, and the role of a medical dosimetrist. This course is twenty weeks in length. Prerequisite: Admission to the Medical Dosimetry Program.

COURSE OBJECTIVES:

1. Demonstrate an understanding of the basic clinical concepts in radiation oncology.
2. Demonstrate an understanding of how different cancers are treated.
3. Demonstrate an understanding of the latest technologies in radiation oncology.
4. Demonstrate a basic understanding of treatment planning.
5. Demonstrate an understanding of the role of a medical dosimetrist.

COURSE OUTLINE:

Topics
1. Clinical concepts in radiation oncology
2. Treatment methods
3. New technologies
4. Treatment planning

COURSE REQUIREMENTS:

Attend clinical conferences or perform journal article summaries.

PREREQUISITES: Admittance to the Medical Dosimetry Program.

TEXTBOOKS: NA

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by timely completion of:

Conference/Journal Article Summaries	70%
Research Papers	30%

Late work will not be accepted. No credit will be awarded for work submitted after the deadline.

Note: An overall GPA of 3.0 or greater in all graduate coursework is required to successfully complete the Medical Dosimetry Program. This is a SIUC Graduate School Policy.

RAD 530
The Essentials of Medical Dosimetry
Spring Semester Syllabus

COURSE DEFINITION:
RAD 530-2 The Essentials of Medical Dosimetry - This course covers the various quality assurance procedures performed in a radiation oncology department. Also included are various statistics topics to educate the student in becoming a good consumer of medical dosimetry research literature. Professional development, billing/coding, HIPAA, and professional service are also addressed. This course is twenty weeks in length. Prerequisite: A grade of "C" or better in RAD 510, RAD 515, RAD 520, and RAD 525.

COURSE OBJECTIVES:

1. Demonstrate an understanding of quality assurance procedures.
2. Demonstrate an understanding of statistics/research terms.
3. Demonstrate an understanding of professional development.
4. Demonstrate an understanding of billing/coding and HIPAA.
5. Demonstrate an understanding of professional service in the field of medical dosimetry.

COURSE OUTLINE:

Topics
1. Quality assurance
2. Statistical terminology
3. Professional development
4. Resumes
5. Billing/coding
6. HIPAA
7. Professional service

COURSE REQUIREMENTS:

Purchase all texts, attend all lectures, and complete required examinations, quizzes, and homework. Purchase a T130XA scientific calculator.

PREREQUISITES: A grade of "C" or better in RAD 510, RAD 515, RAD 520, and RAD 525.

TEXTBOOKS:
Required:
- Khan, F. M. (2020). *The physics of radiation therapy* (6th ed.). Philadelphia: Wolters Kluwer
- Khan, F.M. (2016). *Treatment planning in radiation oncology* (4th ed.). Philadelphia: Wolters Kluwer
- Washington, C. M., & Leaver, D. T. (2019). *Principles and practices of radiation therapy* (5th Ed). St. Louis: Mosby.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Test Performance	70%
Quizzes/Homework/Presentations/Papers	30%

Late work will not be accepted. No credit will be awarded for work submitted after the deadline.
Note: An overall GPA of 3.0 or greater in all graduate coursework is required to successfully complete the Medical Dosimetry Program. This is a SIUC Graduate School Policy.

RAD 535
Medical Dosimetry Clinical II
Spring Semester Syllabus

COURSE DEFINITION:
RAD 535-4 Medical Dosimetry Clinical II - This is the second of a three course sequence. During the three course sequence, students will complete eight clinical rotations including Brachytherapy, Simulation, Gamma Knife, Treatment Aids, IMRT, External Beam, Physics, Special Measurements and QA. The length of these rotations varies from one to eleven weeks. During this course students will perform two to four of these rotations depending on the rotation schedule. While in the clinical setting students will observe and work directly with a medical dosimetrist. Emphasis is given on learning and understanding the role and responsibilities of a medical dosimetrist in the clinical setting. This course is twenty weeks in length. Prerequisite: A grade of "C" or better in RAD 515.

COURSE OBJECTIVES:

1. Demonstrate an understanding of the basic clinical concepts of medical dosimetry.
2. Demonstrate an understanding of theory and principles of operation of treatment planning computers.
3. Demonstrate an understanding of the different types of radiation production.
4. Understand and calculate radiation attenuation and decay.
5. Demonstrate an understanding of the different types of radiation detectors.
6. Demonstrate a basic understanding of treatment planning.
7. Demonstrate an understanding of the role of a medical dosimetrist.

COURSE OUTLINE:

Topics
1. Clinical rotations
2. Perform clinical competencies
3. External beam calculations
4. Brachytherapy calculations
5. Physics procedures

COURSE REQUIREMENTS:

Purchase all texts. Participate in clinical internship and purchase a T130XA scientific calculator.

PREREQUISITES: A grade of "C" or better in RAD 515.

TEXTBOOKS:

Required:

- Khan, F. M. (2020). *The physics of radiation therapy* (6th ed.). Philadelphia: Wolters Kluwer
- Khan, F.M. (2016). *Treatment planning in radiation oncology* (4th ed.). Philadelphia: Wolters Kluwer
- Washington, C. M., & Leaver, D. T. (2019). *Principles and practices of radiation therapy* (5th Ed). St. Louis: Mosby.

Optional: (Students typically use clinical sites' copy)
- Bentel, G. C. (1992). *Radiation therapy planning* (2nd ed.). New York: McGraw-Hill.
- Vann, A. M., et. al. (2013). *Portal design in radiation therapy* (3rd ed.). Augusta, Georgia: DMV Enterprises.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Growth Evaluations	50%
Clinical Competencies & Reports	40%
Weekly Journal	10%

Late work will not be accepted. No credit will be awarded for work submitted after the deadline.

Note: An overall GPA of 3.0 or greater in all graduate coursework is required to successfully complete the Medical Dosimetry Program. This is a SIUC Graduate School Policy.

If a student receives two or more Growth Evaluations that are an 80% or below during one semester; their continuation in the Medical Dosimetry Program is at the discretion of the Program Director and Clinical Instructor. It is expected that all students consistently show "normal progress" in the development of their dosimetry skills and always demonstrate a positive attitude. Not meeting the normal progress guidelines justifies removal from the program as well. A grade of an "F" will be given for the semester in which the student is removed from the program.

If a student is removed from a clinical site for behavioral reasons, they must leave immediately and will not be allowed to continue the Medical Dosimetry Program. A grade of an "F" will be given for the semester they are removed.

All students must meet the minimum number of clinical competencies and show normal progress per rotation to continue with the program as there is no time available to go back and retake a specific clinical rotation. **By the end of the Spring semester, a student must have completed and posted 75 competencies and reports to meet normal progress guidelines.** All clinical competencies must be completed by the end of the summer semester to successfully complete the program. If has 7 total failed competencies (throughout entire program) or fails a particular competency 4 times, a student will be removed from the program. A grade of an "F" will be given for the semester in which the student does not fulfill the competency requirements.

If a student misses 4 days throughout the program their clinical grade will be lowered one letter grade. If a student misses six or more days during the year, the student can be removed from the program.

RAD 540
The Physics of Medical Dosimetry II
Spring Semester Syllabus

COURSE DEFINITION:
RAD 540-3 The Physics of Medical Dosimetry II – This course covers the following topics: imaging for radiation oncology, IMRT, stereotactic radiosurgery, special procedures, particle therapy, hyperthermia, and radiation safety. This course is twenty weeks in length. Prerequisite: A grade of "C" or better in RAD 520.

COURSE OBJECTIVES:

1. Demonstrate an understanding of imaging in radiation oncology.
2. Demonstrate an understanding of IMRT.
3. Demonstrate an understanding of stereotactic radiosurgery and gamma knife.
4. Demonstrate an understanding of particle therapy.
5. Demonstrate an understanding of hyperthermia.
6. Demonstrate an understanding of radiation safety.

COURSE OUTLINE:

Topics
1. Oncology imaging
2. IMRT techniques
3. Stereotactic radiosurgery and gamma knife
4. Particle therapy
5. Hyperthermia
6. Radiation safety

COURSE REQUIREMENTS:

Purchase all texts, attend all lectures, and complete required examinations, quizzes, and homeworks. Purchase a T130XA scientific calculator.

PREREQUISITES: A grade of "C" or better in RAD 520.

TEXTBOOKS:

Required:
- Khan, F. M. (2020). *The physics of radiation therapy* (6th ed.). Philadelphia: Wolters Kluwer
- Khan, F.M. (2016). *Treatment planning in radiation oncology* (4th ed.). Philadelphia: Wolters Kluwer
- Washington, C. M., & Leaver, D. T. (2019). *Principles and practices of radiation therapy* (5th Ed). St. Louis: Mosby.

Optional: (Students typically use clinical sites' copy)
- Bentel, G. C. (1992). *Radiation therapy planning* (2nd ed.). New York: McGraw-Hill.
- Vann, A. M., et. al. (2013). *Portal design in radiation therapy* (3rd ed.). Augusta, Georgia: DMV Enterprises.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Test Performance	65%
Quizzes/Homework	35%

Late work will not be accepted. No credit will be awarded for work submitted after the deadline.

Note: An overall GPA of 3.0 or greater in all graduate coursework is required to successfully complete the Medical Dosimetry Program. This is a SIUC Graduate School Policy.

RAD 545
Seminars in Medical Dosimetry II
Spring Semester Syllabus

COURSE DEFINITION:
RAD 545-3 Seminar in Medical Dosimetry II – This course consists of various seminars/literature reviews associated with radiation oncology. Topics include treatment techniques for various cancers, technological advances in cancer treatment, cancer treatment trends, and the role of a medical dosimetrist. Prerequisite: This course is twenty weeks in length. Prerequisite: A grade of "C" or better in RAD 525.

COURSE OBJECTIVES:

1. Demonstrate an understanding of the basic clinical concepts in radiation oncology.
2. Demonstrate an understanding of how different cancers are treated.
3. Demonstrate an understanding of the latest technologies in radiation oncology.
4. Demonstrate a basic understanding of treatment planning.
5. Demonstrate an understanding of the role of a medical dosimetrist.

COURSE OUTLINE:

Topics
1. Clinical concepts in radiation oncology
2. Treatment methods
3. New technologies
4. Treatment planning

COURSE REQUIREMENTS:

Attend clinical conferences or perform journal article summaries.

PREREQUISITES: A grade of "C" or better in RAD 525.

TEXTBOOKS: NA

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by timely completion of:

Conference/Journal Article Summaries	70%
Research Papers	30%

Late work will not be accepted. No credit will be awarded for work submitted after the deadline.

Note: An overall GPA of 3.0 or greater in all graduate coursework is required to successfully complete the Medical Dosimetry Program. This is a SIUC Graduate School Policy.

RAD 550
Medical Dosimetry Clinical III
Summer Semester Syllabus

COURSE DEFINITION:
RAD 550-2 Medical Dosimetry Clinical III - This is the third course of a three course sequence. During the three course sequence, students will complete eight clinical rotations including Brachytherapy, Simulation, Gamma Knife, Treatment Aids, IMRT, External Beam, Physics, Special Measurements and QA. The length of these rotations varies from one to ten weeks. During this course students will perform one to two of these rotations depending on the rotation schedule. While in the clinical setting students will observe and work directly with a medical dosimetrist. Emphasis is given on learning and understanding the role and responsibilities of a medical dosimetrist in the clinical setting. This course is ten weeks in length. Prerequisite: A grade of "C" or better in RAD 535.

COURSE OBJECTIVES:

1. Demonstrate an understanding of the basic clinical concepts of medical dosimetry.
2. Demonstrate an understanding of theory and principles of operation of treatment planning computers.
3. Demonstrate an understanding of the different types of radiation production.
4. Understand and calculate radiation attenuation and decay.
5. Demonstrate an understanding of the different types of radiation detectors.
6. Demonstrate a basic understanding of treatment planning.
7. Demonstrate an understanding of the role of a medical dosimetrist.

COURSE OUTLINE:

Topics
1. Clinical rotations
2. Perform clinical competencies
3. External beam calculations
4. Brachytherapy calculations
5. Physics procedures

COURSE REQUIREMENTS:

Purchase all texts. Participate in clinical internship and purchase a T130XA scientific calculator.

PREREQUISITES: A grade of "C" or better in RAD 535.

TEXTBOOKS:

Required:

- Khan, F. M. (2020). *The physics of radiation therapy* (6th ed.). Philadelphia: Wolters Kluwer
- Khan, F.M. (2016). *Treatment planning in radiation oncology* (4th ed.). Philadelphia: Wolters Kluwer
- Washington, C. M., & Leaver, D. T. (2019). *Principles and practices of radiation therapy* (5th Ed). St. Louis: Mosby.

Optional: (Students typically use clinical sites' copy)
- Bentel, G. C. (1992). *Radiation therapy planning* (2nd ed.). New York: McGraw-Hill.
- Vann, A. M., et. al. (2013). *Portal design in radiation therapy* (3rd ed.). Augusta, Georgia: DMV Enterprises.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Growth Evaluations	50%
Clinical Competencies & Reports	40%
Weekly Journal	10%

Late work will not be accepted. No credit will be awarded for work submitted after the deadline.

Note: An overall GPA of 3.0 or greater in all graduate coursework is required to successfully complete the Medical Dosimetry Program. This is a SIUC Graduate School Policy.

If a student receives two or more Growth Evaluations that are an 80% or below during one semester; their continuation in the Medical Dosimetry Program is at the discretion of the Program Director and Clinical Instructor. It is expected that all students consistently show "normal progress" in the development of their dosimetry skills and always demonstrate a positive attitude. Not meeting the normal progress guidelines justifies removal from the program as well. A grade of an "F" will be given for the semester in which the student is removed from the program.

If a student is removed from a clinical site for behavioral reasons, they must leave immediately and will not be allowed to continue the Medical Dosimetry Program. A grade of an "F" will be given for the semester they are removed.

All students must meet the minimum number of clinical competencies and show normal progress per rotation to continue with the program as there is no time available to go back and retake a specific clinical rotation. **By the end of the Summer semester, a student must have completed and posted all competencies and reports to successfully complete the program.** If has 7 total failed competencies (throughout entire program) or fails a particular competency 4 times, a student will be removed from the program. A grade of an "F" will be given for the semester in which the student does not fulfill the competency requirements.

If a student misses 4 days throughout the program their clinical grade will be lowered one letter grade. If a student misses six or more days during the year, the student can be removed from the program.

RAD 555
The Physics of Medical Dosimetry III
Summer Semester Syllabus

COURSE DEFINITION:
RAD 555-2 The Physics of Medical Dosimetry III – This course covers the following topics: Monitor Unit (MU) calculations, point dose calculations and radiation biology. This course is ten weeks in length. Prerequisite: A grade of "C" or better in RAD 540.

COURSE OBJECTIVES:

1. Demonstrate an understanding of monitor unit calculations.
2. Demonstrate an understanding of point dose calculations.
3. Demonstrate an understanding of radiation biology.

COURSE OUTLINE:

Topics
1. Monitor unit calculations
2. Point dose calculations
3. Radiation Biology

COURSE REQUIREMENTS:

Purchase all texts, attend all lectures, and complete required examinations, quizzes, and homeworks. Purchase a T130XA scientific calculator.

PREREQUISITES: A grade of "C" or better in RAD 540.

TEXTBOOKS:

Required:

- Khan, F. M. (2020). *The physics of radiation therapy* (6th ed.). Philadelphia: Wolters Kluwer
- Khan, F.M. (2016). *Treatment planning in radiation oncology* (4th ed.). Philadelphia: Wolters Kluwer
- Washington, C. M., & Leaver, D. T. (2019). *Principles and practices of radiation therapy* (5th Ed). St. Louis: Mosby.

Optional: (Students typically use clinical sites' copy)
- Bentel, G. C. (1992). *Radiation therapy planning* (2nd ed.). New York: McGraw-Hill
- Travis, E.L. (1989). Primer of Medical Radiobiology (2nd Ed.) St. Louis, MO: Mosby – Year Book, Inc.
- Vann, A. M., et. Al. (2013). *Portal design in radiation therapy* (3rd ed.). Augusta, Georgia: DMV Enterprises.

GRADING SCALE:

90-100	A
80-89	B
70-79	C
<70	Failing

Grades will be determined by:

Test Performance	70%
Quizzes/Homework	30%

Late work will not be accepted. No credit will be awarded for work submitted after the deadline.

Note: An overall GPA of 3.0 or greater in all graduate coursework is required to successfully complete the Medical Dosimetry Program. This is a SIUC Graduate School Policy.

Note: A Final Comprehensive Exam will be given during this course and one must receive a passing grade (≥80%) to pass the course. If a score is less than an 80%, a grade of an F will be given. (This exam is comprehensive for the entire program year)

RAD 560
Seminars in Medical Dosimetry III
Summer Semester Syllabus

COURSE DEFINITION:
RAD 560-2 Seminar in Medical Dosimetry III – This course consists of various seminars/literature reviews associated with radiation oncology. Topics include treatment techniques for various cancers, technological advances in cancer treatment, cancer treatment trends, and the role of a medical dosimetrist. This course is ten weeks in length. Prerequisite: A grade of "C" or better in RAD 545.

COURSE OBJECTIVES:

1. Demonstrate an understanding of the basic clinical concepts in radiation oncology.
2. Demonstrate an understanding of how different cancers are treated.
3. Demonstrate an understanding of the latest technologies in radiation oncology.
4. Demonstrate a basic understanding of treatment planning.
5. Demonstrate an understanding of the role of a medical dosimetrist.

COURSE OUTLINE:

Topics
1. Clinical concepts in radiation oncology
2. Treatment methods
3. New technologies
4. Treatment planning

COURSE REQUIREMENTS:

Attend clinical conferences or perform journal article summaries.

PREREQUISITES: A grade of "C" or better in RAD 545.

TEXTBOOKS: NA

GRADING SCALE:

90-100	A	Grades will be determined by:
80-89	B	Timely Completion of
70-79	C	Conference/Journal Article Summaries 100%
<70	Failing	

Late work will not be accepted. No credit will be awarded for work submitted after the deadline.

Note: An overall GPA of 3.0 or greater in all graduate coursework is required to successfully complete the Medical Dosimetry Program. This is a SIUC Graduate School Policy.

Medical Dosimetry Program
Southern Illinois University Carbondale/
Department of Radiation Oncology
Washington University Medical Center
Joseph Dise, M.M.P. – Coordinator

2021-2022 MEDICAL DOSIMETRY PHYSICS COURSE
LECTURE TOPICS

DAYS: Mondays and Wednesdays

TIME: 12:00 -1:30**;** 45 hours of lecture Fall semester, 45 hours of lecture Spring semester

Section 1: Radiologic Physics

Lecture #	Date	Topic	Lecturer
1, 2	**08/9/21**	**Atomic and Nuclear Structure**	**J. Dise**
	08/11/21	A. Atomic Structure	
		1. Rest Mass	
		2. Energy	
		3. Fundamental Particles	
		4. Atomic Structure	
		5. Atomic Binding Energy	
		6. Atomic Shell Filling Rules	
		7. Transitions	
		8. Energy Level Diagrams	
		9. Characteristic Radiation	
		10. Auger Electrons	
		11. Fluorescent Yield	
		B. Nuclear Structure	
		1. Mass, Atomic, and Neutron Number	
		2. Periodic Table of the Elements	
		3. Nuclear Binding Energy	
		4. Fission, Fusion	
		C. Radioactive Decay	
		1. Modes of Decay	
		2. Special Types of Nuclides	
		3. Mathematics of Radioactive Decay	
		4. Equilibrium	
		5. Natural Radioactivity	
3, 4	**08/16/21**	**Interactions of Ionizing Radiation**	**J. Dise**
	08/18/21	A. Types of Electromagnetic Radiation	
		B. Properties of Photons, Relationship of Energy & Wavelength	
		1. Direct and Indirect Ionizing Particles	
		C. Photon Interaction Process, Kerma	
		1. Attenuation and Absorption Coefficients	
		a) Attenuation Coefficients	
		b) Transfer Coefficients	
		c) Absorption Coefficients	
		D. Relationship of Kerma and Absorbed Dose	
		E. Attenuation in the Body	
		F. Modes of Interaction	
		1. Coherent Scattering	
		2. Photoelectric Absorption	
		3. Compton Scattering	
		4. Pair Production	
		5. Triplet Production	
		6. Photodisintegration	
		7. Energy Dependence of Interaction Probabilities	
		8. Attenuation in the Human Body	

G. Interaction of Particle Radiation
   1. Heavy Charged Particles
   2. Interactions of Electrons
   3. Interactions of Neutrons

5 **08/23/21** **<u>Production of X-Rays</u>** **J. Dise**

A. X-Ray Tubes
   1. Anode and Cathode
   2. Focal Spot Size
   3. Reflection and Transmission Targets
   4. Heel Effect
   5. X-ray Emission Spectrum
   6. Factors That Affect the X-ray Emission Spectrum
   7. X-ray Circuits

B. Physics of X-Ray Production
   1. Bremsstrahlung
   2. Characteristic X-Rays
   3. X-Ray Energy Spectra
   4. Operating Characteristics

C. Simulators
   1. Conventional Simulators
   2. CT-Simulators

6 **08/25/21** **<u>Radiation Treatment & Simulation Machines</u>** **J. Dise**

A. Kilovoltage Units

B. Linear Accelerators
   1. Major Subsections
   2. Accelerator Section
   3. Microwave Power (Magnetrons, Klystrons)
   4. Bending Magnet Types
   5. Monitor Chamber
   6. Photon Beam Production
      (a) Target
      (b) Flattening Filter
      (c) Collimation (including Multileaf Collimators)
      (d) Beam Profiles ("Horns")
   7. Computer Control System
   8. Electron Beam Production
      (a) Scattering Foil Systems
      (b) Scanning Electromagnet Systems
      (c) Collimation

C. New Machines
   1. ViewRay
   2. Vero

7, 8 **08/30/21** **<u>Radiation Measurements</u>** **J. Dise**
09/01/21

A. Photon and Energy Flux Density and Fluence

B. The Roentgen

C. Electronic Equilibrium

D. Ionization Chambers
   1. Free-air Chambers
   2. Thimble Chambers
   3. Condenser Chambers
      a) Stem Effect
   4. Farmer Chambers
   5. Parallel-Plate Chambers
   6. Extrapolation Chambers
   7. Diode Detectors
   8. Electrometers
      a) Integrate Mode

b) Rate Mode

E. Exposure Calibration of X-Ray or Gamma-Ray Beams
1. Selection of Calibration Variables
2. Selection of Chamber
3. Positioning of Chamber
4. Corrections to Readings

9, 10 **09/08/21** **09/13/21** **Calibration of Dose Output** **J. Dise**

A. Units of Radiation Dose, Dose Equivalent and RBE-Dose
B. Calculation of Dose from Exposure
1. Converting Exposure to Absorbed Dose in Air
2. f-factor
3. Dose in Free Space
C. Measurement of Absorbed Dose with an Ionization Chamber
1. Stopping Powers
a) Unrestricted Stopping Power
b) Collisional Stopping Power (Sc)
c) Radiative Stopping Power (Sr)
d) Restricted Stopping Power
2. Bragg-Gray Cavity Theory
3. Spencer-Attix Cavity Theory
D. AAPM Calibration Protocols
1. TG-51 Protocol (Photons and Electrons)
2. TG-61 Protocol (Superficial x-rays)

11 **09/15/21** **Other Measurement Systems** **J. Dise**

A. Film
1. Radiographic
2. Radiochromic
B. TLD
1. Phosphorescence
2. Thermoluminescence
C. Scintillation
D. Calorimetry
E. Gel/Chemical Dosimetry
F. Diode Dectors

12 **09/20/21** **Radiologic Physics Exam** **J. Dise**

Section 2: External Beam Clinical Physics

13 **09/22/21** **External Beam Dosimetry Concepts** **J. Dise**

A. Dosimetric Variables
1. Inverse Square Law
2. Backscatter factor
3. Peak Scatter Factor
4. Electron Buildup
5. Percent Depth Dose
a) Mayneord F-factor
b) TAR Correction to F-factor
6. Equivalent Squares
7. Tissue-air Ratio
8. Scatter-air Ratio
9. Tissue-phantom Ratio
10. Tissue-maximum Ratio

14, 15 **09/27/21** **09/29/21** **System of Dose Calculations** **J. Dise**

A. Monitor Unit Calculations
1. Output Factor
2. Field Size Correction Factors
3. Collimator Scatter Factor and Phantom Scatter Factor

4. Beam Modifier Factors
5. Patient Attenuation Factors

B. Calculations in Practice
   1. SSD Technique
      a) SSD Treatment same as SSD of Calibration
      b) SSD Treatment Different from SSD of Calibration
      c) SSD Treatment and SAD Calibration
   2. SAD Technique
      a) SAD Treatment and SAD Calibration
      b) SAD Treatment and SSD Calibration
      c) SAD Rotational Treatment

C. Beam Weighting
D. Arc rotation therapy
E. Irregular Fields

16, 17 **10/04/21** **10/06/21** **<u>Computerized Treatment Planning</u>** **J. Dise**

A. Isodose curves (beam characteristics)
B. Skin Dose
C. Parallel Opposed Beam Combination
D. Wedge Isodose Curves
   1. Wedge Angle and Hinge Angle
   2. Wedge Factor
E. Wedge Techniques
   1. Wedge Pair
   2. Open and Wedged Field Combination
   3. Skin Compensation

16, 17 **10/11/21** **10/13/21** **<u>Computerized Treatment Planning (continued)</u>** **J. Dise**

F. Beam Combination (3-,4-,6- field techniques)
G. Dose-Volume Specification

ICRU 50
1. GTV, CTV, PTV
2. Organs at Risk
3. Dose Specification

ICRU 62
1. ITV
2. Planning Risk Volume
3. Conformity Index

18, 19 **10/18/21** **10/20/21** **<u>Dose Calculation Algorithms</u>** **J. Dise**

A. Basic Dose Algorithms
   Generation of Isodoses
   Irregular Fields
B. Corrections for Inhomogeneities
   a) Simple 1-D and 2-D Methods
   b) Convolutions Methods
   c) Monte Carlo Methods
   d) Dose Perturbations at Interfaces

20, 21 **10/25/21** **10/27/21** **<u>Electron Beam</u>** **J. Dise**

A. Depth-dose/Isodose characteristics
   1. AAPM TG-25
B. Treatment Planning with Electrons
   1. Rules of Thumb
   2. Selection of energy, field size
   3. Electron Skin Dose
   4. Electron Bolus
   5. Electron Field Shaping

C. Field Matching
   1. Electron-electron Gapping
   2. Electron-photon Gapping
D. Electron Backscatter
E. Inhomogeneities and Electrons

22, 23 **11/01/21** **3D CRT Including ICRU Concepts** **J. Dise**
11/03/21 **and Beam Related Biology**

A. 3DCRT concepts volumetric (3DCRT) vs. non-volumetric
   1. Technology and methods for planning (volume-based planning)
   2. Building patient models (image reconstruction and segmentation)
   3. Virtual simulation
   4. Implications of treatment variabilities
      Systematic and random setup variability, patient breathing
      Contouring variability

22, 23 **11/08/21** **3D CRT Including ICRU Concepts** **J. Dise**
11/10/21 **and Beam Related Biology (continued)**

B. Volumetric Beam Placement
   1. DRR Generation
   2. BEV, DVH
   3. Non-coplanar beams
   4. Planning Tools
      Biological implications of uniform vs. non-uniform dose delivery
      Non-biological and biological dose-volume metrics (DVHs, TCPs, NTCPs)
      Margins (PTVs, PRVs)
C. Treatment Planning Methods
   Beam Selection
   4D Imaging and Planning
   Dose Reporting
   Volumetric vs. Point Prescriptions

24 **11/15/21** **Assessment of Patient Setup and Verification** **J. Dise**

A. Positioning and immobilization methods and devices
   Table coordinates, lasers, distance indicators
   Positioning options (calibrated frames, optical and video guidance, etc.)
   Breathing maintenance
   Immobilization methods (thermoplastic masks, bite blocks, etc.)
B. Treatment Verification
   1. Image Based
      Radiographic
      Cone-beam CT
      MVCT
      Internal markers (e.g., implanted fiducials)
   2. Non-image based
      Ultrasound
      Video imaging
      Electromagnetic sources
      On-line correction of setup errors
   3. Adaptive planning concepts

25 **11/17/21** **Treatment Planning Evaluation and QA** **J. Dise**

A. Plan Quality
   1. ICRU Definitions (Max Dose)
   2. PTU Coverage
   3. OAR Evaluation
B. Deliverability
   1. Complexity

2. Uncertainties
3. Volatility

C. TP – Quality Assurance
1. TG-53
2. Review of Images & Targets
3. Review of Beam Data
4. VanDyk Recommendations
5. Data Transfer
6. TP Disasters

26 **11/29/21** **Adjoining Fields & Special Dosimetry Problems** **J. Dise**

A. Two-Field Problem
B. Three-Field Problem
C. Craniospinal Gapping
D. Peripheral Dose
E. Pacemaker
F. Gonadal Dose
G. Pregnant Patient
H. Surface Dose

27, 28 **12/01/21** **External Beam Quality Assurance** **J. Dise**
12/06/21

A. Overview of Quality Assurance in Radiation Therapy
Goals
Staffing
Roles, training, duties & responsibilities of individuals
Equipment Selection and Specifications
B. Linac and Imaging QA
Acceptance Testing – Linac
Commissioning – Linac
Data Required
Computer Commissioning
Routine Quality Assurance and Test Tolerance
Daily QA
Monthly QA
Yearly QA
C. Quality Assurance of Imaging Apparatus
Portal imagers
Linac mounted real-time fluoroscopy units
KVCT (cone beam) quality assurance testing
MVCT quality assurance (TomoTherapy)
D. Dosimetric Patient QA
1. Dosimetry based
Diodes
TLDs
MOFSET

29 **12/8/21** **Radiation Shielding** **J. Dise**

A. Treatment Room Design
1. Controlled/Uncontrolled Areas
2. Types of Barriers
3. Factors in Shielding Calculations
a) Workload (W)
b) Use factor (U)
c) Occupancy factor (T)
d) Distance
B. Shielding Calculations
1. Primary Radiation Barrier
2. Scatter Radiation Barrier
3. Leakage Radiation Barrier
4. Neutron Shielding for High Energy Photon and Electron Beams

C. Sealed Source Storage

29	**12/13/21**	**Radiation Shielding - continued** D. Protection Equipment and Surveys 1. Operating Principles of Gas-filled Detectors 2. Operating Characteristics 3. Radiation Monitoring Equipment a) Ionization chamber (Cutie Pie) b) Geiger-Mueller Counters c) Neutron Detectors 4. Personnel Monitoring	**J. Dise**
30	**12/15/21**	**External Beam Physics Exam**	**J. Dise**

Section 3: Brachytherapy Physics

1, 2	**01/03/22** **01/05/22**	**Brachytherapy Principles** A. Radioactivity and Radionuclide Production B. Definition of Brachytherapy C. Brachytherapy Classification D. Brachytherapy Radionuclides E. Characteristics of Brachytherapy Sources F. Source Strength Specification 1. Exposure Rate Constant 2. Radium-226 3. Air-Kerma Strength 4. Source Strength Conversion 5. Historical Impact of Source Strength Specification	**R. Morris**
3, 4	**01/10/22** **01/12/22**	**Brachytherapy Dosimetry** A. Relationship between Exposure and Dose B. Point Source Calculations C. Linear Source Calculations 1. Sievert Integral 2. Approximations 3. Along and Away Tables D. TG-43 Formalism	**R. Morris**
5, 6	**01/19/22** **01/24/22**	**HDR Procedures** A. Afterloader Principles B. Source and Transfer System Design C. Treatment Planning Techniques D. Treatment Sites E. HDR Quality Assurance	**R. Morris**
7	**01/26/22**	**Intracavitary Brachytherapy** A. Brachytherapy Rationale in GYN Treatment B. GYN Intracavitary Applicators 1. Cylinder Applicators a) Disease Site b) Applicator Types c) Dose Specification c) Planning Technique 2. Tandem and Ovoid Applicators a) Disease Site b) Applicator Types c) Implant Design d) ICRU 38 Dose Specification c) Traditional Loading Systems and Planning Techniques d) HDR vs LDR e) GEC-ESTRO Recommendations	**R. Morris**

3. Simon-Heyman Capsules
4. Tandem and Ring Applicators

8 **01/31/22** **<u>Interstitial Implants</u>** **R. Morris**

A. Paterson-Parker System
   1. Planar Implant
   2. Volume Implant
B. Quimby System
   1. Planar Implant
   2. Volume Implant
C. Paris System

9, 10 **02/02/22** **<u>Prostate, Breast, and Eye Brachytherapy Implants</u>** **R. Morris**
02/07/22

A. LDR Prostate Brachytherapy
   1. Pre-Planning
   2. Isotope Characteristics
   3. Treatment Planning
   4. Dose Prescription
   5. Sources of Uncertainty
B. HDR Prostate Brachytherapy
   1. HDR Implant Techniques
   2. Dose Prescriptions
D. Accelerated Partial Breast Irradiation (APBI)
   1. Advantages
   2. Interstitial Implants
   3. Single-Lumen Balloon Implants (Mammosite)
   4. Multi-Lumen Implants
      a) Contura
      b). Strut Adjusted Volume Implant (SAVI)
B. Eye Applicators

11 **02/09/22** **<u>Radiation Safety and Radiopharmaceuticals</u>** **R. Morris**

A. Radiation Safety
   1. Regulations
   2. Written Directives
   3. Medical Events
   4. Package Receipt
   5. Area Surveys
B. Radiopharmaceuticals
   1. Iodine treatment for thyroid
   2. Radioimmunotherapy
   3. Microspheres

12 **02/14/22** **<u>Brachytherapy Physics Exam</u>** **R. Morris**

<u>Section 4: Imaging, IMRT, Special Procedures, Radiation Safety</u>

13 **02/16/22** **<u>Imaging: Magnetic Resonance Imaging</u>** **T. Kim**

A. MRI
   1. Physical principles
   2. T1, T2, TE, TR imaging characteristics
   3. Advantages & limitations of MRI images for diagnosis and computerized treatment planning

14 **02/21/22** **<u>Imaging: Ultrasound</u>** **T. Kim**

A. Ultrasound
   1. Physical principles
      2. Utility in diagnosis and patient positioning

15 **02/23/22** **<u>Imaging: Computed Tomography</u>** **T. Kim**

A. CT
   1. Physical principles: Serial, Helical

2. Hounsfield Units, CT numbers, inhomogeneity corrections based on CT scan images

16, 17 **02/28/22** **<u>Imaging in Radiation Oncology</u>** **T. Kim**

03/02/22 A. Diagnostic Imaging
1. Physical principles
2. Port Film Imaging
3. Film based
4. XV-2 film, EDR-2 film characteristics

B. Nuclear Medicine Imaging
1. PET Physical principles
2. Utility for Radiation Therapy

3. SPECT

C. Electronic Portal Imaging
1. Overview of electronic portal imaging devices
2. Types of portal imaging devices
3. Clinical applications of EPID technology in daily practice

D. 4DCT
1. Overview of 4DCT
2. Utility for Radiation Therapy

E. Quality assurance
1. Image transfer process, accuracy, fidelity

18 **03/14/22** **<u>IMRT – Delivery Techniques</u>** **T. Roth**

A. IMRT Characteristics
B. IMRT Delivery Systems
1. Compensators
2. Segmental MLC (SMLC) and Dynamic MLC (DMLC)
3. Tomotherapy: Helical and Cyclical
4. Volume Modulated Arc Therapy (VMAT)
5. Cone-beam ring gantry delivery (Halcyon)

C. Organ motion management
1. Interplay effect
2. Gating

19 **03/16/22** **<u>IMRT – Optimization and Planning</u>** **T. Roth**

A. IMRT Planning Basics
1. Forward vs inverse planning
2. Target and OAR definition
3. Dose goal / constraints
4. Beam angle selection

B. Common Planning Approaches
C. Optimization
1. Objective Functions
2. Deterministic Methods
3. Stochastic Methods

D. Knowledge-Based Planning

20 **03/21/22** **<u>IMRT – Plan Evaluation, Adaptation and QA</u>** **B. Gu**

A. IMRT Plan Evaluation
1. Evaluation strategies (distinguishing good plans from poor)
2. Plan improvement and revision

B. Adaptive Radiation Therapy
1. Off-line adaptive RT
2. On-line adaptive RT

C. IMRT Quality assurance
1. Systematic QA
2. Patient specific QA
3. Record/verify

21 **03/23/22** **B. Gu**

MR-guided Radiation Therapy

A. MR-guided Radiation Therapy
   1. Basic magnetic field and MRI concept review
   2. Overview of MRI-guided delivery systems
   3. Treatment planning
   4. Quality assurance for an MRI-guided delivery system

B. ViewRay
   1. Specific operation issues (NRC overview, MRI safety, etc)

22, 23 **03/28/22** **B. Gu**
03/30/22

Special Topics and Procedures

A. TBI
B. TSET
C. Electron Arc
D. ESRT
E. Special Dosimetry Topics
   1. Scripting
   2. Auto Planning/Contouring
   3. Deformable Dose Accumulation
   4. Robust Planning

24, 25 **04/04/22** **J. Dise**
04/06/22

Radiation Safety

A. Concepts and Units
   1. Radiation Protection Standards
   2. Quality Factors
   3. Definitions for Radiation Protection
   4. Dose Equivalent
      a) Units of Dose Equivalent
   5. Effective Dose Equivalent

B. Types of Radiation Exposure
   1. Natural Background Radiation
   2. Man-Made Radiation
   3. NCRP #91 Recommendations on Exposure Limits

C. Protection Regulations
   1. NRC Definitions
      a) Recordable Event
      b) Misadministration
   2. NRC Administrative Requirements
      a) Radiation Safety Program
      b) Radiation Safety Officer
      c) Radiation Safety Committee
      d) Quality Management Program
   3. NRC Regulatory Requirements

26 **04/11/22** **J. Dise**

Informatics

A. DICOM
B. PACS
C. Network Integration and Integrity
D. Storage and Archival
E. IS Maintenance
   F. Image Fusion
      1. Advantages
      2. Challenges
      3. Techniques
      4. Limitations
   G. Deformable body/structure image fusion

27, 28 **04/13/22** **B. Gu**
04/18/22

Particle Therapy

A. Protons
   - Proton Beam Energy Deposition

- Equipment for Proton Beam Therapy
- Clinical Beam Dosimetry
- Clinical Proton Beam Therapy
- Treatment Planning
- Treatment Delivery
- Clinical Applications
- Clinical Beam Dosimetry

B. Other Particles
- Carbon
- Neutrons

C. Biology
- LET
- RBE

29	**04/20/22**	**<u>Stereotactic Radiosurgery</u>**	**T. Kim**

A. SRS Delivery Systems
1. Linac based
2. Gamma Knife
3. Robotic Linac

B. Simulation and immobilization/repositioning
C. Dose prescription & treatment planning
D. Treatment calculations
E. SRS quality assurance

30	**04/25/22**	**<u>Section 4 Exam</u>**	**B. Gu**

Medical Dosimetry Program
Clinical Rotation
Goals and Assessment

Clinical Rotation
Students will learn clinical practices through direct clinical experiences, reviewing related journal articles, attending related conferences, and keeping a journal of experiences and questions. Student, clinical instructors, program advisory board, program director, and clinical preceptor will provide ongoing assessment throughout the program.

Students must achieve "normal progress" for every rotation to continue enrollment in the program.

Goals of each rotation

Brachytherapy
Student will be capable of preparation, treatment, and follow-up of the brachytherapy patient. Student will act in the role of the brachytherapy technologist, medical dosimetrist, and medical physicist as related to brachytherapy cases.

Conventional Simulation (If available) and CT Simulation
Student will perform early planning for patient's treatment by constructing immobilization devices, obtaining measurements, directing isocenter, setting treatment field boundaries, producing radiographs, and acquiring CT study set.

Treatment Aids
Student will produce treatment aids for patient's treatment by constructing field-shaping blocks, manipulating multileaf collimated fields (MLC), constructing compensating filters and/or bolus devices.

Dose Calculations/Chart Review
Student will perform dose calculations and review therapy charts for consistency among dose prescription, isodose, calculation sheet, and daily treatment record.

External Beam Treatment Planning
Student will evaluate patient's case, consider physician's prescription, delineate normal structures from CT images, utilize virtual simulation software, optimize a plan for treatment, discuss plan with Dosimetrist, Physician, Physicist, and Radiation Therapist, document patient's set-up and plan, use patient measurements and set-up parameters to calculate fields for treatment, enter set-up and dose into the treatment verification computer system.

Gamma Knife/Stereotactic Radiosurgery
Student will observe/perform quality assurance procedures for stereotactic treatments, work with the Medical Physicist, Radiation Oncologist and Neurosurgeon in generating a treatment plan, and observe the planning and treatment of gamma knife patients.

IMRT
Using IMRT capable planning systems, the student will plan a variety of IMRT cases, including organ delineation, verifying reference point, reviewing target volume definition and dose prescription with radiation oncologist, verifying plan with medical physicist, performing treatment machine QA with physicist, and documenting plan for treatment. Student will assist Radiation Therapists in the treatment of a few patients.

Plan and QA all for all treatment units, Varian/Elekta/Tomotherapy
The student will participate in treatment planning and QA for all treatment and simulator machines that are available.

Quality Assurance
Student will perform and document daily, weekly, monthly and annual quality assurance procedures on linear accelerators to include mechanical checks, output checks, calibration measurements, laser checks. Student will perform and document quality assurance procedures on gamma knife, simulators, CT scanner.

Assessment

Objectives
Student uses objectives as a guide during his/her clinical practicum.

Competencies
Student will complete practicum-related competencies as described by the objectives, throughout his/her clinical rotation. Students should inform his/her clinical instructor when they are ready to complete a specific competency.

Written Journal
The student will write experiences, thoughts, and questions related to his/her current clinical practicum. The student will also include a statement on how the rotation is going and also what competencies were accomplished for the week. This document should be posted to Desire2Learn every Friday evening by 11:59 pm. No late journal assignments will be accepted after the availability window closes. The program director will review the journal weekly and comment back.

Journal Article Reviews or Conference Reports.
Students will write a summary of a journal article/conference. Making sure they can apply the information to the clinical setting. Discussion includes comments from the student regarding the learning that occurred, then comments and questions from the program faculty as to how analysis could be changed or improved so further learning takes place. Some readings will be assigned and other can be related to the students research interests.

Projects/Case Studies
Throughout clinical practicum, student will be involved in projects that supplement clinical rotation

Meetings among students, clinical instructors, program director
Student will meet with clinical instructors to go over growth evaluations and at any other time during specific rotations to assess learning and progress. Students can meet with the program director at any time to assess progress and learning.

Meetings with student and advisory board
A Dosimetry Program Advisory Board meeting will be conducted annually and students will be invited to attend.

Professional Interview Competency
During the first half of the spring semester (January, February, or March) the student will schedule an interview with proper department personnel. Student must email program faculty the name, title, and email address of the person willing to perform the interview and an evaluation form will be sent to them. The student must take a professional dosimetry resume to this interview.

Final Written Exam
A final written exam will be given at the conclusion of the program during RAD 555. The student must receive an 80% or better on this exam to be eligible for graduation from the program. If the 80% or better grade is not earned, a grade of F will be given.

Medical Dosimetry Program
Clinical Rotation Schedule

Clinical Rotations will consist of the following:

Distance Learning Students- this is suggested total time performing the following duties

Brachytherapy	6 weeks
Simulation	3 weeks
Gamma Knife/Stereo/Treatment Aids	1 week- float
External Beam Planning	28 weeks
Dose Calcs/Chart Review	2 weeks
IMRT	10 weeks but can also be performed while in other external beam rotations
Float	1-2 weeks during year if making satisfactory progress on competencies
Special Measurements	throughout year
Tx Machine QA	throughout year

- Please refer to the rotation schedule for your rotation cycle.
- During clinical rotations in which workload is low and respective assignments are complete, student should go to clinical site of prior or next clinical rotation.
- A student growth evaluation must be filled for each clinical rotation. Every four weeks of a given rotation an evaluation must be completed. If the rotation is less than four weeks in length then an evaluation must be done at the conclusion of the rotation. The evaluation is on the next page. i.e. brachytherapy will have two growth evaluations, IMRT two, external beam planning at outside sites will need three.
- For students that are at one clinic site only, a growth evaluation must be completed every four weeks of the program. A total of 12-13 growth evaluations.

SIUC MEDICAL DOSIMETRY PROGRAM
PERSONAL/PROFESSIONAL GROWTH ASSESSMENT

Student: _____ **Rotation: _____**

Please assess each statement by placing the number which best describes the student's professional and clinical performance in the space provided.

1, 2, or 3 = Levels of Unacceptable
4 = Acceptable but improvements can be made
5 = Excellent (consistently performs above level of expectation)

1. Demonstrates good rapport/communication skills with: a. Patient b. Clinical Supervisor c. Department Personnel d. Radiation Oncologist(s) / Physicist	
2. Demonstrates a positive professional attitude and appearance.	
3. Demonstrates good attendance and punctuality- reports to assigned area on time and finalizes all work responsibilities before leaving.	
4. Demonstrates ability to accept and utilize constructive criticism.	
5. Demonstrates cultural competency & respect in all professional interactions.	
6. Demonstrates responsible work ethic. i.e. shows initiative to assist in or perform all clinical duties, exhibits a desire to learn, uses clinical time effectively, seeks out new or additional tasks, willing to help out where needed.	
7. Maintains a focused approach throughout clinical rotation and does not get distracted.	
8. Demonstrates continual improvement of skills for the rotation being evaluated. i.e. contouring accuracy, planning, making fewer mistakes, etc.	
9. Demonstrates the ability to interpret the patient chart and retrieve needed information.	
10. Exercises good judgment in determining treatment technique/approach for desired patient outcome per the physician's prescription. i.e. palliative or curative intent.	
11. Demonstrates competency for the rotation being evaluated. i.e. sim, external beam, brachytherapy, etc.	
12. Demonstrates an understanding of the concepts needed for the rotation being evaluated.	
13. Demonstrates the ability to complete proper documentation for the area being evaluated. i.e. R&V, billing, etc.	
Total Points:	/65

Evaluator's Comments:

Clinical Instructor's Signature Date

Intern's Comments:

Intern's Signature Date

CLINICAL TIME SHEET

NAME: _____ CLINICAL ROTATION_____

*Time sheet is to be kept current at all times and turned in at end of semester. Keep a separate sheet for each clinical rotation.
*Indicate: Number of hours present when present Number of hours absent when absent H = Holiday V = Vacation Day I = Interview Day S=Snow Day
*Ten Vacation Days are specified during your program year. If you are absent for any reason other than vacation or holiday, the time must be made up during the vacation days. You are allotted two interview days during the spring/summer semester only with interview documentation (these are not free days to take when one wants). One personal day is allowed during program.
*Failure to comply with the hours assigned by your clinical site will affect your clinical internship grade.

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Hours Present	Hours Absent	Hours Made Up	Total Days
January																																			
February																																			
March																																			
April																																			
May																																			
June																																			
July																																			
August																																			
September																																			
October																																			
November																																			
December																																			

_____ _____ _____ _____
(Clinical Instructor's Signature) (Date) (Student's Signature) (Date)

***To be turned in at end of each rotation**
****Students at distant clinic sites keep a master time sheet for the entire year**
*****If keeping a master time sheet, please indicate when various rotations were completed.**

Medical Dosimetry Educational Program
Quality Assurance Guidelines
Treatment Machine and Simulator

Student participates in treatment machine quality assurance throughout the Dosimetry Program. Each month the student should participate in a QA procedure.

- For the following QA assignments, student submits a report to D2L following review and signature of assigned dosimetrist, physicist or therapist. Most of these QA assignments should be completed during their respective rotation. The report should include the test being performed, recommended frequency, how the test is performed, and what to do if the test is out of tolerance.

QA	Date Participated	Date Report Turned In
Brachytherapy Applicator		
Brachytherapy Source Exchange		
Brachytherapy Machine/Source		
CT Simulator- daily or perform warm-up procedures		
Varian Dual Energy Linear Accelerator- monthly		
Elekta Linear Accelerator- monthly (or 2nd linac in dept)		
IMRT		
Gamma Knife/Stereotactic		
Tomotherapy QA- if available. If not, must outline/summarize TG 148 QA section only		
Daily Constancy Check to include Electron Constancy Check		
IGRT QA		
Laser/ODI QA		

- During his/her external beam treatment planning rotation, the student will:
    - Observe and participate with all dosimetrists and physicists in monthly QA of all treatment machines.
    - Perform successfully, on own, with supervision of dosimetrist and physicist, one treatment machine QA for the following treatment machines:
        - Varian dual energy linear accelerator
        - Elekta linear accelerator or a 2nd linear accelerator QA in department
        - Superficial machine- if available
        - Daily constancy check to include electron constancy check
    - Write a report for QA completed on own and have clinical instructor verify and sign report. The report must include the test performed, tolerance, and the recommend frequency of completing the test. The report must be posted to Desire2Learn.
        - To achieve normal progress in QA, one must complete 3 QAs by the end of the Fall semester.

Competency Attempt				
	1	2	3	4
Pass				Fail

Southern Illinois University Carbondale
Medical Dosimetry Program

Quality Assurance
Competency Form

The student must participate in and demonstrate an understanding of the test being performed, recommended frequency, how the test is performed, and what to do if the test is out of tolerance.

Please specify the QA task participated in: _____

Comments: _____

_____

_____

_____

_____
Student Signature / Date

_____
Medical Physicist Signature / Date

*A written report of procedure details must also be completed and posted to the course server.

- *All failed competency attempts must be turned in.

Medical Dosimetry Educational Program

Objectives – Brachytherapy Clinical Rotation

Intracavitary and Interstitial Implants

SKILL	RELATED CONCEPT
Preparation	
Identify site of treatment	Determine possible applicators used for specific site
Indicate radioactive source to be used	Describe the properties of sources
Identify applicators specific to case	Distinguish between applicators as they are used clinically. Explain how applicator affects surface dose and percent depth dose and discuss shielding. Determine appropriate treatment system for patient (Fletcher, Manchester, MIR).
Know the difference between LDR and HDR	Explain the similarities and differences between LDR and HDR with regard to applicators, quality assurance, treatment preparation, dose prescription, planning, completion of treatment (paperwork)
Know the difference between manual and remote afterloading	Describe the similarities and differences between these two types of afterloading
Prepare applicators for treatment	Know implication of time and type of sterilization for applicator preparation
Prepare equipment for treatment	Discuss reason for all aspects of equipment preparation
Perform QA on applicators, isotopes, and treatment machines	Analyze logbook and reports for annual applicator QA and write analysis. Write an organized report discussing the process of source QA to include locating source, measuring activity, and inputting into treatment planning system. Refer to T.G. 59 in evaluating treatment machine QA, and analyze data, process and results.
Check in sources	Measure activity of sources and calculate the appropriate decay for the time of use
Know decay modes of radioisotopes and Appropriate shielding	
Know emergency procedures in case of Radioisotope spill, lost source etc.	Evaluate each specific situation in determining appropriate action in case of emergency

SKILL	RELATED CONCEPT
Planning	
Acquire localization films or proper imaging studies.	Critique film for effective use in computer treatment planning with respect to ease and accuracy of dummy source identification. Recognize when necessary to contact dosimetrist to be involved with filming or to review films.
Understand process physician uses in preparing prescription sheet	Determine dose prescription through use of the following dosimetry concepts: decay constant, half-life, source strength, build-up factors
Calculate dose around a point source	Understand the use of "away-long" tables and when point source approximation is valid.
Perform radioactive decay calculations	
Prepare treatment form	Apply rules for treatment system (for ca cervix) - LDR Determine dwell positions and dwell times - HDR
Identify sources and interest points on films Or on appropriate imaging studies.	Explain how orthogonal film coordinates are related and determined
Know significance of source and point location	
Generate treatment plan giving dose distribution in three dimensions	Determine which views provide the most useful information to the physician
Verify input information for accuracy	Analyze treatment plan for accuracy
Treatment	
Identify patient for treatment	Discuss implications of incorrect patient identification, including NRC regulations. Review Code of Federal Regulations, chapter 10, Parts 20 & 35, and discuss with radiation safety officer
Explain procedure to patient	Determine patient's knowledge level and explain procedure that's comprehensible to them
Assist physician in positioning applicators	
Select and validate correct source for treatment	Differentiate among sources according to their properties
Perform treatment time calculations	Explain relationships among dose specification and prescription reference points, mg-hrs, mgRaeq-hrs, total reference air-kerma, 60 Gy reference volume dimensions
Identify various survey meters	Evaluate use of appropriate survey meter for specific situations. Determine if meter reading is adequate.
Complete paperwork, measurements, counts, and return seeds	

Medical Dosimetry Educational Program

Objectives –Brachytherapy Clinical Rotation
Radiopharmaceutical Administration

Objectives for radiopharmaceutical administration are similar to those used for intracavitary and interstitial implants, with the following exceptions:

- Radiopharmaceutical replaces radioactive source
- Preparation for treatment includes the patient's hospital room
- Isodose distributions not generated

Medical Dosimetry Educational Program

Brachytherapy Clinical Competency

Instructions to Evaluator and Student

Listed below are instructions describing the process used for evaluators to assess the student's clinical competence, using the attached Clinical Competency Form and Objectives.

1. The Evaluators for Brachytherapy
- Brachytherapy Technologist
- Medical Dosimetrist
- Medical Physicist

2. A list of required competencies is attached to the student's information packet for the brachytherapy clinical rotation.

3. The student will inform the evaluators when he/she is ready to perform a specific competency.

4. Evaluators(s) will sign the competency form **only** if the student has successfully completed all aspects of the designated case as described in the brachytherapy objectives.

5. In the event the student is unable to successfully complete the specified competency, the clinical instructor will write a comment describing areas for improvement, and indicate this is a failed competency by checking the appropriate box. The CI and student should inform program staff of the failed competency. The student must prepare and make a second attempt at the competency.

6. Upon approval from all clinical instructors for each aspect of the competency, the student will submit the competency form to the dosimetry program director. As stated above, failed competency attempts must also be turned in.

Southern Illinois University Carbondale
Medical Dosimetry Program

Brachytherapy Clinical Competencies
Evaluators, Required Treatment Sites, Guidelines

Evaluators/Clinical Instructors

- Physics staff, brachytherapy technologists, and medical dosimetrists

Required Competencies- one of each

GYN

- Cylinder- Ir-192 or Gynsite applicator
- Tandem and Ovoids – Ir-192 (HDR)
- Ir-192 temporary interstitial implant

Prostate

- I-125 or Pd-103 permanent seed implant

Thyroid

- I-131 radiopharmaceutical administration

Breast and Sarcomas

- Ir-192 HDR – observe, assist and explain all aspects of procedure

Guidelines

Student will complete on his/her own, the six brachytherapy cases listed above, from start to finish by demonstrating skills necessary to prepare, plan and treat patient as described by the brachytherapy clinical objectives.

Successful completion of competency is determined by adherence to the attached clinical objectives and the summarized guidelines listed below. Also, see "Instructions to Evaluator and Student".

- Participate in pre-plan if applicable
- Explain dose prescription and participate in calculation
- Localize implant using films or CT/MRI data set
- Run isodose plan, review plan with physician
- Order sources or radiopharmaceutical
- Record information once radioisotope arrives
- Verify quantity and measure activity
- Prepare seeds, catheters, and I-131
- Participate in implant administration
- Complete paperwork
- Conduct appropriate surveys
- Run post-plan and review with physician
- Unload patient
- Complete paperwork, measurements, counts, and return seeds

Written Report Guidelines

Purpose
Student will write a short report for each brachytherapy treatment site. The purpose of writing the reports is to supplement the required competencies of which the student will be tested, based on a selected patient's case. Each sites competency grade will be determined from competency form and written report content.

Instructions
For each brachytherapy comp, write a one to two page typed report describing the patient's case that you selected for use in testing your competency. Include the following information using this format: Content under numbers **1-7** should be written using a listing format, and content for numbers **8-10** should be written as an explanation in essay format. Number 12 should be answered in a step by step bullet format.

Report Content

1. Treatment site
2. Diagnosis
3. Stage
4. Concomitant modes of therapy
5. Radiation dose prescription
6. Critical structures and their limiting doses
7. Brachytherapy modality
8. Why are the above radiation therapy parameters (5-7) used to treat this patient?
9. How do you evaluate the tumor dose and critical structure doses? Discuss both methods of evaluation.
10. What special considerations exist and how are they applied when planning this patient's treatment?
11. List the CPT billing codes along with the documentation that is needed to justify the codes for this patient.
12. Student will also include a step by step written outline on how to perform the procedure for future reference.

Due Date
Student must submit each report to the Clinical Instructor within one week after completing the brachytherapy competency.

Grade based on
- How accurate the student represents content from the patient's chart and treatment plan
- Use of correct grammar
- How clear is the student's reasoning in explanations

Brachytherapy Competency List

Required Competencies- one of each and a competency form must be filled out for each site

Anatomical Site	Competency Date	Date Competency Report Posted
GYN		
Cylinder – Ir-192 or Gynsite		
Tandem and Ovoids – Ir-192 (HDR)		
Ir-192 temporary interstitial implant		
Prostate		
I-125 or Pd-103 permanent seed implant or HDR Prostaate		
Thyroid		
I-131 radiopharmaceutical administration		
Breast and Sarcomas		
Ir-192 HDR – observe, assist and explain all aspects of procedure		
Miscellaneous		
Miscellaneous Brachytherapy Procedure, i.e. skin or extra procedure		

At the end of the brachytherapy rotation the student must also turn in the three QA projects: Source Exchange, Machine/Source QA, and Applicator QA.

Date QA Projects Completed and Posted _____

All failed competency attempts must be turned in. If a student fails 7 competency attempts (any combination from all rotations) at any time throughout the program or 4 competency attempts (one specific competency), the student will be removed from the program.

To achieve normal progress in brachytherapy, two competencies must be completed by the end of week three of the rotation.

Competency Attempt				
	1	2	3	4
Pass				Fail

Southern Illinois University Carbondale
Medical Dosimetry Program

Brachytherapy Competency Form

Tandem and Ovoids

Refer to the instructions for performing clinical assessment. The student must complete the competency by meeting the related objectives specified for each portion of the implant: preparation, planning, treatment.

Preparation/Calculation Sheet

Comments: _____

_____

_____

_____ _____
Student Signature/Date Brachytherapy Technologist Signature/Date

Planning

Comments: _____

_____

_____

_____ _____
Student Signature/Date Dosimetrist Signature/Date

Treatment

Comments: _____

_____

_____

_____ _____
Student Signature/Date Brachytherapy Technologist Signature/Date

_____
Physicist Signature

Competency Attempt
1 2 3 4
Pass Fail

Southern Illinois University Carbondale
Medical Dosimetry Program

Brachytherapy Competency Form

Cylinder/Gynsite

Refer to the instructions for performing clinical assessment. The student must complete the competency by meeting the related objectives specified for each portion of the implant: preparation, planning, treatment.

Preparation/Calculation Sheet

Comments: _____

_____

_____

_____ _____
Student Signature/Date Brachytherapy Technologist Signature/Date

Planning

Comments: _____

_____

_____

_____ _____
Student Signature/Date Dosimetrist Signature/Date

Treatment

Comments: _____

_____

_____

_____ _____
Student Signature/Date Brachytherapy Technologist Signature/Date

_____
Physicist Signature/Date

Competency Attempt
1 2 3 4
Pass Fail

Southern Illinois University Carbondale
Medical Dosimetry Program

Brachytherapy Competency Form

HDR Iridium-192 GYN Interstitial Implant

Refer to the instructions for performing clinical assessment. The student must complete the competency by meeting the related objectives specified for each portion of the implant: preparation, planning, treatment.

Preparation/ Calculation Sheet

Comments: _____

_____

_____

_____ _____
Student Signature/Date Brachytherapy Technologist Signature/Date

Planning

Comments: _____

_____

_____

_____ _____
Student Signature/Date Dosimetrist Signature/Date

Treatment

Comments: _____

_____

_____

_____ _____
Student Signature/Date Brachytherapy Technologist Signature/Date

_____
Physicist Signature/Date

Competency Attempt				
	1	2	3	4
Pass				Fail

Southern Illinois University Carbondale
Medical Dosimetry Program
Brachytherapy Competency Form

Thyroid Iodine-131 Radiopharmaceutical Administration

Refer to the instructions for performing clinical assessment. The student must complete the competency by meeting the related objectives specified for each portion of the implant: preparation, planning, treatment.

Preparation- room and explanation of procedure

Comments: _____

_____

_____

_____ _____
Student Signature/Date Brachytherapy Technologist Signature/Date

QA Source- Check in

Comments: _____

_____

_____

_____ _____
Student Signature/Date Brachytherapy Technologist Signature/Date

_____
Physicist Signature/Date

Treatment- Room survey

Comments: _____

_____

_____

_____ _____
Student Signature/Date Brachytherapy Technologist Signature/Date

Competency Attempt				
	1	2	3	4
Pass				Fail

Southern Illinois University Carbondale
Medical Dosimetry Program
Brachytherapy Competency Form

Prostate Permanent Seed or HDR Implant

Refer to the instructions for performing clinical assessment. The student must complete the competency by meeting the related objectives specified for each portion of the implant: preparation, planning, treatment.

Preparation

Comments: _____

_____

_____

_____ _____
Student Signature/Date Brachytherapy Technologist Signature/Date

_____
Dosimetrist Signature/Date

_____
Physicist Signature/Date

Pre-Planning and Post-Planning

Comments: _____

_____

_____

_____ _____
Student Signature/Date Dosimetrist Signature/Date

Treatment

Comments: _____

_____

_____

_____ _____
Student Signature/Date Brachytherapy Technologist Signature/Date

_____
Physicist Signature/Date

Competency Attempt				
	1	2	3	4
Pass				Fail

Southern Illinois University Carbondale
Medical Dosimetry Program
Brachytherapy Competency Form

Breast HDR Treatment

Refer to the instructions for performing clinical assessment. The student must complete the competency by meeting the related objectives specified for each portion of the implant: preparation, planning, treatment.

Preparation- Measure and cut catheters

Comments: _____

_____

_____

_____ _____
Student Signature/Date Dosimetrist Signature/Date

Planning

Comments: _____

_____

_____

_____ _____
Student Signature/Date Dosimetrist Signature/Date

_____
Physicist Signature/Date

Treatment

Comments: _____

_____

_____

_____ _____
Student Signature/Date Brachytherapy Technologist Signature/Date

_____
Physicist Signature/Date

Southern Illinois University Carbondale
Medical Dosimetry Program
Brachytherapy Rotation
References/Reading Materials

Textbooks

- Perez, C.A., Brady, L.W., Principles and Practices of Radiation Oncology, Chapter 15 and chapter on HDR by Ezzell
- Khan, F. M., The Physics of Radiation Therapy
- Bentel, G., Treatment Planning and Dose Calculation in Radiation Oncology
- Brachytherapy Physics, ed. Williamson, Thomadsen and Nath. Medical Physics Press
- Principles and Practice of Brachytherapy, ed. by Subir Nag Futura Press

Reports

- "Comprehensive QA for Radiation Oncology: Report of the American Association of Physicists in Medicine, Task Group No. 40." Med Phys 21(4): 581-618, 1994
- "Dosimetry of Interstitial Brachytherapy Sources: Report of the American Association of Physicists in Medicine, Task Group No. 43." Med Phys 22(2): 209-234, 1995
  ** Look for summary by Meigonni
- "Code of Practice for Brachytherapy Physics: Report of the American Association of Physicists in Medicine, Task Group No. 56." Med Phys 24(10): 1557-1598, 1997
- "High Dose-Rate Brachytherapy Treatment Delivery: Report of the American Association of Physicists in Medicine, Task Group No. 59." Med Phys 25(4): 375-403, 1998
- "Permanent Prostate Seed Implant Brachytherapy: Report of the American Association of Physicists in Medicine Task Group No. 64." Med Phys. 26(10): 2054-2076, 1999
- Code of Federal Regulations, chapter 10, parts 20 & 35
- **Williamson, J.F**., Coursey, B.M., DeWerd, L.A., Hanson, W.F., Nath, R. and Ibbott, G. "Guidance to Users of Nycomed Amersham and North American Scientific, Inc. I-125 Interstitial Sources: Dosimetry and Calibration Changes: Recommendations of the American Association of Physicists in Medicine Radiation Therapy Committee Ad Hoc Subcommittee on Low-Energy Seed Dosimetry," Med. Phys. 26:570-573, 1999
- **Williamson, J.F**., Coursey, B.M., DeWerd, L.A., Hanson, W.F., Nath, R., Rivard, M.J., and Ibbott, G., "Recommendations of the American Association of Physicists in Medicine on ^{103}Pd Interstitial Source Calibration and Dosimetry: implications for dose specification and prescription," *Med. Phys*. 27(4):634-642, 2000.
- **Williamson, J.F**., Coursey, B.M., DeWerd, L.A., Hanson, W.F., Nath, R., Rivard, M., Ibbott, G., "On the use of Apparent Activity A_{app} for Treatment Planning of ^{125}I and ^{103}Pd Interstitial Brachytherapy Sources: Recommendations of the American Association of Physicists in Medicine Radiation Therapy Committee Subcommittee on Low-Energy Brachytherapy Source Dosimetry." *Med. Phys.* 26: 2529-2530, 1999.

- **Williamson, J.F**., Coursey, B.M., DeWerd, L.A., Hanson, W.F., and Nath, R., "Dosimetric Prerequisites for routine clinical use of new low energy photon interstitial brachytherapy sources," Med. Phys. 25: 2269-2270, 1998.

Journal Articles
Applicable articles from the following journals and those assigned by staff:

- Medical Dosimetry
- Medical Physics
- International Journal of Radiation Oncology Biology and Physics
- Radiotherapy and Oncology

Online Websites
- medicaldosimetry.org
- aapm.org/pubs/reports
- radiotherapy.com

Handouts
- Mutic, S., "Residents Physics Orientation Course", 2000.
- Mutic, S., handouts on Radiopharmaceuticals
- Applicable problem sets and questions
- Li, Z., Annual Operator Refresher Training for HDR brachytherapy
- Williamson, J.F., "Quality Assurance of Brachytherapy Treatment Delivery and Planning Devices", RSNA Categorical Course in Brachytherapy Physics 1997, pp 111-130
- Handouts from related conferences

Personal Contacts and Responsibilities for Brachytherapy Rotation

- Brachytherapy Staff - Implant procedures, documentation, QA

- Physics Staff.
  Overall QA procedure, regulatory issues
  QA, Treatment planning, HDR commissioning
  Treatment planning software operation, commissioning and QA
  Source room preparation, isotope check-in, and QA sources

- Facility Radiation Safety Officer - Radiation safety

- Dosimetry Staff - Source localization, computer treatment planning, documentation – GYN and Prostate implants

- Scott Collins, C.M.D.- Coordination, brachytherapy rotation

Southern Illinois University Carbondale
Medical Dosimetry Program
Brachytherapy Rotation
Quality Assurance Assignments

Assignment Date/Instructions

A written report in bullet format stating the process of applicator QA, Source Exchange QA, and HDR Machine/Source QA is due at the end of the brachytherapy rotation. This report must also include the tolerances of acceptance, frequency and what to do if test is not within limits.

Clinical Instructors

Brachytherapy Physicists and technologists.

Applicator QA

- Review TG 56
- Review HDR Commissioning Report and radiographs found in Physics area
- Discuss with clinical instructor
- This should include all tests one performs when they get a new applicator for clinical use. i.e. T&O or other applicators.
- Review objectives provided by clinical instructor
- State the test, what is being tested, frequency, tolerance, and how performed.

Source Exchange QA

- Refer to TG 56
- Measure source activity and calculate decayed value
- Input source parameters and verify information in treatment planning system
- Determine accuracy of dose calculation
- State the test, what is being tested, frequency, tolerance, and how performed.

HDR Machine/Source QA

- Take part in QA including source exchange and morning QA
- Refer to TG59 and TG56
- State the test, what is being tested, frequency, tolerance, and how performed.

Medical Dosimetry Educational Program

Objectives
Conventional and CT Simulator Clinical Rotations

Pre-Simulation

- Review resource material at least one day prior to scheduled simulation, in order to be prepared for the day's cases.
- Discuss with physician the initial planning information as described on the simulation information sheet (specific site, beam arrangement, special considerations, etc.)
- Prepare simulation and CT room for each scheduled case.
- Communicate with patient by describing procedure, answering questions and setting them at ease.

Simulation

- Determine the appropriate patient position to optimally treat the patient
- Determine the appropriate immobilization and repositioning devices needed to optimally treat the patient.
- Construct immobilization devices
- Incorporate known treatment boarders, tumor location, limiting critical structures, and patient measurements to determine isocenter
- Use proper scanning techniques to perform simulation and use "Preview" procedures for setting isocenter if applicable
- Direct gantry, collimator and treatment couch to optimally treat the desired area, using specific calculations when necessary
- Determine SSDs for each field

Documentation

- Generate radiographs of each treatment field
- Obtain AP and Lateral set-up films if needed
- Place reference and field marks on patient's skin and immobilization devices
- Record all set-up information in chart
- Enter information into the record and verify computer system
- Discuss nonstandard set-ups with treatment therapists and dosimetrists

Medical Dosimetry Educational Program
Conventional Simulation and CT Simulation Clinical Rotation

References/Reading Material

Procedure Manuals

- CT Simulation
- Conventional Simulation
- Treatment Procedures located in physician staff rooms
- Dosimetry Manuals

Textbooks

- Perez, C.A., Brady, L.W., Principles and Practices of Radiation Oncology
- Khan, F.M. & Potish, R.A., Treatment Planning in Radiation Oncology
- Bentel, G., Radiation Therapy Planning

Professional Journals

- Medical Dosimetry
- Radiation Therapist
- Radiologic Technology
- Medical Physics
- International Journal of Radiation Oncology Biology and Physics
- Radiotherapy and Oncology

Websites

- asrt.org
- medicaldosimetry.org
- aapm.org
- radiotherapy.com

Faculty and Clinical Instructors

- Simulation Radiation Therapists
- Medical Physicists
- Program Director

Medical Dosimetry Educational Program
Instructions to Evaluator and Student
Conventional Simulation and CT Simulation Clinical Competency

Listed below are instructions describing the process used for evaluators to assess the student's clinical competence, using the attached Clinical Competency Form and Objectives.

1. The Evaluators for conventional and CT simulation are the Simulation Radiation Therapists

2. A list of required competencies is attached to the student's information packet for the simulator clinical rotation.

3. The student will inform the evaluators when he/she is ready to perform a specific competency.

4. Evaluators(s) will sign the competency form only if the student has successfully participated in all aspects of the designated case as described in the simulation objectives and guidelines.

5. In the event the student is unable to successfully complete the specified competency, the clinical instructor will write a comment describing areas for improvement, and refrain from signing the competency form. The student must prepare and make a second attempt at the competency.

6. Upon approval from all clinical instructors for each aspect of the competency, the student will submit the competency form to the dosimetry program director.

7. No paper required on competencies.

Medical Dosimetry Educational Program
Evaluators, Clinical Location, Required Treatment Sites
Conventional Simulation and CT Simulation Clinical Competencies

Clinical Instructors/Evaluators

- Simulation Radiation Therapists

Location/Timeframe- if virtual simulation is part of the duties of a simulation therapist, i.e. contouring and putting on beams, the student should perform these duties as well.

- **95% of rotation:** **CT Simulation**
- **5% of rotation:** **Conventional Simulation- Not available in most clinics so 100% CT Simulation**

This is just a suggestion; spend the required amount of time to complete competencies.

Treatment Sites

The student **will assist** in the simulation of each of the following anatomical sites and explain the entire procedure as described by the simulation objectives, on the sites listed below:

***** For the sites listed in which no clinical cases are performed during the two-week clinical rotation, the student must explain to the clinical instructor how the procedure is performed, covering the simulator objectives.

Abdomen
Brain
IMRT
Head and Neck
Mantle/Periaortics
Pediatric
Lung or Esophagus
GYN Pelvis
Rectum
Spine
Sim with contrast
Breast, IM, SCV
Extremity
Prostate
4D Study
Stereotactic (ESRT)

Lung
Breast – tangents

Simulation Competency List

Required Competencies- a competency form must be filled out for each procedure.

Anatomical Site	Competency Date	Conventional or CT Simulation	List Therapist Involved
GYN Pelvis			
Rectum			
Spine			
Abdomen			
Brain			
Head and Neck			
Mantle/Periaortics (Most likely Mock)			
Pediatric			
Lung/Esophagus			
Breast Tangents			
Breast, IM, SCV			
Any sim with contrast			
IMRT			
Prostate			
Stereotactic (ESRT)			
4D Study			
Extremity			

All failed competency attempts must be turned in. If a student fails 7 competency attempts (any combination from all rotations) at any time throughout the program or 4 competency attempts (one specific competency), the student will be removed from the program.
To achieve normal progress in simulation, all competencies must be completed by the end of the rotation (week two).

Competency Attempt
1 2 3 4
Pass Fail

Medical Dosimetry Educational Program
Simulation Competency Form

Refer to the instructions for performing clinical assessment. The student must complete the competency by meeting the related objectives specified for each portion of the simulation.

Site:_____ **Conventional** or **CT**

Comments: _____

_____

_____

_____

_____

_____
Student Signature / Date

_____
Simulator Therapist Signature / Date

*All failed competency attempts must be turned in.

Medical Dosimetry Educational Program

Guidelines
Treatment Aid Paper

Objectives (attached)

Must include how the following items are constructed/used and list limitations for use.

- Photon Blocks
- Electron Blocks
- .Decimal Compensator
- Field in Field planning
- Compensating Filters to include historical data on both lucite and Ellis.
- Custom Bolus

Assessment

- Competencies
- Assignments
- Written Journal

Resources

- **Contacts**
  - Blockmaker, Dosimetrist, Physicist, Radiation Therapist
- **Procedure Manuals**
  - Blockroom
  - Dosimetry
- **Textbooks**
  - Perez, C.A., Brady, L.W., Principles and Practices of Radiation Oncology
  - Khan, F.M. & Potish, R.A., Treatment Planning in Radiation Oncology
  - Kahn, F. M., The Physics of Radiation Therapy
  - Bentel, G., Treatment Planning and Dose Calculation in Radiation Oncology
  - Bentel, G., Radiation Therapy Planning
- **Professional Journals**
  - Medical Dosimetry
  - Medical Physics
  - International Journal of Radiation Oncology Biology and Physics
  - Radiotherapy and Oncology
- **Websites**
  - asrt.org
  - medicaldosimetry.org
  - aapm.org
  - radiotherapy.com

Medical Dosimetry Educational Program

Objectives
Treatment Aid Fabrication

Cerrobend Blocks

- Explain differences in constructing photon and electron blocks
- Understand the aspects of block construction – preparation (film, styrofoam, machine) cutting, pouring, knocking out, filing, mounting, labeling, QA
- Evaluate the accuracy of finished product
- Explain how to correct an inaccurate finished treatment device
- Describe how to modify block for minor adjustment once patient is under treatment
- Explain why cerrobend is used over lead for custom blocking in radiation therapy treatment fields

Field in Field Planning

- Explain why used
- Describe advantages and disadvantages of this technique
- Describe method

Compensating Filters and Bolus

- Describe all aspects of compensating filter construction – (.Decimal, Ellis, etc) tray preparation, reference point selection, assembly, labeling
- Explain why selected metals are used
- Describe other types of compensating filters used in radiation therapy departments throughout the country
- Explain the specific uses of various compensating filters
- Provide examples of anatomical sites using custom bolus (Can be .Decimal as well)
- Explain why various types of custom bolus are used

Special Cases

- Explain the construction of partial transmission blocks

Safety and Quality Assurance

- Understand safety procedures of work in the blockroom
- Describe various aspects of quality assurance for blocks, MLCs, compensating filters, and bolus

Complete paper according to guidelines and objectives.

Southern Illinois University Carbondale
Medical Dosimetry Program
External Beam Rotation
Goals and Objectives

Goals

Student will evaluate patient's case, consider physician's prescription, delineate normal structures from CT images, utilize virtual simulation, optimize a plan for treatment, discuss plan with Dosimetrist, Physician, Physicist, and Radiation Therapist, document patient's set-up and plan, use patient measurements and set-up parameters to calculate fields for treatment, enter set-up and dose into the treatment verification computer system.

Objectives

Using the department's virtual simulation software, treatment planning systems and record and verify system, the student will meet the following objectives for each treatment site.

1. Evaluate the CT study and patient set-up information for appropriate use in planning the specified treatment site, and then delineate the associated normal organs. Use image fusion in applicable cases.

2. Discuss planning information with Radiation Oncologist to include tumor margin, dose prescription, critical structure dose, and possible beam arrangement.

3. Optimize a plan of treatment by incorporating the discussed information, along with isocenter placement, specific beam modifiers, various radiation modalities, and beam weighting, to improve the dose distribution of the plan.

4. Evaluate dose to the tumor and normal organs, along with the practicality of implementing the plan clinically.

5. Discuss the completed plan with the Radiation Oncologist, Physicist and Radiation Therapist for their feedback and approval.

6. Prepare documentation for the plan, calculate monitor units and special points of interest, enter record and verify information, and record treatment considerations appropriately in treatment chart.

Southern Illinois University Carbondale
Medical Dosimetry Program
External Beam Clinical Rotation Schedule and Assignments

- **Days**
  Monday – Friday
- **Hours**
  7:30a.m. – 4:30 p.m., with hours extending prior and after these listed hours when clinical responsibilities are necessary

* Student will participate in less frequently treated sites/techniques (such as craniospinal, Hodgkin's disease and total nodal irradiation) throughout external beam rotation regardless of assigned rotation

** Scheduled external beam rotations do not include IMRT cases unless the students are at the external clinical sites or DL centers or patient load permits. Most of the treatment planning rotations should be spent performing 3D treatment planning. If a body part listed in the 3D competency list is performed with IMRT at that clinic, the student may perform the competency using IMRT and count it for 3D competency. Student will also cover IMRT material during a dedicated clinical rotation.

*** Student must complete at least three competencies at each clinical rotation. Even if a student has all the required competencies complete they must perform a minimum of three competencies at each facility.

- **Priority of Responsibilities while in clinic**
  1. Related planning and assignments dealing with currently scheduled unit
  2. Incomplete competency from prior unit(s)
  3. Planning related to next scheduled unit

- **Assignments**
  - **Competency**
    - Student will select a patient from each unit to use as a case study for testing competency. To successfully complete the competency, the student will use the course objectives as a guide, and perform all aspects of the patient's planning process, beginning with contouring the CT and ending with final documentation for treatment. The competency includes active participation of the planning process, discussion with the clinical instructor throughout the process, and a final written report.
  - **Isodose Homework**
    - During the students first external beam rotation students must complete the Isodose homework posted on Desire2Learn.
  - **Conferences/Reports**
  - **Written Journal**
  - **Evaluations**

- **Additional Guidelines for student throughout clinical rotation and in preparation for competency**

  - During the first week of each unit rotation, student will observe the medical dosimetrist on many clinical cases, and then by the end of the week perform most aspects of treatment planning with assistance from clinical instructors.
  - By the second week of the rotation, the student should perform all aspects of treatment planning with minimal assistance. Early in the second week, the student should begin looking for a patient to use as his/her competency/case study.
  - By the third week, the student will complete his/her competency and participate in clinical treatment planning, acting in the role of a Medical Dosimetrist.
  - The student should keep in mind that during the clinical rotation, he/she will be working on several cases at one time, and should stay organized with each patient going through the planning process.

- **Quality Assurance Guidelines**

  Student is involved in treatment machine quality assurance throughout the Dosimetry Program. During his/her external beam treatment planning rotation, the student will:

  - Observe and participate with dosimetrists and/or physicists in monthly QA of linear accelerators and simulators
  - Perform successfully, on own, with supervision of dosimetrist and/or physicist, one treatment machine QA for the following treatment machines:
    - Varian dual energy linear accelerator.
    - Elekta linear accelerator or second linear accelerator at site.
    - Daily constancy check- this may be done at outside training centers.

  - Write a report for QA completed on own and have clinical instructor read, comment and sign report. This report should include the tests performed, test tolerance, recommended frequency and how to actually perform the test. Turn signed report in to program director

- **Tips for External Beam Rotation**

  - During external beam rotations the student must participate in all the activities that an employed dosimetrist performs.
  - Students should focus on 3D treatment planning when available but may run IMRT plans also.
  - If a body part listed in the 3D competency list is performed with IMRT at that clinic, the student may perform the competency using IMRT and count it for 3D competency
  - During the first 10 weeks of the fall and spring semesters, students must complete 20 journal article summaries (average 2 per week). The second ten weeks of the fall and spring semesters, students will perform two major research papers. One paper will be completed for each semester.
    - End of approximately 19th week- final paper turned in for grade. Paper may be eligible for submission to professional journal if appropriate.
  - Students will participate in the monthly QAs performed at each of the facilities.
  - While in the external beam rotations, the student should rotate to see some scans performed on a PET/CT scanner if available.

Southern Illinois University Carbondale
Medical Dosimetry Program
External Beam Rotation
Competency List

- The following sites or cancer types must have one competency evaluation form/case study report (see attached). In addition to completing competency case studies, student should follow through on a variety of patient's treatment plans for all sites. These competencies may be performed either with IMRT or standard external beam planning depending on how they are performed at you specific clinic site. (Students must still complete the required IMRT competencies also.)

- This form is to be used as a documentation summary of cases. Competency case studies must also be documented using the appropriate objective/competency evaluation form. All completed cases must meet the objectives listed on the attached form to be considered a successful competency.

- A minimum of three competencies must be completed at each clinical site. All failed competency attempts must be turned in. If a student fails 7 competency attempts (any combination from all rotations) at any time throughout the program or 4 competency attempts (one specific competency), the student will be removed from the program.

- To achieve normal progress in external beam, one competency must be completed by the end of week five of the rotation.

- Dosimetrist must initial and date competency form upon student's completion of cases.

External Beam Treatment Planning Anatomical Site (23 Total Competencies Required)	**Method IMRT or 3D**	**Competency Date**	**Date Case Study Filed**	**List Dosimetrist Involved**
Anus or Vulva Conventional 3D Technique				
Breast, Multi-port with SCV and Axilla Fields				
Breast, Tangents Only				
Chestwall				
Craniospinal (most likely test patient)				
Electron Case				
GI Abdomen 3 or 4 Field. i.e. Pancreas, GE Junction				
GYN pelvis (periaortics)				
Image Fusion (MRI, PET, etc.)				
Limb Melanoma/Sarcoma				
Lung (3D)				
Lymphoma				
Mantle (most likely test patient via written report)				
Palliative (Brain, Spine, etc.)				
Pelvis 3-Field With wedges				
Pelvis 4-Field				
Primary Brain				
Primary Head & Neck (Bilateral or Nasopharynx case)				
Prostate 3D or IMRT				
Rectum				
Re-Irradiation or Composite Planning				
Simultaneous Integrated Boost (SIB)				
Special Procedure – protocol, IGRT, breath hold, SRT, emergency sim and treat, TBI etc.				

Competency Attempt				
	1	2	3	4
Pass				Fail

Southern Illinois University Carbondale
Medical Dosimetry Program

External Beam Clinical Competency Evaluation Form

The Medical Dosimetry Student will use each treatment site as a case study to test competency. Student must successfully complete the competency by meeting the objectives specified for each aspect of the treatment plan, and writing a report that meets the attached guidelines. Next to each numbered objective, check whether the student was successful (S) or unsuccessful (U) in meeting the objective during the competency, or check appropriately if objective was not applicable (N/A) to the specific site.

Treatment Site: _____

Course Objectives		**Competency Rank**		
Throughout the clinical rotation, the Dosimetry Student will participate in the following activities and by the end of each unit, on his/her own, will:		**S**	**U**	**N/A**
1.	Evaluate the CT study and patient set-up information for appropriate use in planning the specified treatment site, and then delineate the associated normal organs. Use image fusion in applicable cases.	___	___	___
2.	Discuss planning information with Radiation Oncologist to include tumor margin, dose prescription, critical structure dose, and possible beam arrangement.	___	___	___
3.	Optimize a plan of treatment by incorporating the discussed information, along with isocenter placement, specific beam modifiers, various radiation modalities, and beam weighting, to improve the dose distribution of the plan.	___	___	___
4.	Evaluate dose to the tumor and normal organs, along with the practicality of implementing the plan clinically.	___	___	___
5.	Discuss the completed plan with the Radiation Oncologist, Physicist and Radiation Therapist for their feedback and approval.	___	___	___
6.	Prepare documentation for the plan, calculate monitor units and special points of interest, enter record and verify information, and record treatment considerations appropriately in treatment chart.	___	___	___

_____ _____

Student Signature / Date Medical Dosimetrist Signature / Date

*Written case report and competency form should be posted to the Desire2Learn server (must be submitted together).

**Each failed competency attempt must be turned in.
***If writing a report in place of a competency, the report must be discussed with clinical staff and a competency form completed.

Medical Dosimetry Educational Program
External Beam Clinical Competency

Written Report Guidelines

Purpose
Student will write 20 short reports, one for each treatment site of his/her External Beam Clinical Practicum. The purpose of writing the reports is to supplement the 20 required competencies of which the student will be tested, based on a selected patient's case. Each sites competency grade will be determined from 1) treatment planning practical exam in the clinic, and 2) written report of the case used for the practical exam.

Instructions
For each of the external beam competencies, write a one to two page typed report describing the patient's case that you selected for use in testing your competency. Include the following information using this format: Content under numbers **1-8 as well as 12** should be written using a listing format, and content for numbers **9-11** should be written as an explanation in essay format. **Numbers 1-12 should be no longer than 1-2 pages typed**. Numbers 12 and 13 should be answered in a step by step bullet format.

- **Report Content**
  - **1.** Treatment site
  - **2.** Diagnosis
  - **3.** Stage
  - **4.** Concomitant modes of therapy
  - **5.** Radiation dose prescription
  - **6.** Critical structures and their limiting doses
  - **7.** Beam arrangement and modality
  - **8.** Beam modifiers
  - **9.** Why are the above radiation therapy parameters (5-8) used to treat this patient?
  - **10.** How do you evaluate the tumor dose and critical structure doses? Discuss both methods of evaluation.
  - **11.** What special considerations exist and how are they applied when planning this patient's treatment?
  - **12.** List the CPT billing codes along with the documentation that is needed to justify the code for this patient.
  - **13.** Student will also include a step by step written outline on how to perform the procedure for future reference.

In the event a real patient is not available for a required competency, a written report must be completed for the specific site. It must include all the required content steps listed above as well as a signed competency form based on case discussion with the clinical instructor. It is suggested a mock case be used for beam arrangements.

Due Date
Student must post each report to Desire2Learn within one week after completing the competency.

Grade based on
- How accurate the student represents content from the patient's chart and treatment plan
- Use of correct grammar
- How clear is the student's reasoning in explanations

Medical Dosimetry Program
IMRT Rotation
Objectives and Competency List

The student will participate in the activities listed below throughout his/her IMRT rotation.

Student must complete seven competencies by the end of IMRT rotation: one for each of the following anatomical locations and an extra site: **IF your location completes the IMRT plans mostly with VMAT, a static gantry plan must also be performed to count as one competency.**

Anatomical Site	Method IMRT or VMAT	Competency Date	List Dosimetrist Involved
Esophagus 3D, IMRT, or VMAT			
Lung			
Pelvic Lymph Nodes- i.e. GYN , Anal plan, Para-aortic			
Primary CNS i.e. Brain			
Primary Head and Neck			
Prostate			
SBRT 1 Case on any location			
SBRT 2 Case on any location			
Participate in a Tomotherapy Plan if available or complete an additional IMRT plan. i.e. Breast			

In addition to the above competencies, student must participate in all aspects of as many IMRT patients as possible.

All the above cases should be performed on real clinical patients if possible. At a minimum, the pelvic lymph nodes and H&N cases must be on current clinical cases.

References
Refer to the journals and websites listed on reference list from brachytherapy and simulator clinical rotations. Also refer to Khan, "The Physics of Radiation Therapy" 5th edition.

Assignment
Outline chapter 20 of Khan, "The Physics of Radiation Therapy" 5th edition. This outline is due by the end of the fall semester but suggest it be completed during this rotation if early in the program year. List the major points listed in this chapter. Suggest this be submitted in bullet format.

All failed competency attempts must be turned in. If a student fails 7 competency attempts (any combination from all rotations) at any time throughout the program or 4 competency attempts (one specific competency), the student will be removed from the program.

To achieve normal progress in IMRT, one competency must be completed by the end of week five of the rotation.

IMRT Rotation
Competency Report Guidelines

When submitting the IMRT competency a case report must also be submitted. Include the following information using this format: Content under numbers **1-8** should be written using a listing format, and content for numbers **9-11** should be written as an explanation in essay format. **Numbers 1-11 should be no longer than 1-2 pages typed**. Number 12 should be answered in a step by step bullet format.

- **Report Content**
  - **1.** Treatment site
  - **2.** Diagnosis
  - **3.** Stage
  - **4.** Concomitant modes of therapy
  - **5.** Radiation dose prescription
  - **6.** Critical structures and their limiting doses
  - **7.** Beam arrangement and modality- **If VMAT is being utilized, this section must include details comparing the plan results of static versus VMAT techniques.**
  - **8.** Beam modifiers
  - **9.** What optimization methods were used to successfully complete this plan?
  - **10.** How do you evaluate the tumor dose and critical structure doses? Discuss both methods of evaluation.
  - **11.** List the CPT billing codes along with the documentation that is needed to justify the code for this patient.
  - **12.** Student will also include a step by step written outline on how to perform the procedure for future reference.

Competency Attempt
1 2 3 4
Pass Fail

Medical Dosimetry Program
IMRT Rotation
Competency Form

IMRT Competency_____ **Date**_____

The competency requires the student follow a patient from start to finish, assist and correctly explain every aspect listed below on for specific case. The designated staff (therapist, dosimetrist, physician, and physicist) will sign off in respective areas, verifying successful completion of each competency section.

	Activity	**Staff's Signature/Date**
1)	Set-up films (dosimetrist)	_____
2)	Registration (dosimetrist)	_____
3)	Normal tissue contouring (dosimetrist)	_____
4)	M.D. target volume delineation, dose prescription, and planning (physician)	_____
5)	Planning (dosimetrist and physicist	_____
6)	Physicist review of plan (physicist)	_____
7)	Physicist QA on treatment machine (physicist) (may be for similar case)	_____
8)	Documentation (dosimetrist)	_____
9)	Record and Verify Entry (dosimetrist)	_____
10)	Observe treatment….prefer first day (therapist)	_____

*All Failed competency attempts must be turned in.

**Written case report should be posted to the Desire2Learn server along with competency form.

Medical Dosimetry Educational Program

Objectives
Chart Check Rotation

The student will participate in the following reviews throughout the clinical rotation and write a summary paper for each procedure. The report should detail how the tasks below are performed, what is reviewed, and tolerances accepted. Provide specific details in this report.

Weekly Chart Reviews

Review the following information for consistency and accuracy

- Dose Sheet
- Dose prescription, daily dose record, calculation sheet
- Isodose Plan
- Set-up sheet
- Shift sheet
- Diode measurements

Initial Treatment Check

Review the following information for accuracy

- Monitor unit calculation
- Record and verify entry
- Set-up parameters
- Isocenter shift
- Radiographs
- Isodose if available

External Beam and Brachytherapy Isodose Review

Perform isodose review for agreement and accuracy of the following information

- Set-up parameters
- Critical structure dose
- Target volume dose

Review brachytherapy isodose plans for agreement and accuracy of the following information

- Source placement
- Interest point location
- Prescription dose
- Interest point dose

Special Procedures/Measurements

Participate in the following projects and write a report on the process for each.

- Pacemakers
- TLDs
- Ion chamber measurements
- Output checks using film (not performed much anymore so most likely just a report)

Southern Illinois University Carbondale
Medical Dosimetry Program

Chart Check Rotation
Schedule and Resources

Schedule, Location, and Primary Physics Contact

Dosimetry students will spend two weeks working with all physicists in the chart check area, but one primary physicist is assigned as a contact person and to ensure competencies are met. Discuss point physicist with program director at beginning of rotation.

Procedure Manuals

- Chart Check Protocol
- Dosimetry and Physics Manuals
- Treatment Procedures located in physician staff rooms

Reports

- Task Group 40, 142 or the latest Task Group report
- American College of Radiology Standards for Radiation Oncology Charting

Textbooks

- Perez, C.A., Brady, L.W., Principles and Practices of Radiation Oncology
- Khan, F.M. & Potish, R.A., Treatment Planning in Radiation Oncology
- Khan, F. M., The Physics of Radiation Therapy
- Bentel, G., Treatment Planning and Dose Calculation in Radiation Oncology
- Bentel, G., Radiation Therapy Planning
- Applicable protocols for plans being reviewed

Professional Journals

- Medical Dosimetry
- Medical Physics
- International Journal of Radiation Oncology Biology and Physics
- Radiation Therapist
- Radiotherapy and Oncology

Websites

- medicaldosimetry.org
- aapm.org
- radiotherapy.com
- asrt.org

Faculty and Clinical Instructors

- Medical Physicists- A point person will be provided
- Medical Dosimetrists
- Program Director

Southern Illinois University Carbondale
Medical Dosimetry Program

Chart Check Clinical Rotation
Competency List

Competency	Competency Date	Date Written Report and Competency Posted (together) to Desire2Learn	List Physicist Involved
Chart Review			
Initial Calculation Check			
Isodose Plan Review to include external beam and brachytherapy plans			
Special Procedure • Pacemakers review and process on a real patient. Written report similar to external beam planning report and include verification process.			
Special Procedure • TLDs (most likely not performed, write report)(can do OSLDs, One Dose, etc.)			
Special Procedure • Ion chamber measurements			
Special Procedure • Output checks using film (most likely not performed, write report)			
Other Physics Rotation Assignment	**Date Turned In**		
Pacemaker Assignment with five criteria			

All failed competency attempts must be turned in. If a student fails 7 competency attempts (any combination from all rotations) at any time throughout the program or 4 competency attempts (one specific competency), the student will be removed from the program.

*A written report of the procedure details including what was reviewed, steps taken during the review and any tolerances that are referenced. Also include the CPT billing codes that are charged. Be very specific in this report and it must be posted to the course server with the competency form.

*To achieve normal progress in physics, all competencies must be completed by the end of the rotation.

Southern Illinois University Carbondale
Medical Dosimetry Program

Competency Attempt
1 2 3 4
Pass Fail

Chart Check Clinical Rotation
Competency Form

Refer to the instructions for clinical assessment. The student must complete the competency by meeting the related objectives.

Please circle the specific competency:

Chart Review

Initial Calculation Check

Isodose Plan Review

Special Procedure:_____

Comments: _____

_____

_____

_____
Student Signature / Date

_____
Medical Physicist Signature / Date

*A written report of the procedure details including what was reviewed, steps taken during the review and any tolerances that are referenced. Be very specific in this report and it must posted to the course server with the competency form.
**All failed competency attempts must be turned in.

Medical Dosimetry Program
Chart Check Rotation
Pacemaker Assignment

This must be typed and is only one of the Pacemaker Assignments. See competency list for other requirement.

1) Describe the process physics goes through when notified that a patient has a pacemaker.

2) Explain how a pacemaker impacts the patient's treatment.

3) Explain how a pacemaker impacts treatment planning.

4) Describe the measures taken to avoid harm in treating patients with pacemakers.

5) What role does the dosimetrist play in working on patients with pacemakers?

Medical Dosimetry Program
Gamma Knife/Stereotactic Clinical Rotation
Student Objectives, Competencies and Assignment

The student will participate in the activities listed below throughout his/her Gamma Knife/Stereotactic rotation.

Competency at the end of the rotation requires the student complete the following objectives. The designated staff (physicist, therapist, physician) will sign off in respective areas, verifying successful completion of each competency section.

Objective	**Staff initials, date, or N/A**
Observe and explain process of head frame placement with physician	_____
Observe and explain treatment planning process with medical physicist/dosimetrist	_____
Interact with nurses from radiation oncology and neurosurgery, and explain their role in radiosurgery and Gamma Knife treatments	_____
Explain dose prescription with radiation oncologist	_____
Observe radiation therapist treating the patient	_____
Observe, assist and explain QA process	_____

Contact
Physicist

References
Refer to the journals and websites listed on reference list for brachytherapy and simulator clinical rotations

Assignments- There are three.

1. If available review the educational CD on Gamma Knife/Radiosurgery and write a summary, elaborating on the treatment planning. Be sure to include how we handle special circumstances that arise with various aspects of the patient's treatment. Post this report on Desire2Learn. (Detail GK and linac based).

   If the CD is not available, write a report on the steps a patient goes through for the procedure. Many utilize YouTube to review a video for this as there are several available detailing the steps for this treatment. Also discuss the treatment planning process for Gamma Knife/Radiosurgery (detail GK and linac based). Be sure to include how we handle special circumstances that arise with various aspects of the patient's treatment. Post this report on Desire2Learn.

2. Participate in a Gamma Knife/SRS treatment procedure and write a report similar to the external beam competency reports.

3. Participate in the Gamma knife QA and write the paper for this rotation.

Written Reports (See RAD 525, 545, and 560 Syllabi)

A minimum of two journal summaries per week must be written on during the first 10 weeks of each semester. During the fall semester, the first reports will be on assigned papers. The reports must be posted to Desire2Learn upon completion.

Post the summary, front page of the journal and the front page of the article to Desire2Learn upon completion.

Note: Several of the readings for this area will be assigned readings during the beginning of program.

End of Program Paperwork

It is suggested that students keep a three ring binder with all clinical paperwork for the program. Everything in this binder will be posted to Desire2Learn. The D2L postings will be the permanent record maintained by the program.

All clinical/competency paperwork with checklists and all reports should be kept in a binder in the following order:

i. Time Sheet
ii. Growth Evaluations of Student - (Put all in one section)
iii. Rotation Evaluations from Student- (Put all in one section, one for each rotation)
iv. Brachytherapy
v. Simulation
vi. Treatment Aids
vii. External Beam Planning
viii. Dose Calcs/Chart Review
ix. IMRT
x. Gamma Knife/Stereo
xi. Special Measurements
xii. Tx Machine QA
xiii. Research Papers
xiv. Weekly Journal
xv. Safety Orientation Attendance Sheet

Each student should keep a copy of the binder for their individual records.

Southern Illinois University Carbondale
Medical Dosimetry Program
Safety Orientation Attendance Sheet

For each clinical site a student must attend a safety orientation for the respective facility. This at a minimum must address hazards (fire, electrical, chemical), emergency preparedness, medical emergencies, HIPAA, and Standard Precautions. Radiation safety should also be discussed. By signing below, the student is verifying attendance to this orientation.

Clinic Site: _____

Please mark all topics below when covered:

____Hazards (Fire, Electrical, Chemical)

____Emergency Preparedness

____Medical Emergencies

____HIPAA

____Standard Precautions.

Other, please list:

_____

_____

_____

_____

_____
Student Signature / Date

Southern Illinois University Carbondale
Medical Dosimetry Program

Evaluation of Clinical Rotation From Student

Clinical Location_____

Clinical Rotation_____ **Date**_____

Please rate the following categories. 5=excellent, 1=poor, 0=not applicable
This evaluation must be submitted along with all competency forms prior to your last day at the facility.

This evaluation will be held in confidence and is performed to insure that the facility is meeting the needs of the student dosimetrist. Should any difficulties arise prior to the end of the semester, it is the responsibility of the student to notify the therapy program director immediately.

The facility provided adequate opportunity for completion of the required competencies.	5 4 3 2 1 0
The oncology staff was courteous, informative and helpful.	5 4 3 2 1 0
The clinical instruction and support facilitated my learning experience.	5 4 3 2 1 0
Medical (Physician) input was informative and helpful.	5 4 3 2 1 0
The overall clinical experience was a positive contribution toward my clinical education.	5 4 3 2 1 0

Please list any positive or negative comments below regarding the clinic site.

STUDENT COMMENTS & SIGNATURE:

_____

_____

_____

_____

_____

_____

_____

This evaluation must be submitted at the end of each clinical rotation.

APPENDIX A
SIUC MEDICAL DOSIMETRY PREGNANCY POLICY

The SIUC Medical Dosimetry faculty recognize the basic premise of providing the pregnant student with the information to make an informed decision based on her individual needs and preferences. Thus all SIUC Medical Dosimetry students are provided with the following documents, contained in this Policy.

1. 32 Illinois Administrative Code, Chapter II Section 340.280, Subchapter b, Subsections (a) through (e) "Dose to an Embryo/Fetus".
2. NCRP Report #116, 1993, Section 10 "Protection of the Embryo-Fetus".
3. U.S. Nuclear Regulatory Commission Regulatory Guide 8.13, Revision 3, December 1999, "Instruction Concerning Prenatal Radiation Exposure".

Further information on the fetal effects of radiation may be found in Bushong's radiographic physics book, on pages 543-548 and pages 559-565 (Bushong, S.C. (2004). *Radiologic science for technologists: Physics, biology & protection*, 8th ed. St. Louis, MO: Elsevier Science/Mosby, Inc.)

Finally, the SIUC Medical Dosimetry faculty believe it is the responsibility of the pregnant Medical Dosimetry student to advise her Clinical Instructor and Program Director **voluntarily** and in **writing** of her pregnancy and estimated date of the baby's birth (delivery). Formal, voluntary notification (declaration of pregnancy) is the only means by which the clinical facility and the SIUC Medical Dosimetry program can ensure that the dose to the embryo-fetus is limited during the pregnancy (no to exceed 5 mSv [500 mrem]). **In the absence of the voluntary, written disclosure, a student cannot be considered pregnant.**

Therefore, at the beginning of the program, each SIUC Medical Dosimetry student shall read the documents in this Appendix, have his/her questions answered to his/her satisfaction, and choose to proceed with his/her Radiologic Sciences education as indicated on the Pregnancy Policy form contained herein. If a Medical Dosimetry student becomes pregnant during a clinical semester, it is still the student's responsibility to advise her Clinical Instructor and Program Director **voluntarily** and in **writing** (only if she wishes to declare pregnancy)of her pregnancy and estimated date of the baby's birth (delivery), and to indicate, on the Pregnancy Policy form, her decision towards the Medical Dosimetry program.

The voluntary, written disclosure of her pregnancy and her decision towards the Medical Dosimetry program will be kept in the pregnant student's clinical file, maintained by the Program Director. Release of such information may occur only upon the written permission of the student in question.

PREGNANCY POLICY for MEDICAL DOSIMETRY

The Southern Illinois University at Carbondale (SIUC) Medical Dosimetry faculty believe it is the responsibility of the pregnant Medical Dosimetry student to advise her Clinical Instructor and Program Director **voluntarily** and in **writing** of her pregnancy and estimated date of her baby's birth (delivery). Formal, voluntary notification of pregnancy is the only means by which the clinical facility and the University's Medical Dosimetry program can ensure that the dose to the embryo-fetus is limited during the pregnancy not to exceed 5 mSv (500 mrem). In the absence of the voluntary, written disclosure, a student cannot be considered pregnant.

To comply with this embryo-fetus dose limit, the pregnant Medical Dosimetry student has been given the following documents to read:

a. The January 1994 issue of the 32 Illinois Administrative Code, Chapter II Section 340.280, Subchapter b, Subsections (a) through (e) "Dose to an Embryo/Fetus".
b. NCRP Report #116, 1993, Section 10 "Protection of the Embryo-Fetus".
c. U.S. Nuclear Regulatory Commission Regulatory Guide 8.13, Revision 3, December 1999, "Instruction Concerning Prenatal Radiation Exposure".

WAIVER:

I fully understand the contents of these documents, have had my questions answered to my satisfaction, and I choose to proceed with my Medical Dosimetry education as indicated below.

_____ **I am fully aware of SIUC's pregnancy policy** and choose to continue my clinical and didactic education without modification or interruption. If I am currently pregnant or become pregnant while in the Medical Dosimetry program, I may notify my Clinical Instructor and Program Director **voluntarily** and in **writing** of my pregnancy with one of the options below if I want to declare pregnancy.

_____ **I am pregnant** and choose to continue my clinical and didactic education without modification or interruption. I accept full responsibility for my own actions and the health of my baby. Furthermore, I absolve, discharge, release, and hold harmless my Clinical site and its Oncology staff, and the Board of Trustees for Southern Illinois University together with its officers and employees (the Medical Dosimetry program its faculty) for any legal liability, claims, damages or complications that may occur during fetal growth, birth, and postnatal development of my baby..

_____ **I am pregnant** and choose to continue my clinical and didactic education with some modification of my clinical assignments. I will not participate in brachytherapy or gamma knife procedures. A grade of Incomplete "INC" will be given until I have completed all clinical education missed during my pregnancy. The completion of the "INC" may delay my sitting for the MDCB Exam.

_____ **I am pregnant** and choose to take a leave of absence from the clinical assignments during my pregnancy. A grade of Incomplete "INC" will be given until I have completed all clinical education missed during my pregnancy. The completion of the "INC" may delay my sitting for the MDCB Exam.

_____ **I am pregnant** and choose to take a leave of absence from the SIUC Medical Dosimetry program. If I notify the Program Director of my desire to return, I will be offered a position in the next class, the following year.

_____ **I wish to withdraw my previous declaration of pregnancy.**

I agree to comply with the above-stated policy and with my decision as indicated above.

_____ _____
Student Signature Date

_____ _____
Supervising Clinical Instructor Date

_____ _____
Program Director Date

APPENDIX B

PRENATAL RADIATION EXPOSURE, REGULATORY GUIDE 8.13

A. INTRODUCTION

The Code of Federal Regulations in 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations," in Section 19.12, "Instructions to Workers," requires instruction in "the health protection problems associated with exposure to radiation and/or radioactive material, in precautions or procedures to minimize exposure, and in the purposes and functions of protective devices employed." The instructions must be "commensurate with potential radiological health protection problems present in the work place."

The Nuclear Regulatory Commission's (NRC's) regulations on radiation protection are specified in 10 CFR Part 20, "Standards for Protection Against Radiation"; and 10 CFR 20.1208, "Dose to an Embryo/Fetus," requires licensees to "ensure that the dose to an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 mSv)." Section 20.1208 also requires licensees to "make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman." A declared pregnant woman is defined in 10 CFR 20.1003 as a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.

This regulatory guide is intended to provide information to pregnant women, and other personnel, to help them make decisions regarding radiation exposure during pregnancy. This Regulatory Guide 8.13 supplements Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure" (Ref 1), which contains a broad discussion of the risks from exposure to ionizing radiation.

Other sections of the NRC's regulations also specify requirements for monitoring external and internal occupational dose to a declared pregnant woman. In 10 CFR 20.1502, "Conditions Requiring Individual Monitoring of External and Internal Occupational Dose," licensees are required to monitor the occupational dose to a declared pregnant woman, using an individual monitoring device, if it is likely that the declared pregnant woman will receive, from external sources, a deep dose equivalent in excess of 0.1 rem (1 mSv). According to Paragraph (e) of 10 CFR 20.2106, "Records of Individual Monitoring Results," the licensee must maintain records of dose to an embryo/fetus if monitoring was required, and the records of dose to the embryo/fetus must be kept with the records of dose to the declared pregnant woman. The declaration of pregnancy must be kept on file, but may be maintained separately from the dose records. The licensee must retain the required form or record until the Commission terminates each pertinent license requiring the record.

The information collections in this regulatory guide are covered by the requirements of 10 CFR Parts 19 or 20, which were approved by the Office of Management and Budget, approval numbers 3150-0044 and 3150-

0014, respectively. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

B. DISCUSSION

As discussed in Regulatory Guide 8.29 (Ref. 1), exposure to any level of radiation is assumed to carry with it a certain amount of risk. In the absence of scientific certainty regarding the relationship between low dose exposure and health effects, and as a conservative assumption for radiation protection purposes, the scientific community generally assumes that any exposure to ionizing radiation may cause undesirable biological effects and that the likelihood of these effects increases as the dose increases. At the occupational dose limit for the whole body of 5 rem (50 mSv) per year, the risk is believed to be very low.

The magnitude of risk of childhood cancer following in utero exposure is uncertain in that both negative and positive studies have been reported. The data from these studies "are consistent with a lifetime cancer risk resulting from exposure during gestation which is two to three times that for the adult" (NCRP Report No. 116, Ref. 2). The NRC has reviewed the available scientific literature and has concluded that the 0.5 rem (5 mSv) limit specified in 10 CFR 20.1208 provides an adequate margin of protection for the embryo/fetus. This dose limit reflects the desire to limit the total lifetime risk of leukemia and other cancers associated with radiation exposure during pregnancy.

In order for a pregnant worker to take advantage of the lower exposure limit and dose monitoring provisions specified in 10 CFR Part 20, the woman must declare her pregnancy in writing to the licensee. A form letter for declaring pregnancy is provided in this guide or the licensee may use its own form letter for declaring pregnancy. A separate written declaration should be submitted for each pregnancy and a student can rescind their declaration at any time.

C. REGULATORY POSITION

1. Who Should Receive Instruction

Female workers who require training under 10 CFR 19.12 should be provided with the information contained in this guide. In addition to the information contained in Regulatory Guide 8.29 (Ref. 1), this information may be included as part of the training required under 10 CFR 19.12.

2. Providing Instruction

The occupational worker may be given a copy of this guide with its Appendix, an explanation of the contents of the guide, and an opportunity to ask questions and request additional information. The information in this guide and Appendix should also be provided to any worker or supervisor who may be affected by a declaration of pregnancy or who may have to take some action in response to such a declaration.

Classroom instruction may supplement the written information. If the licensee provides classroom instruction, the instructor should have some knowledge of the biological effects of radiation to be able to answer

questions that may go beyond the information provided in this guide. Videotaped presentations may be used for classroom instruction. Regardless of whether the licensee provides classroom training, the licensee should give workers the opportunity to ask questions about information contained in this Regulatory Guide 8.13. The licensee may take credit for instruction that the worker has received within the past year at other licensed facilities or in other courses or training.

3. Licensee's Policy on Declared Pregnant Women

The instruction provided should describe the licensee's specific policy on declared pregnant women, including how those policies may affect a woman's work situation. In particular, the instruction should include a description of the licensee's policies, if any, that may affect the declared pregnant woman's work situation after she has filed a written declaration of pregnancy consistent with 10 CFR 20.1208.

The instruction should also identify who to contact for additional information as well as identify who should receive the written declaration of pregnancy. The recipient of the woman's declaration may be identified by name (e.g., John Smith), position (e.g., immediate supervisor, the radiation safety officer), or department (e.g., the personnel department).

4. Duration of Lower Dose Limits for the Embryo/Fetus

The lower dose limit for the embryo/fetus should remain in effect until the woman withdraws the declaration in writing or the woman is no longer pregnant. If a declaration of pregnancy is withdrawn, the dose limit for the embryo/fetus would apply only to the time for the estimated date of conception until the time the declaration is withdrawn. If the declaration is not withdrawn, the written declaration may be considered expired one year after submission.

5. Substantial Variations Above a Uniform Monthly Dose Rate

According to 10 CFR 20.1208(b), "The licensee shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman so as to satisfy the limit in paragraph (a) of this section," that is, 0.5 rem (5 mSv) to the embryo/fetus. The National Council on Radiation Protection and Measurements (NCRP) recommends a monthly equivalent dose limit of 0.05 rem (0.5 mSv) to the embryo/fetus once the pregnancy is known (Ref. 2). In view of the NCRP recommendation, any monthly dose of less than 0.1 rem (1 mSv) may be considered as not a substantial variation above a uniform monthly dose rate and as such will not require licensee justification. However, a monthly dose greater than 0.1 rem (1 mSv) should be justified by the licensee.

D. IMPLEMENTATION

The purpose of this section is to provide information to licensees and applicants regarding the NRC statt's plans for using this regulatory guide.

Unless a licensee or an applicant proposes an acceptable alternative method for complying with the specified portions of the NRC's regulations, the methods described in this guide will be used by the NRC staff in the evaluation of instructions to workers on the radiation exposure of pregnant women.

APPENDIX C

QUESTIONS AND ANSWERS CONCERNING PRENATAL RADIATION EXPOSURE

1. Why am I receiving this information?

The NRC's regulations (in 10 CFR 19.12, "Instructions to Workers) require that licensees instruct individuals working with licensed radioactive materials in radiation protection as appropriate for the situation. The instruction below describes information that occupational workers and their supervisors should know about the radiation exposure of the embryo/fetus of pregnant women.

The regulations allow a pregnant woman to decide whether she wants to formally declare her pregnancy to take advantage of lower dose limits for the embryo/fetus. This instruction provides information to help women make an informed decision whether to declare a pregnancy.

2. If I become pregnant, am I required to declare my pregnancy?

No. The choice whether to declare your pregnancy is completely voluntary. If you choose to declare your pregnancy, you must do so in writing and a lower radiation dose limit will apply to your embryo/fetus. If you choose not to declare your pregnancy, you and your embryo/fetus will continue to be subject to the same radiation dose limits that apply to other occupational workers.

3. If I declare my pregnancy in writing, what happens?

If you choose to declare your pregnancy in writing, the licensee must take measures to limit the dose to your embryo/fetus to 0.5 rem (5 millisievert) during the entire pregnancy. This is one-tenth of the dose that an occupational worker may receive in a year. If you have already received a dose exceeding 0.5 rem (5 mSv) in the period between conception and the declaration of your pregnancy, an additional dose of 0.05 rem (0.5 mSv) is allowed during the remainder of the pregnancy. In addition, 10 CFR 20.1208, "Dose to an Embryo/Fetus," requires licensees to make efforts to avoid substantial variation above a uniform monthly dose rate so that all the 0.5 rem (5 mSv) allowed dose does not occur in a short period during the pregnancy.

This may mean that, if you declare your pregnancy, the licensee may not permit you to do some of your normal job functions if those functions would have allowed you to receive more than 0.5 rem, and you may not be able to have some emergency response responsibilities.

4. Why do the regulations have a lower dose limit for the embryo/fetus of a declared pregnant woman than for a pregnant worker who has not declared?

A lower dose limit for the embryo/fetus of a declared pregnant woman is based on a consideration of greater sensitivity to radiation of the embryo/fetus and the involuntary nature of the exposure. Several scientific advisory groups have recommended (References 1 and 2) that the dose to the embryo/fetus be limited to a fraction of the occupational dose limit.

5. What are the potentially harmful effects of radiation exposure to my embryo/fetus?

The occurrence and severity of health effects caused by ionizing radiation are dependent upon the type and total dose of radiation received, as well as the time period over which the exposure was received. See Regulatory Guide 8.29,

"Instruction Concerning Risks from Occupational Exposure" (Ref. 3), for more information. The main concern is embryo/fetal susceptibility to the harmful effects of radiation such as cancer.

6. Are there any risks of genetic defects?

Although radiation injury has been induced experimentally in rodents and insects, and in the experiments was transmitted and became manifest as hereditary disorders in their offspring, radiation has not been identified as a cause of such effect in humans. Therefore, the risk of genetic effects attributable to radiation exposure is speculative. For example, no genetic effects have been documented in any of the Japanese atomic bomb survivors, their children, or their grandchildren.

7. What if I decide that I do not want any radiation exposure at all during my pregnancy?

You may ask your employer for a job that does not involve any exposure at all to occupational radiation dose, but your employer is not obligated to provide you with a job involving no radiation exposure. Even if you receive no occupational exposure at all, your embryo/fetus will receive some radiation dose (on average 75 mrem [0.75 mSv]) during your pregnancy from natural background radiation.

The NRC has reviewed the available scientific literature and concluded that the 0.5 rem (5 mSv) limit provides an adequate margin of protection for the embryo/fetus. This dose limit reflects the desire to limit the total lifetime risk of leukemia and other cancers. If this dose limit is exceeded, the total lifetime risk of cancer to the embryo/fetus may increase incrementally. However, the decision on what level of risk to accept is yours. More detailed information on potential risk to the embryo/fetus from radiation exposure can be found in References 2-10.

8. What effect will formally declaring my pregnancy have on my job status?

Only the licensee can tell you what effect a written declaration of pregnancy will have on your job status. As part of your radiation safety training, the licensee should tell you the company's policies with respect to the job status of declared pregnant women. In addition, before you declare your pregnancy, you may want to talk to your supervisor or your radiation safety officer and ask what a declaration of pregnancy would mean specifically for you and your job status.

In many cases you can continue in your present job with no change and still meet the dose limit for the embryo/fetus. For example, most commercial power reactor workers (approximately 93%) receive, in 12 months, occupational radiation doses that are less than 0.5 rem (5 mSv) (Ref. 11). The licensee may also consider the likelihood of increased radiation exposures from accidents and abnormal events before making a decision to allow you to continue in your present job.

If your current work might cause the dose to your embryo/fetus to exceed 0.5 rem (5 mSv), the licensee has various options. It is possible that the licensee can and will make a reasonable accommodation that will allow you to continue performing your current job, for example, by having another qualified employee do a small part of the job that accounts for some of your radiation exposure.

9. What information must I provide in my written declaration of pregnancy?

You should provide, in writing, your name, a declaration that you are pregnant, the estimated date of conception (only the month and year need be given), and the date that you give the letter to the licensee. A form letter that you can

use is included at the end of these questions and answers. You may use that letter, use a form letter the licensee has provided to you, or write your own letter.

10. To declare my pregnancy, do I have to have documented medical proof that I am pregnant?

NRC regulations do not require that you provide medical proof of your pregnancy. However, NRC regulations do not preclude the licensee from requesting medical documentation of your pregnancy, especially if a change in your duties is necessary in order to comply with the 0.5 rem (5 mSv) dose limit.

11. Can I tell the licensee orally rather than in writing that I am pregnant?

No. The regulations require that the declaration must be in writing.

12. If I have not declared my pregnancy in writing, but the licensee suspects that I am pregnant, do the lower dose limits apply?

No. The lower dose limits for pregnant women apply only if you have declared your pregnancy in writing. The United States Supreme Court has ruled (in *United Automobile Workers International Union v. Johnson Controls, Inc.,* 1991) that "Decisions about the welfare of future children must be left to the parents who conceive, bear, support, and raise them rather than to the employers who hire those parents" (Reference 7). The Supreme Court also ruled that your employer may not restrict you from a specific job "because of concerns about the next generation." Thus, the lower limits apply only if you choose to declare your pregnancy in writing.

13. If I am planning to become pregnant but am not yet pregnant and I inform the licensee of that in writing, do the lower dose limits apply?

No. The requirement for lower limits applies only if you declare in writing that you are already pregnant.

14. What if I have a miscarriage or find out that I am not pregnant?

If you have declared your pregnancy in writing, you should promptly inform the licensee in writing that you are no longer pregnant. However, if you have not formally declared your pregnancy in writing, you need not inform the licensee of your nonpregnant status.

15. How long is the lower dose limit in effect?

The dose to the embryo/fetus must be limited until you withdraw your declaration in writing or you inform the licensee in writing that you are no longer pregnant. If the declaration is not withdrawn, the written declaration may be considered expired one year after submission.

16. If I have declared my pregnancy in writing, can I revoke my declaration of pregnancy even if I am still pregnant?

Yes, you may. The choice is entirely yours. If you revoke your declaration of pregnancy, the lower dose limit for the embryo/fetus no longer applies.

17. What if I work under contract at a licensed facility?

The regulations state that you should formally declare your pregnancy to the licensee in writing. The licensee has the responsibility to limit the dose to the embryo/fetus.

18. Where can I get additional information?

The references to this Appendix contain helpful information, especially Reference 3, NRC's Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure" for general information on radiation risks. The licensee should be able to give this document to you.

For information on legal aspects, see Reference 7, "The Rock and the Hard Place: Employer Liability to Fertile or Pregnant Employees and Their Unborn Children – What Can the Employer Do?" which is an article in the journal *Radiation Protection Management*.

You may telephone the NRC Headquarters at (301) 415-7000. Legal questions should be directed to the Office of the General Counsel, and technical questions should be directed to the Division of Industrial and Medical Nuclear Safety.

You may also telephone the NRC Regional Offices at the following numbers: Region I, (610) 337-5000; Region II, (404) 562-4400; Region III, (630) 829-9500; and Region IV, (817) 860-8100. Legal questions should be directed to the Regional Counsel, and technical questions should be directed to the Division of Nuclear Materials Safety.

REFERENCES FOR APPENDICIES B & C

1. National Council on Radiation Protection and Measurements, *Limitation of Exposure to Ionizing Radiation*, NCRP Report No. 116, Bethesda, MD, 1993.

2. International Commission on Radiological Protection, *1990 Recommendations of the International Commission on Radiological Protection*, ICRP Publication 60, Ann. ICRP 21: No. 1-3, Pergamon Press, Oxford, UK, 1991.

3. USNRC, "Instruction Concerning Risks from Occupational Radiation Exposure," Regulatory Guide 8.29, Revision 1, February 1996.[1] (Electronically available at www.nrc.gov/NRC/RG/index.html)

4. Committee on the Biological Effects of Ionizing Radiations, National Research Council, *Health Effects of Exposure to Low Levels of Ionizing Radiation* (BEIR V), National Academy Press, Washington, DC, 1990.

5. United Nations Scientific Committee on the Effects of Atomic Radiation, *Sources and Effects of Ionizing Radiation*, United Nations, New York, 1993.

6. R. Doll and R. Wakeford, "Risk of Childhood Cancer form Fetal Irradiation," *The British Journal of Radiology*, 70, 130-139, 1997.

7. David Wiedis, Donald E. Jose, and Timm O. Phoebe, "The Rock and the Hard Place: Employer Liability to Fertile or Pregnant Employees and Their Unborn Children – What Can the Employer Do? *Radiation Protection Management*, 11, 41-49, January/February 1994.

8. National Council on Radiation Protection and Measurements, *Considerations Regarding the Unintended Radiation Exposure of the Embryo, Fetus, or Nursing Child*, NCRP Commentary No. 9, Bethesda, MD, 1994.

9. National Council on Radiation Protection and Measurements, *Risk Estimates for Radiation Protection*, NCRP Report No. 115, Bethesda, MD, 1993.

10. National Radiological Protection Board, *Advice on Exposure to Ionizing Radiation During Pregnancy*, National Radiological Protection Board, Chilton, Didcot, UK, 1998.

11. M. L. Thomas and D. Hagemeyer, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities, 1996," Twenty-Ninth Annual Report, NUREG-0713, Vol. 18, USNRC, 1998.[2]

Single copies of regulatory guides, both active and draft, and draft NUREG documents may be obtained free of charge by writing the Reproduction Distribution Services Section, OCIO, USNRC, Washington, DC 20555-0001, or by fax to (301) 415-2289, or by email to <DISTRIBUTION@NRC.GOV>. Active guides may also be purchased from the National Technical Information Service on a standing order basis. Details on this service may be obtained by writing NTIS, 5285 Port Royal Road, Springfield, VA 22161. Copies of active and draft guides are available for inspection or copying for a fee from the NRC Public Document Room at 2120 L Street NW, Washington, DC; the PDR's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202) 634-3273; fax (202) 634-3343.

APPENDIX D
STUDENT ACADEMIC GRIEVANCE PROCEDURES
for the College of Health and Human Sciences
Southern Illinois University Carbondale

GRADES GIVEN AT THE END OF A COURSE ARE FINAL AND MAY NOT BE CHANGED BY ADDITIONAL WORK OR BY SUBMITTING ADDITIONAL MATERIALS.

EXTENUATING CIRCUMSTANCES WHICH TRANSCEND PROFESSIONAL JUDGEMENT OF THE INSTRUCTOR MAY BE APPEALED THROUGH PROCEDURES ESTABLISHED BY THE COLLEGE OF HEALTH AND HUMAN SCIENCES. MATTERS RELATED TO FACULTY JUDGMENT IN GRADING MAY NOT BE APPEALED.

A matter related to academic evaluation is the responsibility of the School that houses the program in which the issue occurs and the office of the Dean of the College of Health and Human Sciences. Every effort should be made to resolve such academic evaluation problems quickly at the program level. In the cases in which the problems are not resolved at the program level, the student has the option to file a formal grievance. It is the instructor's prerogative to assign grades in accordance with his/her academic/professional judgment, and the student assumes the burden of proof in the appeal process. The following process is in alignment with the guidelines set by the University and is designed to assist the student through the appeal process.

Grades may be appealed only on procedural grounds and not on substantive grounds.
Grades may **not** be appealed beyond the level of the Dean.

Matters pertaining to evaluation of a course in which the student is or has been registered that are not resolved between the persons directly involved will be adjudicated in the following manner:

1. A student who has reason to be aggrieved will file the complaint in writing with the School Director responsible for the program in which the incident occurs.

    a. The complaint must be presented in sufficient detail that a proper response may be made.
    b. The complaint must be received by the School Director within 30 working days of the occurrence of the incident.

2. The School Director will submit a copy of the complaint to the other party named in the complaint within three (3) working days.

3. The other party will respond in writing to the complaint to the School Director within 15 working days of receipt of the copy of the complaint.

4. The School Director will, within seven (7) working days of receipt of the response to the complaint, transmit a written decision in the matter to both parties along with notification of appellate procedures. A copy of the response to the complaint will also be sent to the Dean of the College of Health and Human Sciences. Failure of either party to respond through the appropriate appellate channels within 15 working days will be interpreted as acceptance of the decision and its implementation by the appropriate office.

5. Should either party be unwilling to accept the decision of the School Director, an appeal may be made to the Dean of the College of Health and Human Sciences. Such appeal must be submitted in writing within 15 working days of the receipt of the decision by the School Director. The appeal must specify:

    a. The original complaint;

    b. The grounds for the appeal; and

    c. Recommendation(s) for resolution of the complaint.

6. The appellant will select one of the following procedures for adjudication. The appellant may request consultation with the Dean of the College of Health and Human Sciences or their designee prior to this selection.

    a. **Administrative:** The Dean of the College of Health and Human Sciences, or their designee will review the matter with each of the parties involved and render a decision in writing within 30 working days of the review.

    b. **Panel:** The Dean of the College of Health and Human Sciences, or their designee will appoint a panel consisting of three faculty members with no administrative appointment and three students to review the matter and render a decision within 30 working days of the review. The panel has the option to meet with either party in person during the appeal process to collect more information or clarify existing information in the written documentation. This is not required and cannot be requested by the parties involved in the grievance. Written records of the review proceedings will be placed in the Dean's office in the College of Health and Human Sciences.

7. When a decision is reached by one of the above methods, the Dean of the College of Health and Human Sciences, or their designee will notify each of the parties of the decision in writing. A copy of the decision will be filed with the Dean's office in the College of Health and Human Sciences. An information copy will also be sent to the Dean of the Graduate School if the matter involves a graduate student. There is no appeal for grades above the level of the College Dean.

STUDENT ACADEMIC GRIEVANCE PROCEDURES

for Southern Illinois University at Carbondale

Southern Illinois University procedures are available at: https://gradcatalog.siu.edu/the-graduate-school/academic-grievance.php

APPENDIX E
STUDENT COUSELING FORM

Student Name:_____

Date: _____

Reason: _____

Summary of Discussion:

_____

_____

_____

_____

_____

Plan of Action and Follow-up Date:

_____

_____

_____

_____

_____

_____ _____
Program Faculty Signature *Student Signature

_____ _____
Date Date

*Your signature on this document does not indicate agreement but verifies the conversation took place.

APPENDIX F
MAGNETIC RESONANCE (MR) SAFETY SCREENING PROTOCOL

WARNING:
An MR room has a very strong magnetic field that may be hazardous to individuals entering the MR environment if they have certain metallic, electronic, magnetic, or mechanical implants, devices, or objects. Therefore, all students are required to fill out this form before going to their clinical internship. Be advised, the MR system magnet is ALWAYS on.

Do not enter the MR environment or MR system room if you have any question or concern regarding an implant, device, or object.

Please indicate if you have any of the following:

- ❑ Aneurysm clip(s)
- ❑ Cardiac pacemaker
- ❑ Implanted cardioverter defibrillator (ICD)
- ❑ Electronic implant or device
- ❑ Magnetically-activated implant or device
- ❑ Neurostimulation system
- ❑ Spinal cord stimulator
- ❑ Cochlear implant or implanted hearing aid
- ❑ Insulin or infusion pump
- ❑ Implanted drug infusion device
- ❑ Any type of prosthesis or implant
- ❑ Artificial or prosthetic limb
- ❑ Any metallic fragment or foreign body
- ❑ Any external or internal metallic object
- ❑ Hearing aid
- ❑ Other implant_____
- ❑ Other device_____

Please indicate below if you have not specified any of the above:

- ❑ I have not received any implants, devices, or objects to the best of my knowledge

---

I attest that the above information is correct to the best of my knowledge. I have read and understand the entire contents of this form and have had the opportunity to ask questions regarding the information on this form.

_____
Student Signature / Date

APPENDIX G
RUBRIC FOR GRADING RESEARCH PAPERS

Name		Course		Assignment		Date Rcv'd		Due Date	

Item		Criterion Evaluated	Possible Points				
			Poor	Fair	Avg.	Good	Excel or N/A
1	**Introduction Section**	o Research included introductory paragraph o Intro included reason for writing paper (Background of problem) o Intro motivated reader to read the paper o Intro had an effective thesis o Intro clearly identified areas to be discussed later in the work	5	7	9	10	11
2	**Body**	o Writing was clear and concise o Discussion was understandable o Discussion was accurate o Discussion was logical o Discussion sufficiently summarized each theory o Discussion was written in 3rd person	5	7	9	10	11
3	**Conclusion**	o A conclusion was written o Conclusion summarized the findings o Conclusion written in 3rd person	5	7	9	10	11
4	**Reference Section**	o Appropriate references were used o A least 10 references were cited o All references were cited in paper o All citations in paper had corresponding reference listed o Reference page in AMA format	5	7	9	10	11
5	**Style (According to AMA)**	o Paper and references double spaced o Paper written in correct font and font size o Sections of paper properly headed o Citations in text in AMA format o Quotes were formatted and cited properly	5	7	9	10	11
6	**Grammar Vocabulary Spelling Punctuation**	o Vocabulary appropriate to academic/publication level o Correct grammar used o Punctuated correctly o Spell check used	5	7	9	10	11
7	**General Construction**	o Sentence structure is correct, clear, concise and varied o Paragraphs have a topic sentence o Paragraphs have a transition sentences o Unified, coherent paragraph structure o Organized with an introduction, discussion, and conclusion/summary o Discussion was not one continuous quote	5	7	9	10	11
8	**Research Effort**	Each reference directly supports some aspect the discussion, conclusion, and summary	5	7	9	10	11
9	**Development Effort**	o **Must include statistical analysis (if not, a minimum of 25 points will be deducted)** o Must have at least an "n" of 10 of what is being measured o Discussion developed with clear, concrete, and relevant support o Research met the objective of the assignment o Work demonstrates presence of critical thought and analysis o Research produced a meaningful discussion and conclusion o All work was turned in on time	5	7	9	10	11
Sub-Total Points							
Total Points (Total Point Letter Grade Conversion: **A**>89, **B**>79, **C**>69, **D**>59, **F**<60							