

1. Course Number and Course Title:

COE49408 – Introduction to Biomedical Imaging

2. Credits and contact hours

3 credit hours, 3 contact hours

3. Prerequisites and/or Co-Requisites:

Prerequisites: PHY 101 and MTH 221 (Linear Algebra).

4. Name and Contact Information of Instructor:

Dr. Salam Dhou

Office: M-329 (Main Building 3rd floor)

E-mail: sdhou@aus.edu

Phone: Ext. 2943, +971 6 515-2943

Office Hours: Posted on office door and on iLearn

5. Course Description (Catalog Description):

Covers medical image processing fundamentals: imaging theory, image characteristics, data acquisition; digital radiography, computed tomography, image formation and reconstruction algorithms, magnetic resonance imaging, ultrasound imaging, and optical imaging.

6. Textbook and other Supplemental Material:

Class Notes

Other supplemental materials

N. B. Smith and A. Webb, Introduction to medical imaging: physics, engineering and clinical applications, Cambridge, 2011.

T. M. Deserno (Editor), Biomedical image processing, Springer-Verlag Berlin Heidelberg, 2012.

7. Learning Outcomes:

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

1. Demonstrate knowledge and understanding of the use of medical imaging.
2. Explain general characteristics of the medical image such as spatial resolution, signal-to-noise ratio, contrast, data acquisition, and artifacts.
3. Describe medical imaging fundamentals such as image formation, filtering, and reconstruction for different medical image applications.
4. Describe and compare the uses of different modalities of medical imaging including computed tomography (CT), magnetic resonance imaging (MRI), ultrasound imaging, and optical imaging.
5. Apply image processing and analysis methods such as registration, feature extraction, and segmentation on phantom and/or real medical images.

8. Teaching and Learning Methodologies:

Methods include lectures, class discussions, and homework.

9. Course Topics and Schedule:

| Topic | Weeks |
|-------------------------------|-----------|
| Introduction | 1 |
| Imaging theory | 0.5 |
| General image characteristics | 1 |
| Data acquisition | 0.5 |
| Image reconstruction | 2 |
| Computed tomography | 3 |
| Medical Image processing | 3 |
| Magnetic resonance imaging | 1 |
| Ultrasound imaging | 1 |
| Optical imaging | 1 |
| Total | 14 |

10. Schedule of Laboratory and other Non-Lecture Sessions:

N/A

11. Out-of-Class Assignments with Due Dates:

| Assignment | Due Date (tentative) |
|--------------|----------------------|
| Homework 1 | Week 3 |
| Homework 2 | Week 6 |
| Homework 3 | Week 10 |
| Team Project | Week 14 |

12. Student Evaluation:

| Assessment | Weight | Due Date (tentative) |
|-----------------|--------|------------------------|
| Quizzes | 10% | Pop quizzes |
| Homework | 20% | At the end of chapters |
| Midterm-Exam-I | 15% | Week 8 |
| Midterm-Exam-II | 15% | Week 12 |
| Team Project | 10% | Week 14 |
| Final Exam | 30% | Week 16 |

13. Contribution of Course to Program Outcomes:

| Program outcome | Emphasis in this course |
|---|-------------------------|
| (1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. | ● |
| (2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. | ● |
| (3) An ability to communicate effectively with a range of audiences. | |
| (4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. | ● |
| (5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. | ● |
| (6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. | ● |

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|---|---|
| (7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies. | ● |
|---|---|

Emphasis: ● High; ● Medium; ○ Low; Blank – Nothing Specific Expected

14. Letter Grade Policy:

| Letter Grade | Total |
|--------------|-----------------|
| A | 93.00% - 100% |
| A- | 90.00% - 92.99% |
| B+ | 87.00% - 89.99% |
| B | 83.00% - 86.99% |
| B- | 80.00% - 82.99% |
| C+ | 77.00% - 79.99% |
| C | 73.00% - 76.99% |
| C- | 68.00% - 72.99% |
| D | 60.00% - 67.99% |
| F | 00.00% - 59.99% |