New Course Request

Check Appropriate Boxes: Undergraduate credit [✓] Graduate credit [ ] Professional credit [ ]

1. School/Division Radiologic Sciences/School of Medicine
2. Academic Subject Code RADI

3. Course Number RADI-R435 (must be cleared with University Enrollment Services)
4. Instructor Golali Naziripour

5. Course Title Ultrasound Physics II
Recommended Abbreviation (Optional) (Limited to 32 Characters including spaces)

6. First time this course is to be offered (Semester/Year): Spring 2011

7. Credit Hours: Fixed at _____ 3 _____ or Variable from _______ to _______

8. Is this course to be graded S-F (only)? Yes [✓] No [ ]

9. Is variable title approval being requested? Yes [ ] No [✓]

10. Course description (not to exceed 50 words) for Bulletin publication:
Continuation of instruction into the physical principles of ultrasound production and image formation including Doppler, and Color Flow methods of imaging.

11. Lecture Contact Hours: Fixed at _____ 3 _____ or Variable from _______ to _______

12. Non-Lecture Contact Hours: Fixed at _______ or Variable from _______ to _______

13. Estimated enrollment: _______ 8 ______ of which _______ 0 ______ percent are expected to be graduate students.

14. Frequency of scheduling: Once per year Will this course be required for majors? Yes

15. Justification for new course: The course is currently under the R438 variable title topics course. The increase in number of credit hours better reflects effort and the amount of time spent in the course.

16. Are the necessary reading materials currently available in the appropriate library? Yes

17. Please append a complete outline of the proposed course, and indicate instructor (if known), textbooks, and other materials.

18. If this course overlaps with existing courses, please explain with which courses it overlaps and whether this overlap is necessary, desirable, or unimportant.

19. A copy of every new course proposal must be submitted to departments, schools, or divisions in which there may be overlap of the new course with existing courses or areas of strong concern, with instructions that they send comments directly to the originating Curriculum Committee. Please append a list of departments, schools, or divisions thus consulted.

Submitted by: [Signature] Date 11/19/09

Department Chairman/Division Director

Dean of Graduate School (when required) Date

Approved by: [Signature] Date 12/10/09

Dean

Chancellor/Vice-President

University Enrollment Services

After School/Division approval, forward the last copy (without attachments) to University Enrollment Services for initial processing, and the remaining four copies and attachments to the Campus Chancellor or Vice-President.

University Enrollment Services Final—White; Chancellor/Vice-President—Blue; School/Division—Yellow; Department/Division—Pink; University Enrollment Services Advance—White
Medical Imaging Technology
Medical Center/Radiology
Indiana University
RADI-R435
Ultrasound Physics II
Three credit hours
Spring Semester 2009

Adjunct Lecturer: Al Naziripour, M.Sc, Ph.D

Lecture: January 12 to February 20
Friday 8:00 a.m. - 9:15 a.m & 9:30 a.m. – 11:00 a.m.

February 20 to May 15
Friday 12:30 p.m. – 1:15 p.m. & 1:30 p.m. to 3:00 p.m.

email: gonaziri@iupui.edu

Phone: (317) 278-2406

Office hours: My "official" office hours - Thursday: 11:00 a.m. to 12:00 p.m.
IUPUI main Library building-Room 7911
"unofficial" office hours: Can be arranged by e-mail

If for some reason the above time does not fit your schedule, please feel free to make
other arrangements with me -- my time is your time!

Class participation

Please read the entire syllabus carefully as you are responsible for all of the requirements
and procedures described herein. You are also responsible for all announcements,
assignments, changes, etc., whether or not you are present in class.

This class is taught interactively and in this respect the student should bring up
their clinical experience and discuss it with the other students and instructor as
these accounts for up to 20 percent of the student's grade.
**Objective:**
Ultrasound II (408) is designed for the junior or the senior Advanced Medical Imaging student. This course will provide an exciting opportunity for the participant to become better acquainted with the physics of ultrasound production and its practical application to sonography. Instrumentation will be linked to the ultrasound machine through experiments on the program’s ultrasound machine. This course was designed with the content outline provided by the American Registry of Diagnostic Medical Sonographers in Physics. Participants will integrate course material with practical aspects of sonography in their clinical experiences. At the conclusion of this course, the Diagnostic Medical Sonography (DMS) student will be better prepared to enter advanced level course work and also be better prepared for clinical rotations.

**Course Goals**

Upon completion of Physics of Ultrasound, the participant will be able to:

1. Discuss different types of transducer with different applications

2. Discuss the generation of Harmonics and different types of resolution

3. Discuss the difference in beam pattern for some of the common transducers used clinically.

4. Describe the reasons for artifact generation and removal of artifact.

5. Be able to explain the parts of the pulse-echo system from sound production to the video image.

6. Discuss the gray scale and its relationship with dynamics range.

7. Discuss the electronics instrumentation

8. Describe Hemodynamic and Doppler Effect

9. Mean time Vascular and Echocardiograms is extensively discussed

10. Registry exam board questions will be discussed at each class

**Learning Resources**

**Required Reading Materials:**

*Textbook*
I. SUGGESTED Other RESOURCES
Additional handouts from the instructor
Review all lectures notes that are stored on Oncourse


Bushburg, JT, Seibert JA, Boone JM The Essential Physics of Medical Imaging 2nd ed. Lippincott Williams & Wilkins Co 2001

Bushong SC. Diagnostic Ultrasound, McGraw-Hill Phing; 1997


ASSESSMENT AND EVALUATION

Each participant is expected to attend all lectures that are provided and to participate in the demonstrations that are provided.

Each participant is expected to inform the instructor about any accommodations that need to be made in order to fulfill course requirements.

Each participant is expected to inform the instructor about any accommodations that need to be made in regards to testing.

Final Grades will be based on the following percentages:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>15%</td>
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<tr>
<td>Quiz</td>
<td>15%</td>
</tr>
<tr>
<td>Class Participation</td>
<td>25%</td>
</tr>
<tr>
<td>Mid-term exams</td>
<td>20%</td>
</tr>
<tr>
<td>Comprehensive Final Exam</td>
<td>25%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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</tbody>
</table>

Extra credit is available time to time

Grading Scale - letter grades will be awarded on the following scale:
We covered in ultrasound Physics I

**Class Etiquette:**
The lecture period is a time for learning. Inappropriate talking, eating, or working on other coursework during the class session is not acceptable. If the instructor notices behavior that is not conducive to the proper functioning of the class, the involved student(s) will be asked to leave. Cell phones must be turned off. Personal pagers must be on vibrating, not audible. Use of laptops with wireless internet connection should be restricted to note taking or searching for course-related information. Inappropriate use of laptops will result in loss of privilege during class session.

I. Elementary Principles:
Principles of waves, longitudinal and transverse wave, Frequency range and their name, Units and parameters of waves, changes of propagation speed with frequency, dependence of propagation speed with media, positive and negative decibel changes

II. Propagation of ultrasound through Tissues:
Two criterias for reflection, normal and oblique reflection, Propagation speed in different media, Snell’s law, IRC and ITC with formulas, secular and non-specular reflectors, contrast media in the body to enhance the image, improvement due to harmonics imaging, factors depends on attenuation, attenuation properties of a high frequency to a low frequency transducer, determination the useful frequency range and how it is determine Image characterization: echogenic, hypoxemic, isochoric, anechoic

III. Diagnostic Ultrasound Transducer:
How a transducer works? Basic Piezoelectric, function of the crystal in transducer, factors determining the frequency of transducer, quality factor and bandwidth (pulse and continues), damping and matching layer, anatomy of sound wave, interference, ways to increase the length of the near zero, resolution by the size and shape of sound waves
array, how an array transducer works, Four ways to overcome shortcoming of the array transducers and to improve image quality, the proper care of transducer.

**IV. Wave and pulse Echo**

Basic principles of waves echoes

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**Ultrasound Physics II**  
**Spring 2009**  
**January 12 to May 15**

<table>
<thead>
<tr>
<th>Week/day</th>
<th>Lesson</th>
<th>Topics</th>
<th>Sections to read</th>
<th>Assignment</th>
<th>Assessment</th>
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<tbody>
<tr>
<td>Week 1</td>
<td></td>
<td>Resolution &amp; Harmonics</td>
<td>Presentation is posted on course Hand out</td>
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<td>January 16</td>
<td>Lesson 1</td>
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<td>Chapters 10, 17 and 20 of text</td>
<td>HW1</td>
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<td>Week 2</td>
<td>Lesson 2</td>
<td>Display Modes, Dynamics imaging and two dimensional Imaging</td>
<td>Chapter 11, 12, 13 Edelman Hand out on course</td>
<td>HW1 due</td>
<td>Quiz 1 preparation</td>
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<td>Text</td>
<td>Two dimensional &amp; Dynamic range</td>
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<td>Week 3</td>
<td>Lesson 3</td>
<td>Real Time Imaging</td>
<td>Chapter 12, 13, 16 Edelman Hand out</td>
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<td>Week 4</td>
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<td>Pulsed Echo Instrument Display and Image</td>
<td>Chapter 14, 15 Edelman Hand out</td>
<td>HW3</td>
<td>Quiz 2</td>
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<td>Lesson 5</td>
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<td>Lesson 1 &amp; 2</td>
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<td>Week 5</td>
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<td>Mid-term</td>
<td>Lesson 1, 2, 3, 4 &amp; 5</td>
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<td>Mid-term</td>
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<td>Week 6</td>
<td>Lesson 6</td>
<td>Display and Image Storage</td>
<td>Chapter 15 Edelman Hand out</td>
<td>HW5</td>
<td>Mid-term Review</td>
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<td>February 27</td>
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<tr>
<td>Week 7</td>
<td>Lesson 7</td>
<td>Vascular Physics Hemodynamics</td>
<td>Chapter 18 Edelman Hand out</td>
<td>HW6</td>
<td>Quiz 3</td>
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**Comprehensive Final on May 08, 2009 from 1:00 to 3:00 p.m.**

**Attention:** The above syllabus is tentative and the instructor has the right to make changes