2016-17 Program Assessment Report

Nuclear Medicine and Molecular Imaging Technology B.S.

Mission, Objectives & Learning Outcomes

Oregon Tech Mission
Oregon Institute of Technology, an Oregon public university, offers innovative and rigorous applied degree programs in the areas of engineering, engineering technologies, health technologies, management, and the arts and sciences. To foster student and graduate success, the university provides an intimate, hands-on learning environment, focusing on application of theory to practice. Oregon Tech offers statewide educational opportunities for the emerging needs of Oregonians and provides information and technical expertise to state, national and international constituents.

Core Theme 1: Applied Degree Programs
Oregon Tech offers innovative and rigorous applied degree programs. The teaching and learning model at Oregon Tech prepares students to apply the knowledge gained in the classroom to the workplace.

Core Theme 2: Student and Graduate Success
Oregon Tech fosters student and graduate success by providing an intimate, hands-on learning environment, which focuses on application of theory to practice. The teaching and support services facilitate students' personal and academic development.

Core Theme 3: Statewide Educational Opportunities
Oregon Tech offers statewide educational opportunities for the emerging needs of Oregon's citizens. To accomplish this, Oregon Tech provides innovative and rigorous applied degree programs to students across the state of Oregon, including high-school programs, online degree programs, and partnership agreements with community colleges and universities.

Core Theme 4: Public Service
Oregon Tech will share information and technical expertise to state, national, and international constituents.

Program Alignment to Oregon Tech Mission and Core Themes
Our program is in complete alignment with Oregon Tech's Core Themes. Our program is preparing students in a foundational model that builds on itself from the Pre-MIT courses, to didactic/lab courses, and eventually to an 11-month clinical externship. Each level of education and training, builds on the skills and knowledge of the previous level(s). Everything we do is designed to set students up for success. This includes hands on, practical learning that develops more advanced skills with each subsequent course.

Most of our students come from Oregon, and end up working in Oregon. We facilitate this process by partnering with several hospitals in Oregon for our 4th year, clinical externship.

Program Mission
The Bachelor of Science program in Nuclear Medicine and Molecular Imaging Technology at Oregon Institute of Technology provides graduates with the knowledge and clinical skills necessary to become competent, ethical and caring professionals in the field of Nuclear Medicine.

Program Educational Objectives

- The program prepares students to perform as compassionate and caring health care professionals.
- The program prepares our graduates to sit for the ARRT and NMTCB board exams.
- The program prepares students who think critically, communicate effectively and demonstrate professional ethics.
- The program prepares students to utilize diagnostic techniques, sound judgment and good decision making to provide patient services.
- The program prepares students to be aware of radioactive exposure to themselves and patients.

Program Faculty Review
Program Student Learning Outcomes and Objectives were reviewed by program faculty during Fall Convocation Program Assessment Meeting.

The NMT faculty met fall term with the Director of Assessment to discuss our PSLOs, the assessment process, concerns regarding the assessment process at Oregon Tech, and how to move forward.

Showcase Learning Opportunities
Pacific Northwest Society of Nuclear Medicine in Seattle, WA in March, 2017.
Clinical Rotations each term, for (6) terms at Sky Lakes Medical Center, Klamath Falls, OR.

Program History & Vision

Program History
The Nuclear Medicine and Molecular Imaging Technology (NMT) program began accepting students into the program in 1999 and graduated its first class of students in 2001 on the Oregon Tech campus in Klamath Falls. As of June, 2015, our program has a 100% pass rate on the nationally recognized ARRT registry board examination (196 graduates) and 99.42% pass rate on the NMTCB registry examination (183 graduates).

Enrollment trends from 2002-2016 have varied from 39 to 54 students (total) in the past. The number of graduates has gradually increased from 5 students in 2002, to as many as 21 students in 2004. From 2005 until fall 2015, graduate numbers have ranged from 15 -18 students. The total number of students in the Nuclear Medicine and Molecular Imaging Technology program in the fall of 2015 between the sophomore, junior and senior classes was 47 students.

The retention rates for our program in fall of 2015 were 100% for seniors, 100% for juniors, and 94% for sophomores.

The graduate salary range has been $50,000 to $70,000 with a mean of $58,000 per year.

Meeting with Advisory Board
Program faculty held a meeting with their Advisory Board during the academic year.

Advisory Board Review
The Advisory Board reviewed the Program Mission and Objectives during the academic year.

The Oregon Tech Advisory Board/Clinical Instructor meeting was held in Portland, OR on Friday, May 5, 2017 at the Oregon State Office Building. Discussion summary is documented in the next section "Advisory Board Minutes" below.

Attachment 1_Meeting_Minutes_Advisory_Board_2017

Program Enrollment
The IR data only includes the total enrollment of students in the program each year. It does not identify enrollment trends of students accepted into the program each fall. The IR data does not identify attrition specifically which can be independent of new enrollment. The IR data reflects potential trends in new enrollment but also changes in attrition within the program, up or down.

Enrollment in our program has been 16-18 students for the past 7-10 years. In the Fall of 2016 and 2017, our program increased enrollment from 18 students to 20 students respectively. This represents an 11% increase (2 students) for each year.

Attachment 2_Enrollment_5_Year_History_by_Major

Program Graduates
Our program graduated 18 students prior to the recession of the economy in 2008. At that time, the economy was very good and employment opportunities abounded. Allowing for attrition, our program accepted 20-25 students into the program during those two years. Since the recession of 2008, and the efforts to overhaul health care in the United States, we decreased our student acceptance to 16-18 students each year. Allowing for attrition, this meant that we graduated 14-16 students each year, from 2008-2016. Our acceptance rate was lower, but so was our attrition. The percentage of attrition vs. total number of students accepted was lower. As the economy rebounded, and in spite of uncertainty regarding reimbursement in health care, we gradually have accepted more students in the program. It will take 2-3 years to see this increased change in the total number of students graduating in the IR database.

Attachment 3_Graduates_10_Year_History_by_Major

Employment Rates and Salaries
Our program tracks, much more accurately than Career Services, where our graduates are employed each year following graduation, and whether those jobs are full time, part time, or per diem. I can provide these data if requested/necessary. Our program does not ask or receive salary data, as that can vary widely depending on whether the graduate is working full time, part time, per diem, location/geography, and whether they take call or not. In Medical Imaging, graduates across the five programs will typically make between $55,000 and $75,000 dollars in a full time position.

As mentioned previously, employment rates for our program graduates have remained consistent and has largely allowed graduates to stay in the PNW or West Coast. However, employment has shifted from per diem, or part time work, to a higher percentage of full time employment, especially if the graduate is willing to re-locate.

Attachment 4_Grad_Data_First_Destination_3_Year_History_by_Major

Pass Rates on Board and Licensure Exam
Our graduates and our program has a 100% pass rate for the ARRT and/or NMTCB national registry since the inception of the program in the year 2000.

Results of Board or Licensure Exam
Program Pass Rates Meet or Exceed National Average.

Attachment 5_NMTCB_registry_Data_2000_2014

Attachment 6_ARRT_Nat_l_Comparison_2005_2014

Other Program Assessment Data
N/A

Desired Data
N/A

Closing the Loop

Describe any actions taken and re-assessment done during this academic year in response to assessment findings from prior academic years.
N/A

Changes Implemented
N/A

Assessment Findings
N/A

Program Student Learning Outcomes Assessment Cycle

PROGRAM STUDENT LEARNING OUTCOMES **3-Year Cycle** **Nuclear Medicine and Molecular Imaging Technology B.S.**	**2016-17**	**2017-18**	**2018-19**
OIT-BNUC 2016-17.1 The student will demonstrate proficiency in providing patient care.			
OIT-BNUC 2016-17.2 The student will demonstrate knowledge of radiation safety precautions and ALARA concepts.			COURSE X

OIT-BNUC 2016-17.3 The student will demonstrate recognition of, and adherence to, ethical and professional responsibilities.			COURSE X
OIT-BNUC 2016-17.4 The student will perform nuclear medicine imaging procedures according to program and/or departmental protocol using scientific knowledge and skills in scientific reasoning.		COURSE X	
OIT-BNUC 2016-17.5 The student will demonstrate proficiency in obtaining a relevant patient history.		COURSE X	
OIT-BNUC 2016-17.6 The student will demonstrate knowledge of various radiopharmaceuticals and their uses in nuclear medicine imaging.	NMT 215 NMT 388		
OIT-BNUC 2016-17.7 The student will demonstrate knowledge, understanding, and appropriate uses of instrumentation used in a nuclear medicine department.	NMT 225 NMT 388		
OIT-BNUC 2016-17.8 The student will demonstrate knowledge of quality control procedures for instrumentation used in nuclear medicine.		COURSE X	
OIT-BNUC 2016-17.9 The student will demonstrate knowledge of radiation therapy procedures used in nuclear medicine.			COURSE X

Assessment Map & Measure

F – Foundation – introduction of the learning outcome, typically at the lower-division level,
P – Practicing – reinforcement and elaboration of the learning outcome, or
C – Capstone – demonstration of the learning outcome at the target level for the degree

For each outcome, programs should identify at least 2 direct measures (student work that provides evidence of their knowledge and skills), and 1 indirect measure (student self-assessment of their knowledge and skills) for each outcome.

For every program, data from the Student Exit Survey will be an indirect measure at the capstone level.

OIT-BNUC 2016-17.6 The student will demonstrate knowledge of various radiopharmaceuticals and their uses in nuclear medicine imaging.	
Course/Event	NMT 215
Legend	F – Foundation
Assessment Measure	Direct – Standardized Test
Criterion	Minimum acceptable performance is 80% of students must pass the final examination in this course. To pass this course, students must achieve at least a 75% on the final examination.

Attachment 7_PSLO_Survey_Results

Course/Event	NMT 388
Legend	P – Practice
Assessment Measure	Direct – Exam Questions (multiple choice type)
Criterion	The four performance criteria are: Radiopharmaceutical Quality Control, Methods of Localization, Modes of Production, and Critical Organ Uptake. There were five questions for each performance criteria and the minimum acceptable performance is 80% of students with at least a 4 out of 5 in each category correct.

Attachment 8_Final_Exam_2017

Course/Event	Student Exit Survey
Legend	C – Capstone
Assessment Measure	Indirect – Student Exit Survey
Criterion	Clinical Externship students completing their fourth year of education/training were surveyed at the end of their 11-month externship. Students were asked to rate their proficiency of the PSLO using Highly Proficient, Proficiency, Some Proficiency, No Proficiency.

Attachment 7_PSLO_Survey_Results

OIT-BNUC 2016-17.7 The student will demonstrate knowledge, understanding, and appropriate uses of instrumentation used in a Nuclear Medicine department.

Course/Event	NMT 225
Legend	F – Foundation
Assessment Measure	Direct – Exam Questions (multiple choice type)
Criterion	Minimum acceptable performance is 80% of students in this course must pass the final examination. Students must achieve at least a 75% on the final examination.

Attachment 9_NMT_225_Final_Exam

Course/Event	NMT 388
Legend	P – Practice
Assessment Measure	Direct – Exam Questions (multiple choice type)
Criterion	Students were given a quiz including four performance criteria: Collimators, Gamma camera instrumentation, Well counters/Dose Calibrators, and Gas Detectors. There were five questions for each performance criteria and the minimum acceptable performance is 80% of students with a 4 out of 5.

Attachment 10_Spring_Term_Instrumentation_Assessment_Quiz_2017

Course/Event	Student Exit Survey
Legend	C – Capstone
Assessment Measure	Indirect – Student Exit Survey
Criterion	Clinical externship students were surveyed at the end of their 11-month clinical education/training. Students were asked to rate their proficiency for the PSLO by choosing Highly Proficient, Proficient, Some Proficiency, or Not Proficient.

Attachment 7_PSLO_Survey_Results

Analysis of Results

OIT-BNUC 2016-17.6 The student will demonstrate knowledge of various radiopharmaceuticals and their uses in nuclear medicine imaging.

Criterion	Met
Summary	Eighty-Five percent of students passed the final examination in this course. No further action is required.
Improvement Narrative	N/A

Attachment 11_Copy_of_NMT_215_Final_Exam_Grades_Winter_2017

OIT-BNUC 2016-17.7 The student will demonstrate knowledge, understanding, and appropriate uses of instrumentation used in a Nuclear Medicine department.

Criterion	Met
Summary	For this assessment, students needed to achieve at least a 75% (84/112 points) on the final exam in the NMT 225 Instrumentation course. All students achieved at least a 75% on the final exam in this course. No further action is required.
Improvement Narrative	N/A

Attachment 12_Copy_of_NMT_225_Grades_2017

References

Program Assessment Coordinator: Richard Hoylman, Associate Professor, Medical Imaging Technology

Office of Academic Excellence

Oregon Tech

Nuclear Medicine & Molecular Imaging Technology Program

Advisory Board Meeting: Friday, May 5, 2017

Oregon State Office Building
800 NE Oregon Street
Room 1E
Portland, OR 97232-2162

0800-0815 Meet and Greet

Introduction of New Clinical Sites

1. Barnes Jewish Hospital, St. Louis, MO

2. Baylor Scott & White Temple, TX

Strategic Program Management & Development

A. Tier I and II update.

Rick opened the meeting by introducing new clinical externship sites in St. Louis, Missouri and Temple, TX. Several of the members of the Advisory board were not in attendance personally, but were able to log in via Zoom and therefore, participate in the meeting as virtual participants.

Rick re-visited the "Tier I and Tier II" procedure that Oregon Tech has been using for several years to guide decisions each year regarding which externship sites to use that year and which ones to ask to sit out that year. These decisions are based on several factors including:

1. Variety and volume of studies performed.
2. Employment opportunity at that hospital or region.
3. Staffing levels at the clinical site.

0815-0850 1. Registry Statistic Updates/Student Employment Update

2. NMTCB/Programmatic Accreditation Update

3. Externship Handbook/Programmatic Updates/changes

4. Class pictures/Bio

5. Ethics Video Examples

6. Examples of Site Profiles and Case Studies

Rick reviewed registry pass rates and employment updates on graduates from 2016.

Rick also discussed the possibility of pursuing programmatic accreditation with the JRCNMT sometime in the next two years. After much discussion, there was limited time to review case studies and site profiles that students had developed.

0900-1000 **Millenials and the Clinical Setting: Bridging the Gap: Bobbi Kowash**

Bobbi Kowash from the DMS program was kind enough to share some insights with our Clinical instructors/Advisory Board regarding Mellenials, how they learn, and challenges posed with Mellenial students.

1000-1015 BREAK!

1015-1115 **Clinical Instructors: Best Practices**

1. Tour of the department
2. Weekly 'wrap/update' sessions with C.I.
3. Effective communication with staff regarding student's progress

Rick and Vanessa both discussed encouragements to the Clinical Instructors in attendance in an effort to improve the clinical experience for the externship students

From Oregon Tech. Rick shared some survey data he obtained from the 2016 Oregon Tech Nuclear Medicine Technology clinical instructors and students regarding what practices they viewed as "Good" or "Great" in a Clinical Instructor.

1115-1145 Clinical Instructor Feedback/Workshop

There was some lengthy discussion from the Advisory Board regarding best practices

That have proven successful at each of the clinical externship sites. These included:

Weekly wrap up sessions, setting specific goals for students, and using the Professional

Evaluation to help students improve their patient care skills.

1200-1pm LUNCH & Round Table Discussion/Feedback

Oregon TECH

Majors History, Fall 4th Week
November 30, 2016

The following data represents majors declared by student as of Fall 4th week. Students with multiple/dual majors have been reported under each major in which they enrolled; therefore the student headcount will be duplicated. A small number of students that declared a third major have now been included in this report. Data reported is combined for all levels and all locations.
Some programs may have had name changes such as CLS and have been reported as they were (historically).

Description	Fall 2012	Fall 2013	Fall 2014	Fall 2015	Fall 2016	5 Year Difference	5 Year % Change
ABA Course Series	0	0	3	0	0	0	-
Accounting Certificate	0	0	0	0	1	1	-
Allied Health	0	0	0	0	3	3	-
Allied Health Management	11	5	3	2	1	-10	-90.9%
Applied Behavior Analysis	0	0	0	10	17	17	-
Applied Mathematics	41	38	47	42	33	-8	-19.5%
Applied Psychology	146	149	122	96	110	-36	-24.7%
Automat, Robot, & Cntrl Engr	0	0	0	0	1	1	-
Biology	15	8	1	1	0	-15	-100.0%
Biology-Health Sciences	136	150	150	138	151	15	11.0%
Civil Engineering	127	121	110	120	118	-9	-7.1%
Clinical Lab Science-Earlyadm	6	10	35	22	0	-6	-100.0%
Clinical Laboratory Science	62	85	94	95	2	-60	-96.8%
Communication Studies	55	42	39	47	40	-15	-27.3%
Computer Engineering Tech	82	82	81	86	63	-19	-23.2%
Dental Hygiene	226	240	211	221	202	-24	-10.6%
Diagnostic Medical Sonography	86	104	95	102	112	26	30.2%
Dispute Resolution Certificate	1	1	2	4	2	1	100.0%
Echocardiography	121	119	123	122	128	7	5.8%
Electrical Engineering	76	120	146	164	197	121	159.2%
Electronics Engineering Tech	67	58	51	37	32	-35	-52.2%
Embedded Systems Eng Tech	24	25	32	35	57	33	137.5%
Emergency Medical Services Mgt	0	0	17	20	34	34	-
EMT - Paramedic	29	30	29	28	28	-1	-3.4%
Environmental Sciences	49	49	51	48	42	-7	-14.3%
General Studies	495	736	632	1,031	1,414	919	185.7%
Geomatics	1	0	0	0	0	-1	-100.0%
Geomatics-option in GIS	13	14	10	10	7	-6	-46.2%
Geomatics-option in Surveying	49	39	26	31	30	-19	-38.8%
Health Care Mgmt-Admin Mgmt	0	10	14	19	18	18	-
Health Care Mgmt-Clinical Mgmt	0	4	10	11	25	25	-
Health Care Mgmt-Rad Science	0	3	6	12	12	12	-
Health Informatics	0	0	0	20	38	38	-
Health Sciences	1	1	0	1	2	1	100.0%
Information Technology	0	0	0	56	114	114	-
IT Accounting Option	8	4	2	1	1	-7	-87.5%
IT Applications Dev Opt	91	75	71	48	20	-71	-78.0%
IT Bus/Systems Analysis Opt	58	59	69	51	28	-30	-51.7%
IT Health Informatics Opt	54	68	59	32	17	-37	-68.5%
Magnetic Resonance Imagng Spec	0	0	0	0	4	4	-
Manufacturing Engineering Tech	129	99	109	107	101	-28	-21.7%
Marriage and Family Therapy	0	0	0	0	10	10	-
Mechanical Engineering	208	303	331	323	354	146	70.2%
Mechanical Engineering Tech	145	112	121	121	104	-41	-28.3%
Medical Lab Science-Earlyadm	0	0	0	0	17	17	-
Medical Laboratory Science	0	0	0	0	86	86	-
Mgmt Info Sys/Mgmt Acc Option	1	0	0	0	0	-1	-100.0%
Mgmt/Accounting Option	32	38	35	32	19	-13	-40.6%
Mgmt/Marketing Option	34	34	36	34	37	3	8.8%
Mgmt/Small Bus Mgmt Option	54	43	38	37	33	-21	-38.9%
MIT Applicant	0	0	1	2	0	0	-
Nuclear Medicine Technology	47	51	48	48	49	2	4.3%
Nursing	50	49	52	61	69	19	38.0%
Operations Management	61	66	65	69	70	9	14.8%
Optical Engineering	0	0	3	3	3	3	-
Picture Archive/Comm Sys Spec	0	0	1	2	3	3	-
Polysomnographic Technology	19	13	6	12	5	-14	-73.7%
Population Health Management	0	0	3	24	31	31	-
Pre-Clinical Lab Science	0	8	1	20	2	2	-
Pre-Dental Hygiene	62	65	35	37	48	-14	-22.6%
Pre-Medical Imaging Tech	273	287	253	237	226	-47	-17.2%
Pre-Medical Lab Science	0	0	0	0	27	27	-
Pre-Nursing	56	60	53	69	78	22	39.3%
Pre-Paramedic Education	0	3	3	7	0	0	-
Pre-Renewable Energy Eng	111	0	0	0	0	-111	-100.0%
Pre-Respiratory Care	11	12	8	11	9	-2	-18.2%
Radiologic Science	164	163	154	160	152	-12	-7.3%
Renewable Energy Engineering	110	206	203	180	166	56	50.9%
Respiratory Care	85	84	88	103	117	32	37.6%
Sleep Health-Polysom Tech Opt	0	0	4	6	17	17	-
Software Engineering Tech	260	268	289	309	285	25	9.6%
Spec in Entrepreneur/Small Bus	0	0	0	1	2	2	-
Specialization in Accounting	0	0	0	2	2	2	-
Specialization in Marketing	0	0	1	1	1	1	-
Specialization Travel/Tourism	0	1	0	0	0	0	-
System Engr & Technical Mgmt	0	0	2	3	0	0	-
Technology and Management	16	30	43	46	46	30	187.5%
Vascular Technology	88	95	80	93	98	10	11.4%
Total (Duplicated)	**4,146**	**4,539**	**4,407**	**4,923**	**5,371**	**1,225**	**29.5%**
Total (Unduplicated)	**4,001**	**4,414**	**4,273**	**4,786**	**5,232**	**1,231**	**30.8%**

Attachment 3_Graduates_10_Year_History_by_Major

Oregon TECH

10 Year History By Major and Degree Type
As of September 5, 2016

Specializations

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Picture Archive/Comm Sys Spec	-	-	-	-	-	-	4	4	3	-
Specialization in Accounting	-	-	-	-	-	-	-	1	-	-
Specialization in Marketing	-	-	-	-	-	-	-	2	-	-
Total	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**7**	**3**	**0**

Certificates

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Accounting Certificate	-	-	-	-	-	-	-	-	-	-
Dispute Resolution Certificate	1	2	1	2	4	1	6	11	1	2
Marketing Certificate	-	-	-	-	-	-	-	-	-	-
Polysomnographic Technology	-	-	4	14	13	11	8	6	3	9
Total	**1**	**2**	**5**	**16**	**17**	**12**	**14**	**17**	**4**	**11**

Associates

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Associate of Arts	13	8	2	5	-	1	-	-	1	1
Computer Engineering Tech	7	5	3	2	3	-	5	7	6	6
Dental Hygiene	25	26	22	25	18	27	18	23	21	9
Electronics Engineering Tech	3	1	2	1	-	-	-	-	-	-
EMT - Paramedic	19	21	22	25	27	17	28	26	26	29
Office Systems Technology	-	2	2	-	-	-	-	-	-	-
Polysomnographic Technology	-	-	1	2	3	5	6	2	4	-
Respiratory Care	23	16	15	17	-	-	-	-	-	-
Sleep Health-Polysom Tech Opt	-	-	-	-	-	-	-	-	-	3
Software Engineering Tech	7	2	3	2	2	-	-	2	9	2
Total	**97**	**81**	**72**	**79**	**53**	**50**	**57**	**60**	**67**	**50**

Bachelors

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Allied Health Management	-	-	-	1	2	4	3	2	1	-
Applied Environmental Science	1	-	-	-	-	-	-	-	-	-
Applied Mathematics	-	-	7	1	5	4	7	4	4	5
Applied Psychology	46	42	37	30	36	38	30	40	37	31
Biology	10	6	16	14	11	11	3	4	1	2
Biology-Health Sciences	-	-	-	-	-	-	10	14	20	18
Civil Engineering	23	23	29	28	20	14	23	17	15	25
Clinical Laboratory Science	23	24	24	22	22	35	27	34	49	46
Communication Studies	13	13	9	10	13	8	19	13	4	8
Computer Engineering Tech	15	7	14	8	13	3	4	3	3	3
Dental Hygiene	35	38	45	55	49	54	51	76	62	65
Diagnostic Medical Sonography	21	24	21	27	29	24	19	31	25	24
Echocardiography	6	4	16	9	21	32	31	32	29	35
Electrical Engineering	-	-	-	6	11	9	11	17	17	26
Electronics Engineering Tech	18	17	13	10	18	16	11	10	10	13

Bachelors

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Embedded Systems Eng Tech	-	-	-	1	2	2	4	1	5	3
Emergency Medical Services Mgt	-	-	-	-	-	-	-	-	-	1
Environmental Sciences	1	1	3	1	5	5	4	5	11	14
Geomatics	10	8	5	5	1	-	-	-	-	-
Geomatics-option in GIS	-	-	2	1	1	3	3	5	1	2
Geomatics-option in Surveying	-	-	1	11	13	14	10	13	1	12
Health Care Mgmt-Admin Mgmt	-	-	-	-	-	-	-	-	1	2
Health Care Mgmt-Clinical Mgmt	-	-	-	-	-	-	-	-	1	-
Health Sciences	1	3	2	2	2	6	1	1	-	-
Industrial Management	-	-	-	1	-	-	-	-	-	-
Information Technology	4	4	1	2	-	1	-	-	-	-
IT Accounting Option	-	1	2	1	1	2	1	2	-	-
IT Applications Dev Opt	8	5	13	5	6	8	21	12	8	11
IT Bus/Systems Analysis Opt	1	1	4	10	12	6	12	14	13	8
IT Health Informatics Opt	-	-	-	-	2	4	9	6	14	7
Management Information System	12	2	8	3	-	2	-	-	-	-
Manufacturing Engineering Tech	30	15	16	18	18	9	13	5	11	12
Mechanical Engineering	3	3	17	12	11	19	14	27	23	45
Mechanical Engineering Tech	31	19	31	23	24	19	24	18	17	21
Mgmt Info Sys/Mgmt Acc Option	-	3	-	-	-	-	-	-	-	-
Mgmt/Accounting Option	8	4	3	8	4	9	9	12	5	8
Mgmt/Marketing Option	9	7	5	5	7	8	7	4	7	7
Mgmt/Small Bus Mgmt Option	9	11	11	18	8	6	8	12	4	7
Nuclear Medicine Technology	18	18	16	15	16	16	15	14	14	15
Operations Management	8	6	3	15	7	14	16	13	19	18
Optical Engineering	-	-	-	-	-	-	-	-	1	1
Population Health Management	-	-	-	-	-	-	-	-	-	5
Radiologic Science	47	51	50	53	51	50	48	55	45	56
Renewable Energy Engineering	-	-	6	9	29	35	60	35	29	29
Renewable Energy Systems	-	-	1	-	-	-	-	-	-	-
Respiratory Care	5	8	6	7	10	21	21	21	27	22
Software Engineering Tech	44	36	27	27	31	29	41	31	35	47
System Engr & Technical Mgmt	-	-	-	-	-	-	-	-	-	3
Technology and Management	-	-	-	-	-	-	1	1	11	8
Ultrasound/Diag Med Sono Opt	1	-	-	-	-	-	-	-	-	-
Ultrasound/Vascular Option	1	-	-	-	-	-	-	-	-	-
Vascular Technology	30	30	26	23	23	25	21	28	19	24
Total	**492**	**434**	**490**	**497**	**534**	**565**	**612**	**632**	**599**	**689**

Masters

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Civil Engineering	-	-	-	-	-	-	-	-	2	6
Manufacturing Engineering Tech	3	4	7	2	6	8	12	4	8	9
Renewable Energy Engineering	-	-	-	-	-	-	-	1	11	9
Total	**3**	**4**	**7**	**2**	**6**	**8**	**12**	**5**	**21**	**24**

Grand Total

	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Grand Total	**593**	**521**	**574**	**594**	**610**	**635**	**699**	**721**	**694**	**774**

Attachment 4_Grad_Data_First_Destination_3_Year_History_by_Major

Oregon Tech Graduate Outcome Data

a=2013/2014/2015 combined b=2014/2015/2016 combined	% Employed		% Continuing Ed		% Looking for Work		% Not Looking		Success Rate		Median Salary	
	a	**b**	a	**b**	a	**b**	a	**b**	a	**b**	a	**b**
% among those reporting outcomes	83.3	**87.6**	6.1	**6.7**	9.4	**4.9**	1.2	**0.8**	90.6	**95.1**	$ 54,000	**$ 56,000**
Biology-Health Sciences	36	38	60	62	4	0	0	0	96	100	$ 20,750	$ 33,000
Civil Engineering	83	92	11	8	6	0	0	0	94	100	$ 50,000	$ 51,540
Communication Studies	60	67	13	11	27	22	0	0	73	78	$ 27,000	$ 28,500
Computer Engineering Technology	89	93	0	0	0	0	11	7	100	100	$ 63,000	$ 64,000
Dental Hygiene	86	96	4	1	9	2	1	1	91	98	$ 53,000	$ 57,500
Diagnostic Medical Sonography	97	98	3	2	0	0	0	0	100	100	$ 60,000	$ 60,868
Echocardiography	95	93	0	3	5	3	0	0	95	97	$ 60,500	$ 64,000
Electrical Engineering	87	83	0	10	13	7	0	0	87	93	$ 60,000	$ 60,000
Electronics Engineering Technology	73	82	7	5	20	14	0	0	80	86	$ 54,250	$ 66,750
Embedded Systems Engineering Tech	80	83	0	17	20	0	0	0	80	100	$ 58,250	$ 60,000
EMT/Paramedic	100	100	0	0	0	0	0	0	100	100	$ 48,000	$ 52,000
Environmental Sciences	67	76	11	18	22	6	0	0	78	94	$ 39,800	$ 40,000
Geomatics: GIS	100	100	0	0	0	0	0	0	100	100	$ 42,000	$ 42,000
Geomatics: Surveying	69	64	0	9	31	27	0	0	69	77	$ 40,500	$ 43,000
Health Care Management	75	80	25	20	0	0	0	0	100	100	$ 52,000	na
Health Informatics	75	79	10	11	15	11	0	0	85	89	$ 53,000	$ 52,000
Information Technology	84	88	0	2	16	10	0	0	84	90	$ 55,000	$ 55,000
Management: Accounting	78	83	6	6	17	11	0	0	83	89	$ 32,000	$ 32,250
Management: SmBus/Entrepreneursh	77	87	15	13	8	0	0	0	92	100	$ 33,000	$ 40,900
Management: Marketing	82	93	0	0	18	7	0	0	82	93	$ 39,250	$ 48,500
Manufacturing Engineering Technolo	77	85	5	4	13	11	0	0	87	89	$ 62,500	$ 60,000
Mathematics, Applied	60	71	20	29	0	0	20	0	100	100	na	na
Mechanical Engineering	71	82	12	9	10	5	7	4	90	95	$ 60,000	$ 60,000
Mechanical Engineering Technology	86	100	7	0	7	0	0	0	93	100	$ 60,000	$ 62,500
Medical Laboratory Science	100	100	0	0	0	0	0	0	100	100	$ 53,750	$ 55,000
Nuclear Medicine Technology	87	86	0	3	13	11	0	0	87	89	$ 57,000	$ 57,846
Nursing												
Operations Management	83	83	11	14	6	3	0	0	94	97	$ 63,000	$ 63,000
Polysomnographic Technology	83	100	0	0	17	0	0	0	83	100	$ 50,000	$ 40,500
Population Health Management	na	75	na	25	na	0	na	0	na	100	na	$ 42,000
Psychology, Applied	54	66	24	26	15	5	6	3	85	95	$ 30,000	$ 30,000
Radiologic Science	92	97	1	0	6	3	1	1	94	97	$ 47,000	$ 50,000
Renewable Energy Engineering	76	83	6	8	18	9	0	0	82	91	$ 57,000	$ 56,500
Respiratory Care	97	98	0	0	3	2	0	0	97	98	$ 56,000	$ 56,000
Software Engineering Technology	93	91	0	0	3	7	3	3	97	93	$ 62,250	$ 66,750
Technology and Management	100	88	0	0	0	12	0	0	100	88	na	na
Vascular Technology	92	91	0	0	8	9	0	0	92	91	$ 64,602	$ 62,000

Additional Notes:

Numbers may not add to 100 due to rounding

na=not reported, or not available due to small sample size

METHODOLOGY

Sample Frame 2016: 781 degrees awarded per FAST

Survey Response Rate: 49% Total Knowledge Rate 2016: 75%

Sources: Data collected from a variety of sources. Below, for 2016, in chronological order:

- Grad Fair paper survey
- Faculty senior exit survey
- Career Services survey
- Career Services followup with non-respondents
- Faculty information from their contact with students
- LinkedIn Profiles

Salaries of $2,500 and below and $250,000 and above were deleted.

Students with dual majors are included under each major

Known Outcomes 2016: 587

Known Outcomes 2013/2014/2015 combined N=1008

Known Outcomes 2014/2015/2016 combined N=1244

NMTCB Registry Scores

	# of Examinees	Avg Score	Pass (75-81)	Pass w/distinction (82-84)	Pass w/ High distinction (>85)
2000	1	76	1	0	0
2001	11	77.82	11	0	0
2002	10 (1 failure)	79.40	6	3	0
2003	5	79	5	0	0
2004	10	79.90	7	2	1
2005	19	80.74	11	5	3
2006	14	81.29	10	2	2
2007	18	80.67	10	6	2
2008	19	81.74	12	4	3
2009	13	80.77	10	2	1
2010	14	81.07	9	3	2
2011	9	80.11	7	1	1
2012	11	81.27	7	3	1
2013	10	79.80	8	0	2
2014	12	82.17	6	4	2
2015	12	80.42	7	4	1

National Comparison Report

SCHOOL OF NUCLEAR MEDICINE TECHNOLOGY
OREGON INSTITUTE OF TECHNOLOGY
RICK HOYLMAN
320 I CAMPUS DR
KLAMATH FALLS, OR 97601-8801

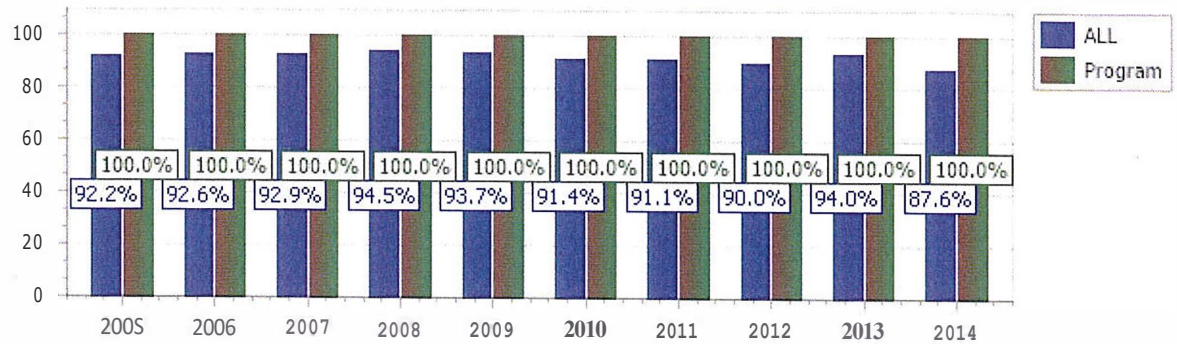
School ID: 8243
Date Generated: 4/26/2015

Report based on dates from 01/2005 through 12/2014

Nuclear Medicine Technology

Calendar Year	Group	Number Candidates	Section Means A	B	C	D	E	Total Mean	Percentile Rank	% Pass
2005	ALL	576	8.7	81	8.4	8.5	9.0	85.0	-	92.2
2005	Program	11	8.4	7.8	8.3	8.7	9.1	85.5	56	100.0
2006	ALL	637	8.8	8.3	8.3	8.5	8.7	84.9	-	92.6
2006	Program	7	8.8	8.2	8.6	8.9	8.7	87.4	69	100.0
2007	ALL	746	8.7	8.2	8.5	8.5	8.6	85.2	-	92.9
2007	Program	14	8.7	8.6	8.8	9.0	8.6	88.7	78	100.0
2008	ALL	787	8.6	8.2	8.4	8.5	8.7	84.7	-	94.5
2008	Program	15	8.5	8.8	8.7	9.0	8.8	88.7	78	100.0
2009	ALL	634	8.5	8.5	8.6	8.4	8.5	85.0	-	93.7
2009	Program	12	8.6	8.8	9.2	9.0	8.8	89.0	78	100.0
2010	ALL	561	8.4	8.2	8.2	8.4	8.7	83.8	-	91.4
2010	Program	15	8.7	8.8	8.8	9.0	9.0	89.3	78	1000
2011	ALL	538	8.5	8.4	8.3	8.4	8.5	84. I	-	91.1
2011	Program	14	8.5	8.8	8.9	9.0	8.6	88.9	78	100.0
2012	ALL	461	8.5	8.3	8.3	8.4	8.6	84.0	-	90.0
2012	Program	14	8.6	8.8	9.0	9.2	9.0	90.0	83	100.0
2013	ALL	513	8.4	8 I	8.3	8.5	8.5	84.1	-	94.0
2013	Program	14	8.6	8.4	8.6	9 I	8.7	88.4	76	100.0
2014	ALL	443	8.2	8.3	8.3	8.3	8.5	83.1	-	87.6
2014	Program	11	9.1	9.0	9.0	9.3	9.0	91.7	92	100.0

Program vs Total Pass Percentage



NOTES:

(I) A percentile rank indicates the percentage of scores at or below the corresponding mean scaled score. Percentile ranks are rounded to the nearest whole number.

(2) These percentile ranks were not obtained by comparing your school mean to all other school means, but rather by comparing the mean score of your program's graduates to the distribution of scores for all graduates.

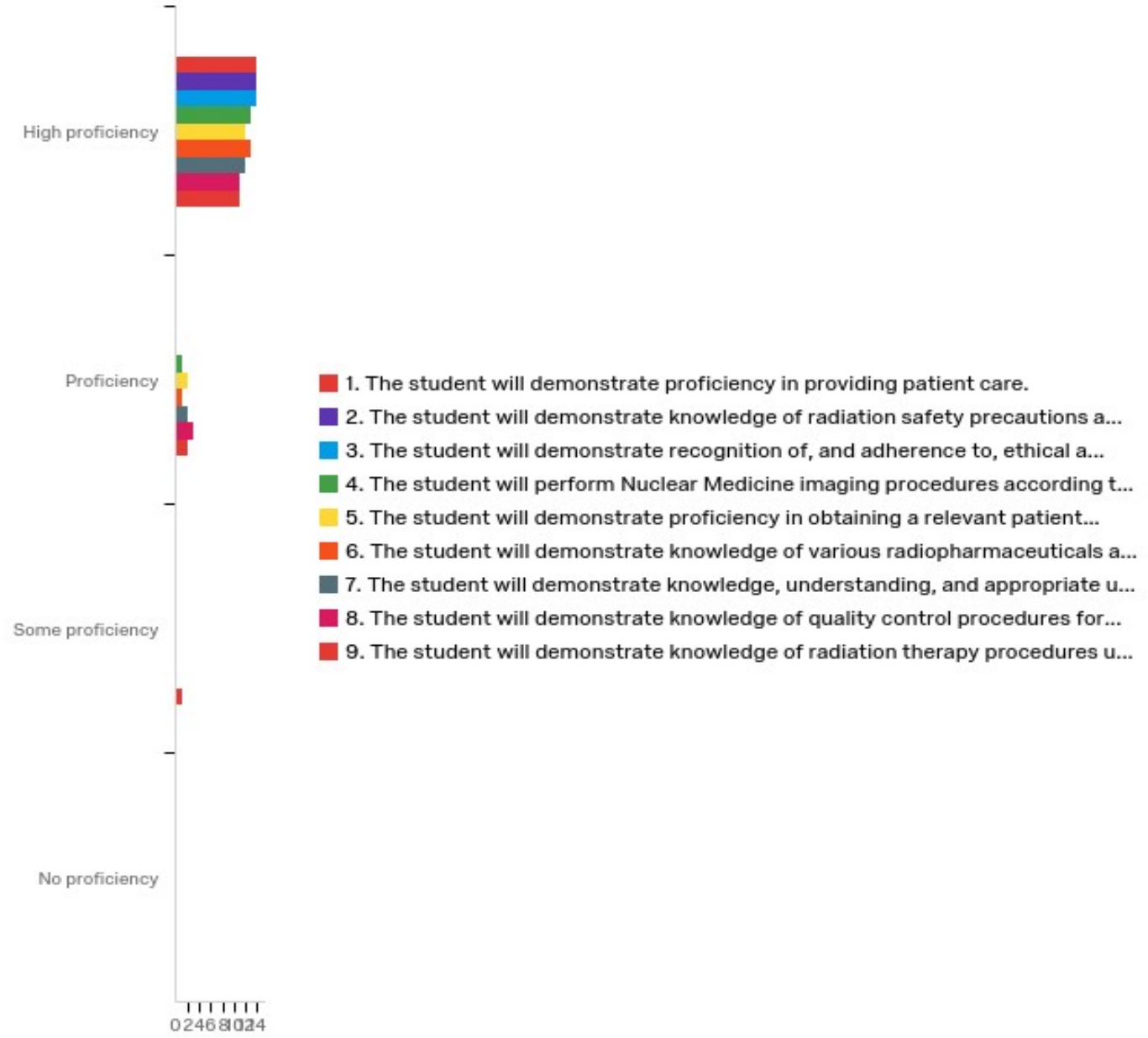
Default Report

2016-17 Student Exit Survey - Nuclear Medicine Technology B.S.

September 1st 2017, 1:28 pm PDT

Q24 - Program Student Learning Outcomes - Nuclear Medicine Technology B.S.

Please rate your proficiency in the following areas:



#	Question	High proficiency		Proficiency		Some proficiency		No proficiency	
10	1. The student will demonstrate proficiency in providing patient care.	12.28%	14	0.00%	0	0.00%	0	0.00%	0
11	2. The student will demonstrate knowledge of radiation safety precautions and ALARA concepts.	12.28%	14	0.00%	0	0.00%	0	0.00%	0
12	3. The student will demonstrate recognition of, and adherence to, ethical and professional responsibilities.	12.28%	14	0.00%	0	0.00%	0	0.00%	0
13	4. The student will perform Nuclear Medicine imaging procedures according to program and /or departmental protocol using scientific knowledge and skills in scientific reasoning.	11.40%	13	9.09%	1	0.00%	0	0.00%	0
14	5. The student will demonstrate proficiency in obtaining a relevant patient history.	10.53%	12	18.18%	2	0.00%	0	0.00%	0
15	6. The student will demonstrate knowledge of various radiopharmaceuticals and their uses in nuclear medicine imaging.	11.40%	13	9.09%	1	0.00%	0	0.00%	0
16	7. The student will demonstrate knowledge, understanding, and appropriate uses of instrumentation used in a Nuclear Medicine department.	10.53%	12	18.18%	2	0.00%	0	0.00%	0
17	8. The student will demonstrate knowledge of quality control procedures for instrumentation used in Nuclear Medicine.	9.65%	11	27.27%	3	0.00%	0	0.00%	0
18	9. The student will demonstrate knowledge of radiation therapy procedures used in Nuclear Medicine.	9.65%	11	18.18%	2	100.00%	1	0.00%	0
	Total	Total	114	Total	11	Total	1	Total	0

Oregon Institute of Technology
NMT 215
Final Exam

For the following questions, 1- 45, please answer the following questions as they relate to the correlating images provided:

1. Slide Image 1: What is the R/P for this study?
a. Tc99m WBC
b. In111 WBC
c. Tc99m Mag3
d. Tc99m DTPA
e. None of the above

2. Slide 1: What is the method of localization?
a. WBC Chemotaxis
b. Phagocytosis
c. Capillary Blockade
d. Compartmental
e. None of the above

3. Slide 1: What is the normal biodistribution of the R/P for this study?
a. Renal
b. Bladder
c. Bone
d. All of the above
e. None of the above

4. Slide 2: What is the R/P for this study?
a. Tc99m WBC
b. In111 WBC
c. Tc99m Choletec
d. Tc99m Sulfur Colloid
e. None of the above

5. Slide 2: What is the method of localization for this R/P?
a. Chemisorption
b. Phagocytosis
c. Active Transport/Polygonal cell uptake/excretion
d. WBC Chemotaxis
e. Binding to Transferrin

6. Slide 3: What study is this?
a. Gated Blood Pool
b. MPI
c. Cisternogram
d. rCBF

7. Slide 3: What is the possible R/P(s)?
a. Tc99m RBC
b. Tc99m Myoview
c. Tc99m Sestamibi
d. All of the above
e. b and c only

8. Slide 4: What is this study?
a. MPI
b. Brain Death
c. In111 WBC
d. Gated Blood Pool
e. None of the above

9. Slide 4: What is the R/P?
a. Cardiolite
b. Tc99m Tetrafosmin
c. Tc99m Sestamibi
d. All of the above
e. None of the above

10. Slide 4: What is the method of localization for the R/P for this study?
a. Compartmental
b. Active Transport
c. Passive Diffusion
d. WBC Chemotaxis
e. None of the above

11. Slide 5: What study is this?
a. rCBF
b. Brain Death
c. Cisternogram
d. Shunt Patency
e. None of the above

12. Slide 5: What is the likely R/P?
a. Tc99m HMPAO
b. In111 DTPA
c. Tc99m DTPA
d. All of the above
e. b or c only

13. Slide 5: What is the method of localization?
a. Active Transport
b. Compartmental via blood flow
c. Capillary Blockade
d. Active Transport via Na/K pump
e. None of the above

14. Slide 6: What is the study?
a. Ga67 Citrate Whole body
b. Bone scan
c. In111 WBC whole body
d. Hepatobiliary
e. None of the above

15. Slide 6: What is the R/P?
a. Ga67
b. Tc99m HDP
c. In111 WBC
d. Tc99m Choletec
e. None of the above

16. Slide 6: What is the method of localization?
a. Binding to Transferrin
b. Chemisorption
c. WBC Chemotaxis
d. Active Transport/Polygonal cell uptake
e. None of the above

17. Slide 7: What study is this?
a. Hepatobiliary
b. GI Bleed
c. In111 WBC
d. Ga67 Citrate Infection
e. None of the above

18. Slide 7: What is the R/P?
a. Tc99m RBC
b. Tc99m Choletec
c. Ga67 Citrate
d. In111 WBC
e. None of the above

19. Slide 7: What is the method of localization?
a. WBC chemotaxis
b. Binding to Transferrin
c. Active Transport/Polygonal Cell uptake/excretion
d. Phagocystosis
e. Compartmental

20. Slide 8: What study is this?
a. In111 WBC
b. Ga67 Citrate Infection
c. Ga67 Citrate Tumor
d. Liver/Spleen
e. Hepatobiliary

21. Slide 8: What is the method of localization?
a. WBC chemotaxis
b. Binding to Transferrin
c. Active Transport/Polygonal Cell uptake/excretion
d. Phagocystosis
e. Compartmental

22. Slide 8: What is the R/P for this study?
a. Tc99m RBC
b. Tc99m Choletec
c. Ga67
d. In111 WBC
e. None of the above

23. Slide 9: What is the R/P for this study?
a. Tc99m Mag3
b. Tc99m DTPA
c. I131 Hippuran
d. I123 HIppuran
e. None of the above

24. Slide 9: What study is this?
a. Renal Transplant
b. Cortical/Morphological Imaging
c. Native Renal Exam
d. None of the above

25. Slide 10: What study is this?
a. Renal Transplant
b. Cortical/Morphological Imaging
c. Native Renal Exam
d. None of the above

26. Slide 10: What is the likely R/P for this study?
a. Tc99m Mag3
b. Tc99mGlucoheptanate
c. I131 Hippuran
d. I123 HIppuran
e. None of the above

27. Slide 11: What study is this?
a. Cisternogram
b. Shunt Patency
c. Brain Death
d. DatScan

28. Slide 11: What is the R/P for this study?
a. Tc99m ECD
b. In111 DTPA
c. Tc99m DTPA
d. Tc99m HMPAO
e. a or d only

29. Slide 12: What study is this?
a. Lung Ventilation with X3133
b. Lung Perfusion with DTPA aerosol
c. Lung Ventilation with DTPA aerosol
d. Lung Perfusion with MAA
e. None of the above

30. Slide 12: What is the R/P for this study?
a. Tc99m DTPA aerosol
b. Xe133
c. Tc99m MAA
d. None of the above

31. Slide 12: What is the method of localization for this study?
a. Compartmental
b. Phagocystosis
c. Active Transport
d. Passive Diffusion
e. None of the above

32. Slide 13: What is this study?
a. Brain Death
b. Shunt Patency
c. Cisternogram
d. DatScan
e. None of the above

33. Slide 13: What is the R/P for this study?
a. In111 DTPA
b. Tc99m DTPA
c. Tc99m HMPAO
d. a and b only
e. None of the above

34. Slide 13: What is the method of localization for this study?
a. Compartmental
b. Phagocystosis
c. Active Transport
d. Passive Diffusion
e. None of the above

35. Slide 14: What is this study?
a. Bone Scan
b. In111 WBC scan
c. Sulfur Colloid scan
d. Ga67 Citrate Whole Body
e. None of the above

36. Slide 14: What is the R/P for this study?
a. In111 DTPA
b. In 111 WBC
c. Ga67 Citrate
d. Tc99m WBC
e. Tc99m S.C.

37. Slide 14: What is the method of localization for this study?
a. WBC chemotaxis
b. Compartmental
c. Capillary blockade
d. Phagocytosis
e. None of the above

38. Slide 15: What study is this?
a. lung Ventilation
b. lung perfusion
c. Liver/Spleen
d. None of the above

39. Slide 15: What is the method of localization for this study?
a. Passive Diffusion
b. Antigen/Antibody binding
c. Binding to Transferrin
d. Active Transport
e. None of the above

40. Slide 15: What is the R/P used for this study?
a. Tc99m MAA
b. Xe133
c. Tc99m DTPA aerosol
d. None of the above

41. Slide 16: What is this study?
a. In111 WBC
b. Tc99m HMPAO WBC
c. Tc99m Sulfur Colloid
d. I 131 Whole body
e. Ga67 Citrate Whole Body

42. Slide 16: What R/P is used for this study?
a. Ga67 Citrate
b. In 111 WBC
c. Tc99m HMPAO WBC
d. I 131
e. Tc99m S.C.

43. Slide 16: What is the method of localization for this R/P & study?
a. Passive Diffusion
b. Antigen/Antibody binding
c. Binding to Transferrin

d. Active Transport
e. None of the above

44. Slide 17: What study is this?
a. Lung Ventilation
b. Lung Perfusion
c. MPI
d. None of the above

45. Slide 17: What R/P used for this study?
a. Tc99m MAA
b. Tc99m DTPA aerosol
c. Xe133
d. None of the above

46. Slide 17: What is the method of localization for this study?
a. WBC chemotaxis
b. Compartmental
c. Capillary blockade
d. Phagocytosis
e. None of the above

47. Which of the following is bound to Transferrin?
a. In111 WBC
b. Tc99m HMPAO WBC
c. Tc99m ECD
d. Ga67 Citrate
e. None of the above

48. Which of the following is Cyclotron produced?
a. In111
b. Ga67
c. I 131
d. I 123
e. All of the above except 'c'

49. Which of the following is used for Chronic Infections or FUO Chronic Phase?
a. Ga67 Citrate
b. In111 WBC
c. I 123
d. I 131
e. Tc99m HMPAO WBC

For questions 50-57, match the following:

50. Labels neutrophils primarily
51. Detects pneumocystic carinii pneumonia
52. Pediatric FUO or Osteomyelitis
53. Oral administration
54. 48-72 hours imaging
55. Labelled with DatScan

a. Ga67 Citrate
b. In111 WBC
c. Tc99m HMPAO
d. I 123
e. both b and c only

56. Bound to Transferrin
57. Thyroid Uptake and Scan
58. Lymphoma Imaging

59. In the Ultra Tag kit, what purpose or role does Syringe 1 serve?
a. Oxidize the Stannous Chloride outside of the cell
b. Sequester any extracellular Stannous ion
c. Adjust the pH
d. Oxidize the Stannous Chloride inside the cell
e. b and c only

60. Which of the following is true of Syringe I in the Ultra Tag kit?
a. contains Citric Acid
b. contains Sodium Citrate
c. serves as a pH adjuster
d. contains Sodium Hypochlorite
e. all of the above except d

61. Which of the following is true of Syringe II in the Ultra Tag kit?
a. contains Citric Acid
b. contains Sodium Citrate
c. Sequesters extracellular Stannous Chloride
d. contains Sodium Hypochlorite
e. all of the above except d

62. What is the function of Vial A in the Sulfur Colloid kit?
a. serves as a pH buffer
b. keeps the Tc99m from reverting back to Tc99m 04-
c. helps to make the heptasulfide colloid particles during the heating process
d. all of the above
e. b and c only

63. Which of the following R/Ps is associated with identifying cholysystitis?
a. Mebrofenin
b. Hepatolite
c. Choletec
d. all of the above
e. all of the above except a

For questions 64-70, match the Radiopharmaceutical/Exam with the correct Method of Localization:

64. Tc99m MAA
65. Tc99m DTPA Aerosol
66. I 123
67. Sulfur Colloid
68. Heat Damaged RBCs
69. V/P Shunt Evaluation
70. DMSA

a. Phagocystosis
b. Compartmental/Blood Flow
c. Cell sequestration
d. Active Transport
e. Capillary Blockade

For questions 71-77, match the properties of an ideal Diagnostic and/or Therapeutic R/P:

71. Pure Beta emitter
72. Short T1/2
73. 100-250 Kev
74. Readily available
75. Simple to prepare
76. Medium to High energy
77. Moderately long T1/2
78. Pure gamma emitter
79. Low radiation to patient & to others

a. Diagnostic
b. Therapeutic
c. Both
d. None of the above

80. Heptasulfide colloid particles are associated with which R/P?
a. Choletec
b. Mebrofenin
c. Hepatolite
d. Mag3
e. None of the above

81. For which of these R/Ps, does the camera have to be available immediately following injection?
a. Cardiolite
b. Sestamibi
c. Myoview
d. Tetrafosmin
e. Thallium

For Questions 82-93, match the Radionuclide with the associated Production mechanism:

82. Ga^{67}
83. In^{111}
84. Ga^{68}
85. Xe^{133}
86. Rb^{82}
87. I^{123}
88. Cr^{51}
89. Tl^{201}
90. O^{15}
91. I^{131}
92. Cs^{137}
93. Co^{57}

a. Nuclear Reactor
b. Cyclotron
c. Generator System

For questions 94-97, match the following quality control procedures:

94. ITLC
95. % bound vs. % free
96. <10 ug/ml
97. <0.15 uCi/mCi

a. Radionuclide purity
b. Radiopharmaceutical purity
c. Chemical purity
d. Pyrogenicity
e. None of the above

Use the following information for questions 98-100. Show your work and clearly circle your answers:

Elution: 0700 575 mCi 8cc

98. Calculate the volume of elution to draw up for a Cardiolite kit where 80 mCi is needed at 0930:

99. Calculate the volume of the Cardiolite kit needed for a 29 mCi patient at 1100:

100. Calculate the volume of the elution above to draw up for a MDP kit where 105 mCi is needed at 1pm (Assume this is the only kit made from the elution above at 0700):

Oregon Institute of Technology
NMT 225

Final Exam

For each of the following multiple choice questions, choose the best answer from the list. For each of the True and False questions, answer A for True and B for False.

1. T or F. Sensitivity refers to the minimum distance between two objects that can still be distinguished as two distinct sources.

2. An In111 WBC patient needs to be imaged. Which collimator would be best used for this patient study?
a. MEGP b. HEGP c. LEHR d. LEAP e. Pinhole

3. A large breasted Tl 201 patient needs a Spect study of the heart. Which of these collimators would be best used for this study?
a. MEGP b. HEGP c. LEHR d. LEAP e. Pinhole

4. Ga67 is used for a lymphoma patient needing a 48 hr whole body study. Which collimator would be best used for this patient?
a. MEGP b. HEGP c. LEHR d. LEAP e. Fanbeam

5. A Tc99m MIBI heart study using 25 mCi needs to be done on a patient. To maximize counts and get the best resolution, which collimator would be best for this study?
a. MEGP b. Cadio-fanbeam c. LEHR d. Pinhole e. Diverging

6. Which of these collimators makes a large organ appear smaller on the crystal?
a. Pinhole b. Converging c. Diverging d. LEHR e. Fanbeam

7. Which of these collimators are the holes not parallel and angled outward?
a. Diverging b. Converging c. LEHR d. Pinhole e. Fanbeam

8. Which of these collimators are all the holes not parallel but angled inward to make a smaller organ appear larger on the crystal?
a. Fanbeam b. Converging c. Diverging d. Cardio-fanbeam e. Pinhole

9. Which of these collimators are the holes parallel in one dimension, but converge in another dimension and the bed must be off centered for imaging a small organ?
a. Fanbeam b. Converging c. Diverging d. Cardio-fanbeam e. Pinhole

10. T or F. LEHR has a higher angle of acceptance than LEAP.

11. MEGP collimator provides the best images for which of the following?
a. Tc99m b. In111 c. Ga67 d. I 123 e. I 131

12. HEGP collimator provides the best images for which of the following?
a. Ga67 b. I 131 c. In 111 d. all of the above e. a and b only

13. T or F. Energy ranges of 100-200 kev are considered Medium energy and are best imaged with a MEGP collimator.

14. T or F. Energy ranges of 200-300 kev are considered High energy and are best imaged with a HEGP collimator.

15. T or F. NaI (Tl) is an organic scintillator.

16. Which of the following is not a characteristic of NaI (Tl) crystals?
a. hyperphilic b. fragile c. sensitive to temperature changes d. all of the above
e. b and c only

17. T or F. The light intensity within a NaI (Tl) crystal is directly proportional to the # of flashes of light.

18. T or F. As the gamma energy increases, the light intensity decreases.

19. Which of these crystals is doped with Cerium?
a. LPO b. BGO c. LSO d. YSO e. none of the above

20. Which of these structures is made of Cesium or Antimony?
a. Dynodes b. Photocathode c. Anode d. Amplifier e. none of the above

21. T or F. The number of electrons from the photocathode is not directly proportional to the intensity of light coming from the crystal.

22. Which of the following produces proportional amplification and pulse shaping?
a. Gain control b. PHA c. HV supply d. Linear Amplifier e. PMT

23. In which of these regions does an increase in voltage produces UV photoelectrons?
a. Proportional b. Geiger-Meuller c. Ionization d. Recombinant
e. limited proportionality

24. In which of these regions is the pulse ht. not proportional to the initiating event?
a. Geiger-Meuller b. Proportional c. Recombinant d. continuous discharge e. all of the above

25. T or F. Most gas detectors are filled with Argon or they could by dry pressurized air.

26. In which of these regions is one e- collected per ionizing event?
a. Ionization b. Proportional c. Recombinant d. Geiger-Meuller
e. Continuous discharge

27. Which of the following is not an example of an ionization chamber?
a. Dose Calibrator b. Pocket Dosimeter c. Well counter d. all of the above
e. a and c only

28. T or F. Because different amounts of radiation and energies produces different amounts of ionization (current), equal activities of different radionuclides produces the same quantities of current.

29. Which of the following utilizes a quartz fiber electroscope?
a. Cutie Pie b. Pocket Dosimeter c. Dose Calibrator d. Geiger-Mueller
e. none of the above

30. 300-500 V corresponds to which of the following regions?
a. Proportional b. Ionization c. Recombinant d. Geiger-Mueller
e. none of the above

31. T or F. Geiger-Mueller tubes cannot distinguish between different energies and types of radiation.

32. A GM tube must be calibrated:
a. weekly b. daily c. quarterly d. annually e. after repair

33. The average range of a positron for F^{18} is:
a. 4.1 mm b. 0.2 cm c. 2.4 cm d. 2.4 mm e. 0.2 mm

34. The maximum range of a positron in water is:
a. 2.4 mm b. 0.2 mm c. 2.4 cm d. 41. mm e. 0.2 cm

35. Which of these rejects and or accepts pulses of a certain voltage intervals?
a. Linear Amplifier b. pre-amplifier c. PMT d. PHA e. none of the above

36. Which of these converts analog signal to digital signal?
a. PHA b. ADC c. PMT d. DPM e. CPM

37. Which of these matrices would be best given: Spect imaging using Tl201 on a large patient?
a. 128 x 16 b. 512 x 16 c. 256 x 16 d. 64 x 16 e. none of the above

38. Which of these matrices would be best given: dynamic flow study using Tc99m, small patient, 25-30 mCi?
a. 128 x 16 b. 256 x 16 c. 64 x 16 d. 512 x 16 e. none of the above

39. Which of these matrices would be best given: 20 mCi Tc99m HDP chest static for 800k cts to rule out tumor in the chest?
a. 128 x 16 b. 512 x 16 c. 64 x 16 d. 64 x 8 e. none of the above

40. Which of these is an electronic circuit that accepts signal pulses from a radiation detector and counts them?
a. PHA b. Gamma Camera c. Dose Calibrator d. Scaler e. none of the above

41. A peak that arises on a gamma spectrum of approx. 72 kev is called:
a. Compton scatter b. Lead Xray peak c. Iodine Escape peak d. Tc99m photopeak

42. T or F. Realistically, the pulse height is not a narrow line, but a broad peak.

43. I 123 Standard counts, done at 9:00 am are 345978 and std. Bkg. Cts. are 234, thyroid counts, done at 10:00 am the next day, are 5435 and thigh bkg cts. are 211. What is the thyroid uptake?
a. 1.51 % b. 1.51 cpm c. 5.6 % d. 0.41% e. 16.5%

44. What is the thyroid uptake in #43 using I 131 and the patient returns 24hrs after the dose was administered?
a.1.65% b. 1.38% c. 11.9% d. 20.3% e. 0.59%

45. What is the thyroid uptake in #43 using Tc99m and the patient returns 20 minutes after the dose was administered?
a. 63% b. 1.57% c. 15.1% d. 14.5% e. 16.4%

46. Electromagnetic energy differs from particulate radiation in that EM radiation has:
a. 0 mass and 0 charge b. 0 mass only c. a solid particle d. all of the above
e. a and c only

47. T or F. Electrons and neutrons are examples of electromagnetic radiation both in and around the nucleus.

48. What has the same atomic number but different atomic mass?
a. isotope b. isotone c. isobar d. isomer e. metastable state

49. What has the same atomic mass, but different atomic number?
a. isotope b. isotone c. isobar d. isomer e. metastable state

50. What has the same atomic mass, but different number of neutrons?
a. isotope b. isotone c. isobar d. isomer e. metastable state

51. $^{98}Mo\ (n,y)^{99}Mo$ is an example of:
a. electron capture b. neutron capture c. proton capture d. positron emission
e. beta decay

52. $^{99}Mo \rightarrow {}^{99m}Tc + B- + v$ is an example of:
a. positron decay b. beta decay c. electron capture d. conversion electron
e. none of the above

53. $^{15}O \rightarrow {}^{15}N + B^{+} + v$ is an example of:
a. positron decay b. beta decay c. electron capture d. conversion electron
e. none of the above

54. $^{123}I + e^{-} \rightarrow {}^{123}Te + v$ is an example of:
a. positron decay b. beta decay c. electron capture d. neutron capture
e. none of the above

55. ^{194}Pp (p,n) ^{194}Uu is an example of:
a. positron decay b. beta decay c. electron capture d. neutron capture
e. none of the above

56. In #55 above, which of these is the emitted particle?
a. p b. ^{194}Pp c. ^{194}Uu d. n e. none of the above

57. If I have 250 Gy and a QF of 10, how much do I have in S.I. units of Absorbed Dose Equivalent?
a. 250,000 mSv b. 2,500,000 mSv c. 2500 Sv d. 2500 rem e. b and c only

58. If I have 4.8×10^{8} dps, how many MBq do I have?
a. 37 b. 22.2 c. 480 d. 370 e. 48

59. If the T_b is 2.3 days and the T_p is 13.3 hrs, what is the effective T1/2?
a. 0.93 days b. 0.93 hrs c. 2.03 days d. 10.71 hrs e. 2.03 hrs

60. Which of the following is a unit of Absorbed Dose Equivalent?
a. Rad b. Gy c. Sv d. MBq e. a and b only

61. Which of the following is a unit of Absorbed Dose?
a. Rem b. Sv c. MBq d. Rad e. b and c only

62. Which of the following is a unit of Radioactivity?
a. Sv b. Rem c. Rad d. Gray e. none of the above

63. Which of the following is deposited energy per unit mass?
a. Gy b. Rem c. Sv d. MBq e. mCi

64. Which of the following is a unit of Absorbed Dose Equivalent?
a. Rem b. Gy c. Sv d. a and b only e. a and c only

65. Which of the following is best or most accurate to measure the patient background activity when doing a thyroid uptake test?
a. neck b. room background c. thigh d. none of the above

66. Which of the following has a geometric efficiency of nearly 99%?
a. Thyroid probe b. Gamma Camera c. Geiger Meter d. Pocket Dosimeter e. none of the above

67. Gimli the Dwarf is a disgruntled nurse working on the oncology floor taking care of a I 131 Therapy patient. What radiation monitoring device would Gimli use to document his exposure while caring for this patient?
a. Geiger meter b. Proportional Counter c. Pocket Dosimeter d. ring film badge e. none of the above

68. T of F. Detector efficiency for a well counter increases with increasing photon energy.

69. T or F. The larger the sample volume, the less efficient the well counter becomes.

70. An intrinsic gamma camera uniformity must be done at least:
a. weekly b. quarterly c. daily d. annually e. only after repairs

71. Center of Rotation (COR) QC must be done at least:
a. monthly b. quarterly c. annually d. daily e. only after repairs

72. Spatial Resolution on a gamma camera must be done at least:
a. monthly b. quarterly c. annually d. weekly e. none of the above

73. T or F. Spatial Resolution evaluation may be done extrinsic or intrinsic using a Co57 sheet source or a Tc99m Flood source.

74. Which of the following produces the highest counts per pixel assuming the dose, distance and time for acquisition are constant?
a. 64 x 16 b. 512 x 16 c. 128 x 16 d. 256 x 16 e. 1024 x 16

75. T or F. 16 bits of information is also called a byte.

76. T or F. Multiple frames acquired one at a time for a preset number of counts or time in one plane without the camera moving are acquired in what is commonly termed "Dynamic" mode.

77. A keyboard, mouse, and monitor are all examples of:
a. CPU b. Memory c. I/O devices d. computer software

78. All arithmetic and logic functions of a computer are handled by the:
a. memory b. I/O devices c. CPU d. ADC e. none of the above

79. Data acquired using the "R" wave of the patient EKG is termed:
a. Dynamic b. Static c. Spect d. Gated e. Planar

80. T or F. The number one cause of gamma camera non-uniformities is complete PMT failure.

81. Which of the following can cause detector head non-uniformities?
a. Cracked crystal b. tube out of tune c. complete tube failure d. all of the above e. b and c only

82. Which of these converts pulses to digital signal that can be stored?
a. ABC b. PHA c. PMT d. PAC e. none of the above

83. T or F. 2D mode is used with the tungsten septa in place between the crystals.

84. T or F. "True" events within a PET camera are estimated with a delayed timing window of > 20ns.

85. Which of these is the best all around crystal to be used for PET applications?
a. BGO b. NaI (Tl) c. LSO d. GSO e. GTO

86. Which of these has the highest density (gm/cm^3?)
a. NaI (Tl) b. LSO c. BGO d. GSO

87. Which of these has the highest light transmission/ kev of energy?
a. NaI (Tl) b. LSO c. BGO d. GSO

88. T or F. Neutron rich radionuclides decay by either positron emission or electron capture.

89. T or F. It is possible to convert particulate mass to electromagnetic energy.

90. T or F. A linear accelerator can also produce positron emitting radionuclides.

91. T or F. A blank scan is a transmission scan done with the patient on the bed.

92. T or F. An emission scan determines how many photons are seen or attenuated from an external beam.

93. T or F. With a pinhole collimator, the image enlarges as the organ moves further away from the patient.

94. Assuming 360 days/year & 30 days/month, an accuracy test must be done using the Cs137 source. It was calibrated 9/1/97 and found to be 5.78 mCi. What is the activity on 11/12/04?
a. 5.12 mCi b. 4.39 mCi c. 4.55mCi d. 4.89 mCi e. 3.99 mCi

95. T or F. If the calibrated activity on 11/12/04 is 4.25mCi, this an acceptable accuracy test?

96. Dose calibrator Linearity test must be done:
a. monthly b. quarterly c. annually d. daily e. none of the above

97. Dose calibrator Accuracy test must be done:
a. monthly b. quarterly c. annually d. daily e. none of the above

98. Dose calibrator Geometry test must be done:
a. monthly b. quarterly c. annually d. daily e. none of the above

99. A Cutie Pie is an example of:
a. proportional counter b. type of Geiger counter c. Pocket Dosimeter
d. ionization counter e. none of the above

100. A radiopharmacy draws up 73 mCi of F^{18}at 0430. How much is left for injection when it arrives at the Nuclear Medicine Dept. and is checked in the dose calibrator at 1300 (1pm)?
a. 69 mCi b. 14.5 mCi c. 4.5 mCi d. 56.7 mCi e. 2.94 mCi

Oregon Institute of Technology

Instrumentation Assessment
Spring Term 2017

I. Collimators:

1. In which of the following are the holes in the collimator not parallel?
a. Diverging
b. LEAP
c. LEHR
d. Converging
e. a and d only

2. Which of these makes a larger object appear smaller on the crystal?
a. Converging
b. LEAP
c. LEHR
d. Fanbeam
e. none of the above

3. . Which of these collimators are all the holes angled outward?
a. Converging
b. Fanbeam
c. Cardiofanbeam
d. Diverging
e. none of the above

4. Which of the following makes a smaller organ appear larger on the crystal?
a. Converging
b. Diverging
c. Fanbeam
d. Cardiofanbeam
e. all of the above except b

5. If the length of the bore of a collimator is the same (thickness of the collimator), which of the following has the smallest angle of acceptance?
a. HEGP
b. LEHR
c. LEAP
d. MEGP

II. Gamma Camera Instrumentation

6. Which of the following has the shortest scintillation decay time?
a. NaI (Tl)
b. BGO
c. LSO
d. they all have the same decay time
e. b and c are the same

7. Which of the following is usually made of Cesium or Antimony?
a. Dynodes
b. crystal
c. Anode
d. Photocathode

8. Which of the following delivers the pulse to the PHA?
a. High voltage supply
b. PMT
c. Linear amplifier
d. none of the above

9. Which of the following amplifies and shapes the pulse coming from the PMT?
a. Linear amplifier
b. High voltage
c. PHA
d. all of the above

10. Which of the following converts the pulses coming from the pulse height analyzer to the signal on the computer screen?
a. ABC
b. PMT
c. PHA
d. ADC

III. Well Counter/Dose Calibrator QC

11. Constancy test is done:
a. daily
b. install, annually, after repairs
c. install, quarterly, after repairs
d. install, after repairs
e. none of the above

12. Accuracy test is done:
a. install, quarterly, after repairs
b. daily
c. install, annually, after repairs
d. install, monthly, after repairs
e. none of the above

13. Linearity test is done:
a. install, quarterly, after repairs
b. daily
c. install, annually, after repairs
d. weekly
e. at installation only

14. What is the purpose of the dose calibrator linearity test?
a. to compare the measured reading to the calculated reading
b. to compare the effect of placement of the source within the dose calibrator
c. to measure the response of the dose calibrator over a wide range of activity
d. to measure the response of the dose calibrator from one day to the next
e. none of the above

15. What is the purpose of the dose calibrator accuracy test?
a. to compare the measured reading to the calculated reading
b. to compare the effect of placement of the source within the dose calibrator
c. to measure the response of the dose calibrator over a wide range of activity
d. to measure the response of the dose calibrator from one day to the next

IV. Gas Detectors:

16. Which of these is an example of a gas detector?
a. pocket dosimeter
b. well counter
c. thyroid probe
d. all of the above
e. a and b only

17. Which of these utilizes a quart fiber for measuring the ionization within a gas chamber?
a. Gieger tube
b. Dose Calibrator
c. Well Counter
d. Proportional Counter
e. none of the above

18. In which of these regions does an increase in voltage produces UV photoelectrons?
a. Proportional
b. Geiger-Meuller
c. Ionization
d. Recombinant
e. limited proportionality

19. In which of these regions is the pulse ht. not proportional to the initiating event?
a. Geiger-Meuller
b. Proportional
c. Recombinant
d. continuous discharge
e. all of the above

20. A GM tube must be calibrated:
a. weekly
b. daily
c. quarterly
d. annually
e. after repair

1. e
2. e
3. d
4. e
5. b
6. c
7. d
8. c
9. a
10. d
11. a
12. c
13. a
14. c
15. a
16. a
17. e
18. b
19. a
20. d

Attachment 11_Copy_of_NMT_215_Final_Exam_Grades_Winter_2017

Last Name	First Name	Final Exam [Total Pts: 100] |304933	Final Grade [Total Pts: 100] |304934
Student	1	78	
Student	2	95	
Student	3	84	
Student	4	86	
Student	5	93	
Student	6	98	
Student	7	93	
Student	8	83	
Student	9	95	
Student	10	91	
Student	11	95	
Student	12	85	
Student	13	73	
Student	14	87	
Student	15	72	
Student	16	89	
Student	17	88	
Student	18	92	
Student	19	95	

85% of students passed the final exam with at least a 75% score.

Attachment 12_Copy_of_NMT_225_Grades_2017

Last Name	First Name	Final w/e.c [Total Pts: 112] |354263	
Student	1	98.5	met
Student	2	103.5	met
Student	3	102	met
Student	4	103.5	met
Student	5	98	met
Student	6	108	met
Student	7	111.25	met
Student	8	106	met
Student	9	85.5	met
Student	10	106.5	met
Student	11	93.25	met
Student	12	109	met
Student	13	94.5	met
Student	14	92.5	met
Student	15	97.25	met
Student	16	79.75	met
Student	17	96.25	met
Student	18	94.5	met
Student	19	100	met
Student	20	100.25	met