Republic of Yemen

Ministry of Education & Higher Research

Council of Academic Accreditation & Quality Assurance of

Higher Education (CAQA)

21 septamber University of Medical and Applied Science

Faculty of Applied Medical Science

Department of Medical Radiology and Imaging Technology

Program of Radiologic Technology and Medical Imaging

Course Specification of

Radiographic Mathematics

Course Code. (____)

2024

Prepared by:	Reviewed by:	Head of the Department:	Quality Unit:	Dean:
	Dr. -----	Dr. Awadh Al-Kubati	Dr. Mohammed Al-shamahi	Dr. Abdulsalam Dalaq

I. General Information:

1.	**Course Title:**	Radiographic Mathematics				
2.	**Course Code:**					
3.	**Credit Hours:**	**Credit Hours**	**Theory Contact Hours**		**Practical Contact Hours**	
			Lecture	**Tutorial/ Seminar**	**Lab**	**Clinical**
		2	2	--	--	--
4.	**Level/ Semester at which this Course is offered:**	2nd Level / 1st Semester				
5.	**Pre –Requisite (if any):**					
6.	**Co –Requisite (if any):**	None				
7.	**Program (s) in which the Course is Offered:**	Bachelor of Radiologic Technology and Medical Imaging				
8.	**Language of Teaching the Course:**	English				
9.	**Location of Teaching the Course:**	Faculty of Applied Medical Science				
10.	**Prepared by:**					
11.	**Date and Number of Approval by Council:**					

II. Course Description:

This course provides an in-depth understanding of the mathematical principles and techniques used in radiologic technology. It covers topics such as algebra, geometry, trigonometry, and calculus, focusing on their application in radiographic imaging, dosimetry, and image analysis. Emphasis is placed on problem-solving and critical thinking skills necessary for the accurate interpretation and manipulation of radiographic data.

III. Course Intended Learning Outcomes (CILOs) : Upon successful completion of the course, students will be able to:		Referenced PILOs		
A. Knowledge and Understanding:		**I, P or M/A**		
a1	Explain the mathematical concepts used in radiographic imaging.	**M**	**A1**	Demonstrate an understanding of fundamental knowledge of Biomedical sciences (Biology, Biophysics, Anatomy, Physiology, Sectional anatomy, and medical imaging technique).
a2	Describe the application of algebra and geometry in image analysis.	**M**	**A2**	Explanation of the principles and procedures of medical imaging acquisitions, medical imaging techniques, and Radiological Technology Sciences as well as patient positioning in computed radiography and MRI technique.
B. Intellectual Skills:				
b1	Analyze radiographic images using mathematical techniques.	**P**	**B3**	Analyze and evaluate evidence-based information needed in medical imaging practice.
b2	Develop solutions for radiographic problems using mathematical models.	**P**	**B1**	Assess the radiation exposure times and intensity of exposure to guarantee the imaging technique is accurate to reduce the risk factors and adapt to patient needs.
C. Professional and Practical kills:				
c1	Perform accurate calculations for dosimetry.	**M**	**C2**	Apply technical skills in using medical imaging devices, tools, and materials in radiological technology practice.
c2	Utilize mathematical software for image analysis.	**M**	**C4**	Utilize appropriate manual and automated techniques in radiological imaging investigations.

D. Transferable Skills:				
d1	Communicate complex mathematical concepts clearly.	**M**	**D1**	Communicate effectively with clinicians, patients, and support staff.
d2	Apply problem-solving skills in various radiographic contexts.	**M**	**D4**	Function effectively as an individual, as a member, or leader of a team engaged in appropriate activities to the radiologic technology disciplines to accomplish a common goal.
I= Introduced, P=Practiced or M/A= Mastered/Advanced				

(A) Alignment of Course Intended Learning Outcomes (Knowledge and Understanding) to Teaching Strategies and Assessment Methods:			
Course Intended Learning Outcomes		**Teaching Strategies**	**Assessment Strategies**
a1	Explain the mathematical concepts used in radiographic imaging.	▪ Lectures, Interactive Discussions	▪ Written Exams, Quizzes, Midterm Exams, Assignments
a2	Describe the application of algebra and geometry in image analysis.	▪ Case Studies, Group Projects	▪ Written Exams, Quizzes, Midterm Exams, Assignments
(B) Alignment of Course Intended Learning Outcomes (Intellectual Skills) to Teaching Strategies and Assessment Methods:			
Course Intended Learning Outcomes		**Teaching Strategies**	**Assessment Strategies**
b1	Analyze radiographic images using mathematical techniques.	▪ Problem-Based Learning, Tutorials	▪ Written Exams, Quizzes, Midterm Exams, Assignments
b2	Develop solutions for radiographic problems using mathematical models.	▪ Workshops, Independent Study	▪ Written Exams, Quizzes, Midterm Exams, Assignments
(C) Alignment of Course Intended Learning Outcomes (Professional and Practical Skills) to Teaching Strategies and Assessment Methods:			
Course Intended Learning Outcomes		**Teaching Strategies**	**Assessment Strategies**

c1	Perform accurate calculations for dosimetry.	▪ Problem-Based Learning, Tutorials	▪ Written Exams, Quizzes, Midterm Exams, Assignments
c2	Utilize mathematical software for image analysis.	▪ Problem-Based Learning, Tutorials	▪ Written Exams, Assignments

(D) Alignment of Course Intended Learning Outcomes (Transferable Skills) to Teaching Strategies and Assessment Methods:

Course Intended Learning Outcomes		Teaching Strategies	Assessment Strategies
d1	Communicate complex mathematical concepts clearly.	▪ Group Discussions	▪ Problem-Solving Tasks
d2	Apply problem-solving skills in various radiographic contexts.	▪ Role-Playing Exercises	

IV. Course Contents:

A. Theoretical Aspect:

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	**Introduction to Radiographic Mathematics**	– Overview, Importance in Radiology	1	2	a1, a2
2	**Basic Algebra in Radiography**	– Equations, Inequalities – Practice Problems, Real-World Applications – Problem Solving, Application in Radiology	1	2	b1, d2
3	**Advanced Algebra in Radiography**	– Functions, Graphs – Complex Equations, Functions	1	2	b1, d2
4	**Geometry in Imaging**	– Shapes, Angles – 3D Imaging, Volume Calculations	1	2	a2, c1
5	**Advanced Geometry in Imaging**	– Distances, Area and Volume Calculations	1	2	a2, c1
6	**Trigonometry in Radiology**	– Sine, Cosine, Tangent – Exercises, Practical Use Cases	1	2	b2, c2

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
7	**Applications of Trigonometry**	– Image Positioning – Exercises, Practical Use Cases	1	2	b2, c2
8	**Mid-Term Exam**	– In all previous Topics	1	2	a1, a2, b1, b2, c1
9	**Basic Calculus in Radiography**	– Derivatives – Derivative and Integral Problems	1	2	a1, b1
10	**Advanced Calculus in Radiography**	– Integrals – Complex Equations, Functions	1	2	a1, b1
11	**Applications of Calculus in Dosimetry**	– Radiation Dose Calculations	1	2	b1, c1
12	**Image Analysis Techniques**	– Fourier Transforms – Fourier Transform Practice	1	2	b2, c2
13	**Advanced Image Analysis**	– Image Reconstruction	1	2	b2, c2
14	**Error Analysis**	– Types of Errors – Data Analysis, Error Correction	1	2	a2, d1
15	**Statistical Methods in Radiography**	– Statistical Methods in Radiography	1	2	a2, d1
16	**Final Theoretical Exam**	– All theoretical topics	1	2	a1, a2, b1, b2, c1, c2
Number of Weeks /and Units Per Semester			**16**	**32**	

B. Practical Aspect (Lab/Clinical) (if any):

No.	Tasks/ Experiments	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	**None**			
2				
3				
Number of Weeks /and Units Per Semester		**14**	**28**	

C. Tutorial Aspect (if any):

No.	Tutorial	Number of Weeks	Contact Hours	Learning Outcomes (CILOs)
1	None			
2				
3				
Number of Weeks /and Units Per Semester				

VII. Teaching Strategies:

- Lectures,
- Group Discussions,
- Collaborative Assignments
- Role-plays
- Demonstrations
- Problem-based learning
- Tutorials

VII. Assessment Methods:

- Written Exams,
- Quizzes,
- Midterm Exams,
- Assignments
- Oral exams

VII. Assignments:

No.	Assignments	Week Due	Mark	Aligned CILOs (symbols)
1	Algebra and Geometry Assignment	Week 3	2	a1, b1
2	Trigonometry Application Assignment	Week 5	2	b2, c2
3	Calculus in Dosimetry Assignment	Week 7	2	b1, c1
4	Image Analysis Techniques Assignment	Week 9	2	b2, c2

No.	Assignments	Week Due	Mark	Aligned CILOs (symbols)
5	**Statistical Methods Assignment**	Week 11	**2**	a2, d1, d2
Total			**10**	

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment	Aligned Course Learning Outcomes
1	**Quizzes**	Various	10	10%	a1, a2
2	**Midterm Exam**	Week 6	10	10%	b1, b2
3	**Assignments**	Week 3	10	10%	b1, c1, c2, d2
4	**Final Exam**	Week 16	70	70%	a1, a2, b1, b2
Total			**100**	**100 %**	

IX. Learning Resources:

1- Required Textbook(s) (maximum two):

1. Juan Lacay, William Baker, Jarek Stelmark, 2018, Mathematics for Radiologic Technologists: A Primer for Imaging Professionals, Pearson
2. Juan Lacay, William Baker, Dennis D Gibbons, 2009, Mathematics for Allied Health Sciences, 2nd ed, Pearson Custom Publishing

2- Essential References:

1. Charles L. Epstein, 2001-2002, The Mathematics of Medical Imaging, Charles L. Epstein.

3- Electronic Materials and Web Sites etc.:

Electronic Materials and Websites

- Radiopaedia
- Khan Academy – Mathematics

X. Course Policies: (Based on the Uniform Students' By law (2007)

1	**Class Attendance:** Class Attendance is mandatory. A student is considered absent and shall be banned from taking the final exam if his/her absence exceeds 25% of total classes.

2	**Tardiness:** A student will be considered late if he/she is not in class after 10 minutes of the start time of class.
4	**Assignments & Projects:** Assignments and projects must be submitted on time. Students who delay their assignments or projects shall lose the mark allocated for the same.
5	**Cheating:** Cheating is an act of fraud that results in the cancelation of the student's exam or assignment. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply.
6	**Forgery and Impersonation:** Forgery/Impersonation is an act of fraud that results in the cancelation of the student's exam, assignment or project. If it takes place in a final exam, the penalties stipulated for in the Uniform Students' Bylaw (2007) shall apply**.**
7	**Other policies:** The University official regulations in force will be strictly observed and students shall comply with all rules and regulations of the examination set by the Department, Faculty and University Administration.
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الجمهورية اليمنية
وزارة التربية والتعليم والبحث العلمي
جامعة 21 سبتمبر للعلوم الطبية والتطبيقية
كلية التكنولوجيا الطبية

Faculty of Applied Medical Science

Department of Medical Radiology and Imaging Technology

Program of Radiologic Technology and Medical Imaging

Course Plan (Syllabus) of

Radiographic Mathematics

Course Code. .....

I. Information about Faculty Member Responsible for the Course:								
Name of Faculty Member:		**Office Hours**						
Location& Telephone No.:	-----							
E-mail:	--@--.--	SAT	SUN	MON	TUE	WED	THU	

2024/2025

Prepared by:	Reviewed by:	Head of the Department:	Quality Unit:	Dean:
	Dr. -----	Dr. Awadh Al-Kubati	Dr. Mohammed Al-shamahi	Dr. Abdulsalam Dalaq

I. General Information:

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			Lecture	**Tutorial/ Seminar**	**Lab**	**Clinical**
		2	2	--	--	--
15.	**Level/ Semester at which this Course is offered:**	2nd Level / 1st Semester				
16.	**Pre –Requisite (if any):**					
17.	**Co –Requisite (if any):**	None				
18.	**Program (s) in which the Course is Offered:**	Bachelor of Radiologic Technology and Medical Imaging				
19.	**Language of Teaching the Course:**	English				
20.	**Location of Teaching the Course:**	Faculty of Applied Medical Science				
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22.	**Date and Number of Approval by Council:**					

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Upon successful completion of the course, students will be able to:

	A. Knowledge and Understanding:
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a2	Describe the application of algebra and geometry in image analysis.
	B. Intellectual Skills:
b1	Analyze radiographic images using mathematical techniques.
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	C. Professional and Practical kills:
c1	Perform accurate calculations for dosimetry.
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	D. Transferable Skills:
d1	Communicate complex mathematical concepts clearly.
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IV. Course Contents:

A. Theoretical Aspect:

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3	**Advanced Algebra in Radiography**	– Functions, Graphs – Complex Equations, Functions	1	2
4	**Geometry in Imaging**	– Shapes, Angles – 3D Imaging, Volume Calculations	1	2

No.	Units/Topics List	Sub Topics List	Number of Weeks	Contact Hours
5	**Advanced Geometry in Imaging**	– Distances, Area and Volume Calculations	1	2
6	**Trigonometry in Radiology**	– Sine, Cosine, Tangent – Exercises, Practical Use Cases	1	2
7	**Applications of Trigonometry**	– Image Positioning – Exercises, Practical Use Cases	1	2
8	**Mid-Term Exam**	– In all previous Topics	1	2
9	**Basic Calculus in Radiography**	– Derivatives – Derivative and Integral Problems	1	2
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Number of Weeks /and Units Per Semester			**16**	**32**

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No.	Tasks/ Experiments	Number of Weeks	Contact Hours
1	**None**		
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3			
Number of Weeks /and Units Per Semester		**14**	**28**

C. Tutorial Aspect (if any):

No.	Tutorial	Number of Weeks	Contact Hours
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4	Image Analysis Techniques Assignment	Week 9	2

No.	Assignments	Week Due	Mark
5	**Statistical Methods Assignment**	Week 11	2
Total			**10**

VIII. Schedule of Assessment Tasks for Students During the Semester:

No.	Assessment Method	Week Due	Mark	Proportion of Final Assessment
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2	**Midterm Exam**	Week 6	10	10%
3	**Assignment 1**	Week 3	10	10%
4	**Final Exam**	Week 16	70	70%
Total			**100**	**100 %**

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