TEXAS A&M UNIVERSITY-KINGSVILLE

ANNUAL REPORT BY FACULTY MEMBERS

JANUARY 2015 - DECEMBER 2015

This report serves multiple purposes: (1) to bring your personal file up to date, (2) to inform administrative units which otherwise might not know of your activities in several categories, and (3) to provide information for merit pay recommendations. Copies of reports for the relevant years will be assembled in order (4) to provide data supporting request for promotion and (5) to provide data supporting request for tenure.

Please report only activities for the year. All information should be given on this form (continue on the back when necessary). Supporting material should go on into appendices. Failure to follow instructions indicates inefficiency in reporting.

Zhaohui Wang
Name

Visiting Assistant Professor
Rank

Electrical Engineering and Computer Science
Department

Ph.D.
Highest Degree

University of Arizona
Institution Granting Degree

August 2014
Date of Initial Appointment at TAMUK

No
Tenured?  No
Tenure-Track

August 2014
Date of Present Rank

Texas of A&M University - Kingsville
Institution where so Appointed

2015 Annual Report, 1
I. TEACHING EFFECTIVENESS

Present in summary from evidence of your teaching effectiveness. Include supporting data in an appendix. Use such evidence as student evaluations, peer evaluations, syllabi, outlines, A-V aids developed, new courses developed, and improved methods of teaching previous courses.

Answer:

A. In 2015 I taught ten courses with 695 students.
   (1) In Spring 2015, I taught four graduate courses: EEEN 5303-021 T: Studies On Current Research with 11 students, EEEN 5333-001 Principles of VLSI Circuit Design with 84, CSEN 5325-003 Software Engineering with 74, CSEN 5325-005 Software Engineering with 57. [Exhibit- 1(1)]
   (2) In Summer II 2015, I taught three graduate courses: EEEN 5339-001 Embedded System Design with 79, CSEN 5303-008 T: Programming Languages with 77, CSEN 5303-018 T: Programming Languages with 79. [Exhibit- 1(2)]
   (3) In Fall 2015, I taught three graduate courses: EEEN 5321-001 Digital Computer Design with 76, EEEN 5321-002 Digital Computer Design with 80, EEEN 5333-002 Principles of VLSI Circuit Design with 80. [Exhibit- 1(3)]

B. Student evaluation
   In Spring 2015, the average scores are 4.09 (EEEN 5303-021), 3.65 (EEEN 5333-001), 4.03 (CSEN 5325-003), 3.92 (CSEN 5325-005), totally averaged to be 3.92. [Exhibit- 2] These are higher than the scores in Fall 2014: 3.68 (EEEN 5321-001), 3.74 (EEEN 5321-002), 3.74 (EEEN 5333-002), 3.79 (EEEN 5337-002), totally averaged to be 3.74. The reasons are from several strategies I applied to the classes: (1) I took stricter exam policies, the students who cheated in the exam were refused to continue exam and graded zero; (2) the students got more practice in the class to prepare for the exam questions. However there is still one low score 3.65 (EEEN 5333-001). It is caused by the fact that the classroom can only provide 57 seats to 84 students. I have to organize the students into two groups for the exams.
   In Summer 2015, the average scores are 3.74 (EEEN 5339-001), 4.09 (CSEN 5303-008), 3.91 (CSEN 5303-018), totally averaged to be 3.91.[Exhibit- 3] These are close to scores in the Spring 2015, but its lowest score 3.74 is higher. The reason to this score is that I had to teach 6 hours/day from Monday to Thursday every week and I did not have enough time to prepare well the teaching materials of two new courses.
   In Fall 2015, the average scores are 3.96 (EEEN 5321-001), 3.90 (EEEN 5321-002), 3.99 (EEEN 5333-002), totally averaged to be 3.95.[Exhibit- 4] These are extremely higher than the scores (3.74) in Fall 2014. The reason is that I used the homework questions from the previous year as examples in the class, and I let the students practice the similar questions in the homework, so the students felt confident to the exams.

C. Feedback/Comment from the students
   The comments are mostly positive to my teaching.[Exhibit- 2~Exhibit- 4] The student rating of my instruction is pretty good to me. This good standing encourages me to make better performance in the next year.
   In Spring 2015, the complains are all from the course EEEN 5333-001 Principles of VLSI Circuit Design. The problems come from the facts that (1) the classroom can only provide 57 seats to 84 students. I have to organize the students into two groups for the exams; (2) I did not provide enough examples to the
homework questions. All these problems are resolved in Fall 2015.

The reason of improvement in 2015 over 2014 lies in the fact that I tried my best to find the solution of my drawback reflected from the evaluation forms.

(1) In the 2014’s evaluation form, I found the student complain I did not provide enough examples to the students. So I used the 2014’s homework questions as the examples, and modified the parameters in the questions as new questions for homework.
(2) I should not sign any signature to extra students if there is no seat available in the classroom.
(3) I sent exam policies to each student before the exam, and the students who cheated in the exam would be graded zero. [Exhibit- 9(3)]

D. Use of instructional consultant
I learned lots of teaching skills through the training from the university, suggestion from other faculties, and interaction with the students. I discussed the difficulties from the classroom with other faculties in the engineering college and the staffs in the Center for Teaching Effectiveness, and I got a lot of suggestion to handle the cases in the classroom.

(1) In the 2014’s evaluation form, I also found the students complained I did not involve the students well. I checked this question from the university Teaching effectiveness Center. Dr. Karen Sue Bradley suggest me pause 10minutes after 20 minutes’ teaching. During this pause, I can interact with students by questioning the content I just teach in previous 20 minutes.
(2) I continued enhancing my teaching skills and research ability from the weekly training of teaching effectiveness.

E. Syllabi
I updated the syllabi according to the instruction from the university and senior professors.

(1) To resolve the problem of late attendance, Dr. Karen Sue Bradley suggest me to apply quiz at the beginning of each class. I add one sentence to the syllabi, “Assessment activity will start at the beginning of the class.”
(2) To prevent any cheating in the exams, I add another one sentence to the syllabi, “It is the policy of the TAMUK College of Engineering that no electronic devices are permitted in course examinations without the permission of the instructor.”
(3) According the specific feature of the course EEEN 5303-021 T- Studies On Current Research, I designed research strategies to initiate the students’ research abilities. [Exhibit- 9(1)]

F. New courses developed
(1) In Fall 2015, I submitted one new undergraduate-level course proposal, EEEN 4336 Selected Topics in Electrical Engineering: Medical Imaging Principles, to the Department of Electrical Engineering and Computer Science, and it passed the evaluation. [Exhibit- 5(1)]
(2) In Fall 2015, I submitted one new graduate-level course proposal, EEEN 5303 Advanced Topics in Electrical Engineering: Medical Imaging [Exhibit- 5(2)], to the Department. It is still under review.

G. Improved methods of teaching previous courses are provided as follows.
My teaching skills and ability was cultivated from this interaction with other faculties, and become mature and more effective. The student’s evaluation to my initial teaching experience is pretty good.

(1) I built and updated the ppt file to prepare class notes and presented it in the class.
(2) I used Projector and laser pointer to present slides in the class.

2015 Annual Report, 3
(3) I uploaded the prepared notes and book excerpts to the Blackboard, so that the students can use them to prepare for homework and exams.

(4) I organized the students into small groups, about 5-6 students, to do projects.

(5) I used on-line submission to project report for reference to final grading.

(6) To avoid cheating in the exam, I assign seat to each student according their first name or previous score on the exam day. I monitor exam strictly. Anyone who was using cell phone in the exam will be stopped continuing the exam.

(7) I am always in the office in the office hours, so that the students can check office and ask me directly.

H. Use of on-campus technology centers and programs to support integration of new technology into teaching

1) I used Blackboard and iTech to support integration of new technology into teaching.
2) I uploaded the course material to the Blackboard so that the students can get help in time.
3) I used Turnitin and Rubric tools to help me grade the project reports.
4) In Fall 2015, I found there is no computer in the classroom BUSA 227, so I contacted iTech to install one computer in BUSA 227.
5) In Spring 2015, I found the project cannot work in classroom INDT 108, so I contacted iTech to change the projector, but they did not fix it. I carried my own projector to the classroom to continue my teaching.

I. Direction of dissertations and theses

1) In Spring 2015, in the course “EEEN 5303-02 T:Studies on Current Research”, I helped 11 students on the research on multiple topics to finish their graduation plan with course option.
2) In Spring 2015, I also advised two theses students on the research of Ultrasound Current Source Density Imaging and High Frame Rate Imaging.
II. SCHOLARLY AND ARTISTIC ENDEAVORS

List articles, monographs, books, book reviews, presentations to professional and learned societies, and creative and artistic endeavors. Submit a copy of each publication and reviews (if available). Any research in progress that is listed must have documentation to indicate the extent of the progress during this reporting period.

Answer:

A. Publications

(1) In 2015, I finished revision of one paper that is still under review: Zhaohui Wang, Rajab Challoo, Weida Hao, Chung S. Leung, and Russell S. Witte, “Complementary detection of multiple electrical sources in tissue using acoustoelectric effect,” Ultrasound in Medicine and Biology.[Exhibit- 6(1)-2] From its review evaluation, it will be accepted soon. [Exhibit- 6(1)-1]

(2) In 2015, I submitted one paper, “Polarity Detection in Ultrasound Current Source Density Imaging”, to the SPIE Medical Imaging Conference 2016. [Exhibit- 6(2)]

(3) In 2015, I submitted the other one paper, “A Study of Doppler Algorithms in Fourier Imaging Method”, to the SPIE Medical Imaging Conference 2016. [Exhibit- 6(3)]

B. Grant application

(1) In Fall 2015, I submitted one proposal of a service learning course, “Medical Imaging”, to the college. [Exhibit- 7(1)]

(2) In Fall 2015, I submitted Funding Support Request to the Department of Electrical Engineering and Computer Science. The department will provide me support about $3K~4K. [Exhibit- 7(2)]

(3) In 2015, I prepared one proposal for NSF support on medical imaging: Prepared proposal: “2D-array Opto-acousto-electric Transducer for Real-time 3D Photoacoustic Imaging.” [Exhibit- 7(3)]

(4) In 2015, I prepared one proposal for NSF support: “Ultrasound Current Source Density and Elasticity Imaging: A New Modality to Noninvasively Map Cardiac Arrhythmia in Heart Patients.” [Exhibit- 7(4)]

C. Reviewed journal papers

In 2015, I reviewed 4 papers for several journals: two is for Applied Physics Letters and the other two for Journal of Ultrasound in Medicine.

(1) Journal of Ultrasound in Medicine, MS # 14-11044 - Version 1, “Research on effect of ultrasound/SonoVue microbubble on CD4+CD25+ regulatory T cells viability and optimized parameters for its transfection.” [Exhibit- 8(1)]

(2) Journal of Ultrasound in Medicine, MS # 14-12081 - Version 1, “Evaluation of Correlation between Carotid Artery Elasticity and Intima-media Thickness in Patients with Uremia by Echo Tracking.” [Exhibit- 8(2)]


III. PROFESSIONAL GROWTH AND ACTIVITIES

List information in the following order:
1. Membership in professional organizations, including offices held during year;
2. Attendance at professional meetings (in an appendix attach dates of meetings, list of sessions attended, and other professional activities engaged in at meetings);
3. Professional consultationships and lectures (include supporting data);
4. Professional honors received;
5. Continuing professional education (status of doctorate if not conferred; post graduate or post-doctoral work at a university; training received in workshops and non-university courses).

Answer:

1. Membership in professional organizations, including offices held during year;
   (1) 2016 Chair-elect of American Chemical Society South Texas Local Section
   (2) Member of American Chemical Society
   (3) Member of Institute of Electrical and Electronics Engineers (IEEE)
   (4) Member of IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society
   (5) Member of Biomed Committee at Texas A&M University - Kingsville

2. Attendance at professional meetings
   (1) On April 15, 2015, I served as a judge for the 6th Annual Javelina Research Symposium.
   (2) On April 16, 2015, I served as a judge for Graduate Students’ Research Poster Competition.
   (3) On May 1, 2015, I served as a judge for TAMUK College of Engineering Annual Engineering Senior Design Conference.

3. Professional consultationships and lectures
   A. Professional consulting.
      (1) I am a committee member of Master of Mechatronics program. I took part in its discussion in the ABET retreat meeting to contribute my suggestion and knowledge on Dec. 3, 2015.
      (2) On Feb. 25, 2015, I prepared the description of student advising to the UG EE handbook committee. [Exhibit-9(2)]
      (3) In Spring 2015, I provided advice on research to eleven graduate students with course option (EEEN5303-021).
      (4) In Spring 2015, I provided advice on research to two graduate students with thesis option (EEEN5306-001).
   B. I was a committee member to Master thesis students.
   C. I was a judge to the Graduate Project Poster Conference.
      (1) Dec. 2, 2015, I evaluated one poster.
      (2) May 6, 2015, I evaluated more than three posters.

D. Professional lectures

2015 Annual Report, 6
(1) On Feb. 26, 2015, I attended the EWeek activity, and I used automatic presentation to show my Biophysics Research to the high-school students.

4. Professional honors received
(1) I was elected as 2016 Chair-elect of American Chemical Society South Texas Local Section in Fall 2015, and will take the position of Chair of American Chemical Society South Texas Local Section in 2017.

5. Continuing professional education
A. Professional training from the College of Engineering.
   (1) On Sep. 22, 2015, 9-11am, I attended the meeting that was held by the Dean for all faculty hired “last year and this year”.
   (2) Aug. 12-13, 2015, I attended “Teaching Effectiveness Workshop” presented by Dr. Rebecca Brent

B. I took part in the New Faculty Training Program in 2015.
   (1) Aug. 28, 2015, “Welcome and overview of the NFIP”, Dr. Brenda Melendy, Dr. Jaya Goswami
   (2) Sep. 4, 2015, “Office of Sponsored Research and Programs (OSRP) presentations, including SPIN accounts”
   (3) Sep. 11, 2015, “OSRP presentations”
   (4) Sep. 18, 2015, “Including Students in Research: Honors College and McNair Scholars Program”
   (5) Sep. 25, 2015, “QEP, Writing Intensive courses, and the Undergraduate Writing Center”
   (6) Oct. 2, 2015, “Transculturation and International Programs”
   (7) Oct. 9, 2015, “Crafting the annual report and Promotion &Tenure portfolio: Faculty meet with their respective Deans, Associate Deans, or Assistant Deans”
   (8) Oct. 16, 2015, “Best Practices in Distance Learning: Flipping the Classroom”
   (10) Oct. 30, 2015, “AVID and active learning strategies”
   (11) Nov. 6, 2015, “Compliance Office and Title IX”
   (12) Nov. 13, 2015, “Library Resources”
   (13) Nov. 20, 2015, “Last meeting of the semester. Triad debriefings”

C. I attended Spring 2015 Monday Noon Seminars to improve my teaching skills.
   (2) Feb. 02, 2015, “How Should I Coach an Underperforming Colleague?”
   (3) Feb. 09, 2015, “How Can I Minimize Cheating in the Classroom?”
   (4) Feb. 16, 2015, “How Do I Convert a F2F Class to a Hybrid Course?”
   (5) Feb. 23, 2015, “How Do I Use FLCs to Strengthen Institutional Assessment?”
   (6) Mar. 02, 2015, “How Do I Develop a High-Impact Capstone Course?”
   (8) Mar. 23, 2015, “I’m Teaching Online Next Term. What Do I Have to Know?”
   (10) Apr. 6, 2015, “How Can I Use Student Feedback to Improve My Teaching?”
   (11) Apr. 13, 2015, “How Can I Incorporate a Group Poster Session into My Class?”
   (12) Apr. 20, 2015, “What Should I Do When a Student Challenges My Authority?”

D. I attended several seminars.
E. I attended several workshops.

1. Mar. 25, 2015, “Flip” Your Classroom”, by Dr. Marybeth Green
4. Oct. 7, 2015, I attended “TPI Professional development opportunities” for Certification of Professional Development in Distance Education and Instructional Technology.
7. Nov. 20, 2015, “Proposal Writing Workshop”, by Dr. S. Ozcelik
IV. NON-TEACHING ACTIVITIES SUPPORTIVE OF UNIVERSITY PROGRAMS

List information in the following order:
1. Significant committee and administrative assignments on campus (indicate number of meetings and hours of work during reporting period);
2. Sponsorship of student organizations (indicate number of meetings and hours of work during reporting period);
3. Recruitment activities; student advisement; degree planning;
4. Acquisition and development of facilities; program and curriculum development;
5. Attendance at and support of general University functions;
6. Other service supportive of the University.

Answer:

1. Significant committee and administrative assignments on campus (indicate number of meetings and hours of work during reporting period)
A. I am a member of Biomed Committee at Texas A&M University - Kingsville.
   (1) On Jan. 29, 2015, I attended the Biotech committee meeting in the Howe conference room.
   (2) On Sep. 4, 2015, I attended the Biotech committee meeting in the Howe conference room.
   (3) On Nov. 13, 2015, I attended the Biotech committee meeting in the Howe conference room.

B. I have an Affiliate Associate Membership on the Graduate Faculty, and I am a committee member to
   Master thesis students.
      Programming”, Nahid Rahman, Chair: Young Lee.
      Dojo”, student: Dhanunjaya Maripalli, Chair: Young Lee.

C. I am a member of American Chemical Society.
   (1) In 2015, I was elected as 2016 Chair-elect of American Chemical Society South Texas Local
      Section.

3. Recruitment activities; student advisement; degree planning;
A. In 2015, I continued taking the position of Graduate Coordinator to help graduate students registering
   courses.
   (1) From 01/05/2015 to 01/20/2015, when other graduate coordinators were still in vacation, I
      provided advisement to new students of Spring 2015.
   (2) In June 2015, I carried recruitment advertisements to the Center of Chinese Study Abroad in
      Hefei, Anhui, China.
   (3) From Jan. 13 to Jan. 15, 2015, from 9:30 am to 4:30 pm, I advised Graduate Student
      Advising in Memorial Student Union Building to help graduate students for course registration.

4. Acquisition and development of facilities; program and curriculum development;
A. I am a committee member of MS Programs in Mechatronics.
   (1) On Dec. 3, 2015, I took part in its committee discussion to contribute my suggestion and
      knowledge in the ABET retreat meeting.

B. In Spring 2015, in the course “EEEN 5303-021 T:Studies on Current Research”, I helped 11 students
on the research on multiple topics to finish their graduation plan with course option. According the specific feature of the course EEEN 5303-021 T- Studies On Current Research, I designed research strategies to initiate the students’ research abilities. [Exhibit- 9(1)]

5. Attendance at and support of general University functions;
A. I attended a few activities to support general university functions.
   (1) On Jan. 16, 2015, I attended the Spring General Faculty Meeting held in the Peacock Auditorium (BESB 100).
   (2) On Jan. 30, 2015, I attended the Metacognition in the Classroom, Javelina Dining Hall, Room 200.
   (3) On Feb. 05, 2015, I attended the Graduate Coordinator Meeting in the Founders Room
   (4) On 02/26/2015, I attended the Eweek Challenge activity. I used automatic presentation to show my Biophysics Research to the high-school students.

B. I attended all Departmental Meetings.
   (1) Mar. 31, 2015, I attended department meeting.
   (2) May 7, 2015, I attended departmental meeting and ABET retreat.
   (3) Aug. 25, 2015, I attended EECS Department Meeting in Deans Conf Room EC 302.
   (4) Sep. 29, 2015, I attended EECS Department Meeting.
   (5) Oct. 27, 2015, I attended EECS Department Meeting.

C. I attended several ABET activities.
   (1) May 7, 2015, ABET retreat for Spring 2015.
   (2) Nov. 8, 2015, I provided my support to the “ABET visiting”.
   (3) Dec. 3, 2015, ABET retreat for Fall 2015.

6. Other service supportive of the University.
I attended several meetings to support the college and university.
   (1) Sep. 23, 2015, “Center for Teaching Effectiveness Open House”
   (2) Aug. 20, 2015, “Opening 2015-16 Faculty/Staff Meeting”
   (3) Aug. 28, 2015, 5:30-7pm, nix home
   (4) Sep. 15, 2015, 5-6pm, “Fall 2015 Annual Picnic”, provided food service to students.
   (5) On Apr. 10, 2015, I attended EE undergraduate program advisory board meeting The meeting is scheduled in the Dean's conference room
   (6) Oct. 29, 2015, “EE Undergraduate Advising Training” with Dr. Bailey in EC 302
   (7) Oct. 30, 2015, “New faculty advisor training” in EC 104
   (8) Nov. 4, 2015, “College Faculty meeting” in EC109.
Exhibit- 1: Course enrollment
(1) Enrollment of the courses I taught in Spring 2015.
(2) Enrollment of the courses I taught in Summer 2015.
(3) Enrollment of the courses I taught in Fall 2015.

Exhibit- 2: Student evaluation of courses I taught in Spring 2015
(1) EEEN 5303-021 T: Studies on Current Research.
(2) EEEN 5333-001 Principles of VLSI Circuit Design.
(3) CSEN 5325-003 Software Engineering
(4) CSEN 5325-005 Software Engineering

Exhibit- 3: Student evaluation of courses I taught in Summer 2015
(1) EEEN 5339-001 Embedded System Design
(2) CSEN 5303-008 T: Programming Languages
(3) CSEN 5303-018 T: Programming Languages

Exhibit- 4: Student evaluation of courses I taught in Fall 2015
(1) EEEN 5321-001 Digital Computer Design.
(2) EEEN 5321-002 Digital Computer Design.
(3) EEEN 5333-002 Principles of VLSI Circuit Design.

Exhibit- 5: New course proposals submitted to the Department of Electrical Engineering and Computer Science
(1) EEEN 4336 SELECTED TOPICS IN ELECTRICAL ENGINEERING-Section 00X– Medical Imaging Principles
(2) EEEN 5303 Advanced Topics in Electrical Engineering: Medical Imaging Principles and Applications

Exhibit- 6: Publication in 2015

Exhibit- 7: List of grant application
(1) Service Learning Course in Spring and Summer 2016: CSEN 5325-003/005 Software Engineering for Medical Imaging
(2) Funding support request to the department of Electrical Engineering and Computer Science

Exhibit- 8: I reviewed 4 papers for several journals.
(1) Journal of Ultrasound in Medicine, MS # 14-11044 - Version 1 Research on effect of ultrasound/SonoVue microbubble on CD4+CD25+ regulatory T cells viability and optimized parameters for its transfection

(2) Journal of Ultrasound in Medicine, MS # 14-12081 - Version 1 Evaluation of Correlation between Carotid Artery Elasticity and Intima-media Thickness in Patients with Uremia by Echo Tracking


Exhibit- 9: Contribution to updated syllabi or handbooks

(1) Spring 2015 EEEN5303-021 T- Studies On Current Research
(2) Description of graduate student advising to the UG EE handbook committee
(3) Exam policies I sent to the students’ email
### TEACHER LOAD REPORT
Provost and Vice President for Academic Affairs

Semester or Term: **SPRING 2015**

**Faculty Name:** Wang, Zhaohui  
**K#:** K00352558  
**Department:** Electrical Engineering & Computer Science

**Title:** Visiting Assistant Professor  
**PIN NO:** J03449

#### ORGANIZED COURSES

<table>
<thead>
<tr>
<th>Course</th>
<th>Sect</th>
<th>Sem Hrs</th>
<th>Lect Hrs p/w</th>
<th>No of Stud</th>
<th>Course</th>
<th>Sect</th>
<th>Sem Hrs</th>
<th>No of Stud</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSEN 5325</td>
<td>003</td>
<td>3</td>
<td>3</td>
<td>74</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRN 20285</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CRN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CSEN 5325</td>
<td>005</td>
<td>3</td>
<td>3</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRN 20287</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CRN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EEEN 5333</td>
<td>001</td>
<td>3</td>
<td>3</td>
<td>84</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRN 20359</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CRN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EEEN 5303</td>
<td>021</td>
<td>3</td>
<td>3</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRN 22647</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CRN</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### LABS TAUGHT

<table>
<thead>
<tr>
<th>Course</th>
<th>Sect</th>
<th>Sem Hrs</th>
<th>Clock Hrs p/w</th>
<th>No of Stud</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### LABS/RECITATIONS SUPERVISED

<table>
<thead>
<tr>
<th>Course and CRN</th>
<th>No of Sections</th>
<th>Clock Hrs p/w</th>
<th>No of Studs</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### APPLIED MUSIC

<table>
<thead>
<tr>
<th>Course and CRN</th>
<th>No of Sections</th>
<th>Clock Hrs p/w</th>
<th>No of Studs</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### SUPERV STUDENT TEACH

<table>
<thead>
<tr>
<th>Course and CRN</th>
<th>No of Sections</th>
<th>Clock Hrs p/w</th>
<th>No of Studs</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### COMPOSITE COURSES **

<table>
<thead>
<tr>
<th>Course and CRN</th>
<th>No of Sections</th>
<th>Clock Hrs p/w</th>
<th>No of Studs</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### RELEASE TIME

<table>
<thead>
<tr>
<th>Course and CRN</th>
<th>No of Sections</th>
<th>Clock Hrs p/w</th>
<th>No of Studs</th>
<th>Semester Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Only if lab carried semester hour credit  ** In addition to listing above

**ASSURANCE STATEMENT:** We certify that this faculty member's academic credentials meet all SACS requirements.

Signature of Faculty Member:  
Signature of Chair:  
Signature of Dean:  
Date:

**FOR OFFICE USE:** PLEASE DO NOT WRITE BELOW THIS LINE

Revised; Explanation  
Person Authorizing Change:

### CLOCK HOURS

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Labs Taught</th>
<th>Lab Supervision</th>
<th>App Mus</th>
<th>Lecture</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### LOAD COMPUTATION

<table>
<thead>
<tr>
<th>Total Semester Hours</th>
<th>Total Students</th>
<th>Total Load</th>
<th>Reassigned Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Semester Hours - I.I.  
Percent Effort (appointment 01 and 02 - CBM 008)  
Exhibit-1(1)  
Provost 3-06
Faculty Name: **Wang, Zhaohui**  
K#: **K00352558**  
Department: **Electrical Engineering & Computer Science**  
Title: **Visiting Assistant Professor**  
PIN NO: **J03449**

### ORGANIZED COURSES

<table>
<thead>
<tr>
<th>Course</th>
<th>Sect</th>
<th>Sem Hrs</th>
<th>Lect Hrs</th>
<th>No of Stud</th>
<th>Course</th>
<th>Sect</th>
<th>Sem Hrs</th>
<th>No of Stud</th>
<th>Course</th>
<th>Sect</th>
<th>Sem Hrs</th>
<th>No of Stud</th>
<th>Course</th>
<th>Sect</th>
<th>Sem Hrs</th>
<th>No of Stud</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSEN 5303</td>
<td>008</td>
<td>3</td>
<td>3</td>
<td>77</td>
<td>CRN 40806</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN 40967</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN 40453</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
</tr>
<tr>
<td>CRN 4053</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td>CRN</td>
<td></td>
</tr>
</tbody>
</table>

### LABS/RECITATIONS SUPERVISED

<table>
<thead>
<tr>
<th>Course and CRN</th>
<th>No of Sections</th>
<th>Clock Hrs p/w</th>
<th>No of Studs</th>
<th>Semester Hours</th>
<th>Course and CRN</th>
<th>Sem Hrs</th>
<th>Number of Students</th>
<th>Crs and CRN</th>
<th>Crs and CRN</th>
<th>Total Number of Students</th>
<th>Total Number of Hours Released</th>
</tr>
</thead>
</table>

*Only if lab carried semester hour credit  **In addition to listing above

### ASSURANCE STATEMENT:

We certify that this faculty member’s academic credentials meet all SACS requirements.

Signature of Faculty Member:  
Signature of Chair  
Signature of Dean:  
Date:

FOR OFFICE USE: PLEASE DO NOT WRITE BELOW THIS LINE

Revised; Explanation  
Person Authorizing Change:

### CLOCK HOURS

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Labs Taught</th>
<th>Lab Supervision</th>
<th>App Mus</th>
<th>Lecture</th>
<th>Labs Taught</th>
<th>Labs Supervised</th>
<th>Applied Music</th>
<th>Student Teachers</th>
</tr>
</thead>
</table>

Semester Hours - I.I.  
Total Semester Hours  
Total Students  
Total Load  
Percent Effort (appointment 01 and 02 – CBM 008)  
Exhibit-1(2)  
Reassigned Time  
Provost 3-06
## TEACHER LOAD REPORT

**Provost and Vice President for Academic Affairs**  
**Semester or Term:** FALL 2015

### Faculty Name: Wang, Zhaohui
**K#:** K00352558  
**Department:** Electrical Engineering & Computer Science

### PIN NO: J03449

### Title: Visiting Assistant Professor

<table>
<thead>
<tr>
<th>Course</th>
<th>Sect</th>
<th>Sem Hrs</th>
<th>Lect Hrs p/w</th>
<th>No of Stud</th>
<th>Course</th>
<th>Sect</th>
<th>Sem Hrs</th>
<th>No of Stud</th>
<th>Course</th>
<th>Sect</th>
<th>Sem Hrs</th>
<th>No of Stud</th>
<th>Course</th>
<th>Sect</th>
<th>Sem Hrs</th>
<th>No of Stud</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEN 5321</td>
<td>001</td>
<td>3</td>
<td>3</td>
<td>76</td>
<td>CRN</td>
<td>CRN</td>
<td></td>
<td></td>
<td>CRN</td>
<td>CRN</td>
<td></td>
<td></td>
<td>CRN</td>
<td>CRN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRN 12310</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EEN 5321</td>
<td>002</td>
<td>3</td>
<td>3</td>
<td>80</td>
<td>CRN</td>
<td>CRN</td>
<td></td>
<td></td>
<td>CRN</td>
<td>CRN</td>
<td></td>
<td></td>
<td>CRN</td>
<td>CRN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRN 12310</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EEN 5333</td>
<td>002</td>
<td>3</td>
<td>3</td>
<td>78</td>
<td>CRN</td>
<td>CRN</td>
<td></td>
<td></td>
<td>CRN</td>
<td>CRN</td>
<td></td>
<td></td>
<td>CRN</td>
<td>CRN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRN 12316</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### LABS/RECICTIONS SUPERVISED

<table>
<thead>
<tr>
<th>Course and CRN</th>
<th>No of Sections</th>
<th>Clock Hrs p/w</th>
<th>No of Studs</th>
<th>Semester Hours</th>
<th>Course and CRN</th>
<th>Sem Hrs</th>
<th>Number of Students</th>
<th>Crs and CRN</th>
<th>Crs and CRN</th>
<th>Total Number of Students</th>
<th>Total Number of Hours Released</th>
</tr>
</thead>
</table>

*Only if lab carried semester hour credit  
**In addition to listing above*

### ASSURANCE STATEMENT: We certify that this faculty member's academic credentials meet all SACS requirements.

Signature of Faculty Member: ___________________________  
Signature of Chair: ___________________________  
Signature of Dean: ___________________________  
Date: ___________________________

**FOR OFFICE USE:** PLEASE DO NOT WRITE BELOW THIS LINE  
Revised; Explanation: ___________________________  
Person Authorizing Change: ___________________________

### CLOCK HOURS

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Labs Taught</th>
<th>Lab Supervision</th>
<th>App Mus</th>
<th>Lecture</th>
<th>Labs Taught</th>
<th>Labs Supervised</th>
<th>Applied Music</th>
<th>Student Teachers</th>
</tr>
</thead>
</table>

### LOAD COMPUTATION

<table>
<thead>
<tr>
<th>Semester Hours - I.I.</th>
<th>Total Semester Hours</th>
<th>Total Students</th>
<th>Total Load</th>
<th>Reassigned Time</th>
</tr>
</thead>
</table>

| Percent Effort (appointment 01 and 02 - CBM 008) | Exhibit-1(3) |

**Provost 3-06**
Course Evaluation Results for: EEEN 5303 021 - Zhaohui Wang

TAMUK OIR <koir2000@tamuk.edu>

Tue 5/26/2015 2:35 PM

To: Zhaohui Wang <Zhaohui.Wang@tamuk.edu>;

Course Evaluation Report

Dear Faculty Member,

The Student Rating of Instruction system is now closed. The final results for your class are shown below: NOTE: It has come to our attention that these results play an important part in yearly evaluations; therefore, we recommend that these final email results be kept in a safe place. Once the semester closes and final emails are sent out, it becomes difficult to pull them off the program we are using.

<table>
<thead>
<tr>
<th>Term</th>
<th>Division Department</th>
<th>Course ID</th>
<th>Course</th>
<th>Description</th>
<th>Professor</th>
<th>Evaluations Taken</th>
<th>Total Enrollment Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>201520 EN</td>
<td>EECS</td>
<td>EEEN 5303 021 22647</td>
<td>T:Studies on Current Research Zhaohui Wang</td>
<td>11</td>
<td>11</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

The Course Avg will be green if over 10% of the Course Mean, and red if less than 10% of the Course Mean.

Instructor & Course Questions

<table>
<thead>
<tr>
<th>Description</th>
<th>Total</th>
<th>Strongly Agree(%</th>
<th>Agree(%)</th>
<th>Neutral(%)</th>
<th>Disagree(%)</th>
<th>Strongly Disagree</th>
<th>N/A(%)</th>
<th>Std Dev</th>
<th>Instr Overall Mean</th>
<th>Course Mean</th>
<th>Dept Mean</th>
<th>Div Mean</th>
<th>Univ Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considerate of the students during class</td>
<td>11</td>
<td>45</td>
<td>55</td>
<td>4.45</td>
<td>0.50</td>
<td>4.45</td>
<td>4.10</td>
<td>4.57</td>
<td>4.53</td>
<td>4.49</td>
<td>4.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presents the subject matter in a clear and organized manner</td>
<td>11</td>
<td>27</td>
<td>64</td>
<td>9</td>
<td>4.09</td>
<td>0.79</td>
<td>4.09</td>
<td>3.88</td>
<td>4.47</td>
<td>4.44</td>
<td>4.37</td>
<td>4.41</td>
<td></td>
</tr>
<tr>
<td>Tests and other requirements cover the course description in the syllabus</td>
<td>11</td>
<td>36</td>
<td>45</td>
<td>9</td>
<td>4.09</td>
<td>0.90</td>
<td>4.09</td>
<td>4.25</td>
<td>4.49</td>
<td>4.51</td>
<td>4.48</td>
<td>4.52</td>
<td></td>
</tr>
<tr>
<td>Sets high academic standards</td>
<td>11</td>
<td>36</td>
<td>36</td>
<td>27</td>
<td>4.09</td>
<td>0.79</td>
<td>4.09</td>
<td>3.89</td>
<td>4.44</td>
<td>4.44</td>
<td>4.45</td>
<td>4.49</td>
<td></td>
</tr>
<tr>
<td>Follows the grading system outlined in the syllabus</td>
<td>11</td>
<td>36</td>
<td>55</td>
<td>9</td>
<td>4.27</td>
<td>0.62</td>
<td>4.27</td>
<td>4.24</td>
<td>4.48</td>
<td>4.47</td>
<td>4.46</td>
<td>4.52</td>
<td></td>
</tr>
<tr>
<td>Available during office hours</td>
<td>11</td>
<td>64</td>
<td>36</td>
<td>4.64</td>
<td>0.48</td>
<td>4.64</td>
<td>4.42</td>
<td>4.46</td>
<td>4.51</td>
<td>4.47</td>
<td>4.49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lectures focus on the material outlined in the syllabus</td>
<td>11</td>
<td>55</td>
<td>45</td>
<td>4.55</td>
<td>0.50</td>
<td>4.55</td>
<td>4.21</td>
<td>4.46</td>
<td>4.46</td>
<td>4.45</td>
<td>4.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Results are returned in a reasonable amount of time</td>
<td>10</td>
<td>50</td>
<td>40</td>
<td>10</td>
<td>4.40</td>
<td>0.66</td>
<td>4.40</td>
<td>4.17</td>
<td>4.40</td>
<td>4.44</td>
<td>4.41</td>
<td>4.47</td>
<td></td>
</tr>
<tr>
<td>Textbook support the course objectives</td>
<td>11</td>
<td>45</td>
<td>45</td>
<td>9</td>
<td>4.36</td>
<td>0.64</td>
<td>4.36</td>
<td>4.26</td>
<td>4.46</td>
<td>4.42</td>
<td>4.43</td>
<td>4.48</td>
<td></td>
</tr>
</tbody>
</table>

Exhibit-2(1)
Takes time to answer questions 11 18 18 27 27 9 3.09 1.24 3.09 3.22 3.00 3.42 3.88 4.30
Attempts to involve students in class discussions/activities 11 36 45 18 4.18 0.72 4.18 3.70 4.44 4.37 4.38 4.47
Required high quality work 11 36 36 27 4.09 0.79 4.09 3.33 3.38 3.66 4.05 4.34
Communicates the importance of the subject matter 11 36 55 9 4.27 0.62 4.27 3.88 4.47 4.43 4.43 4.48
Cannot be reached during posted office hours 11 18 9 18 27 27 2.64 1.43 2.64 2.47 2.55 2.45 2.46 2.45
Uses examples to help students understand 11 27 64 9 4.18 0.57 4.18 3.76 4.45 4.41 4.41 4.47

Additional Questions

<table>
<thead>
<tr>
<th>Description</th>
<th>Response Total</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of effort required to succeed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Same</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Grade that I expect in this class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Reason for taking this course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Views on the quality of the instruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ntg</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

You may reply to this e-mail with any questions or concerns about the system. Thank you!
Course Evaluation Results for: EEEN 5333 001 - Zhaohui Wang

TAMUK OIR <koir2000@tamuk.edu>

Tue 5/26/2015 2:16 PM

To: Zhaohui Wang <Zhaohui.Wang@tamuk.edu>;

Course Evaluation Report

Dear Faculty Member,

The Student Rating of Instruction system is now closed. The final results for your class are shown below: NOTE: It has come to our attention that these results play an important part in yearly evaluations; therefore, we recommend that these final email results be kept in a safe place. Once the semester closes and final emails are sent out, it becomes difficult to pull them off the program we are using.

<table>
<thead>
<tr>
<th>Term</th>
<th>Division</th>
<th>Department</th>
<th>Course ID</th>
<th>Course Description</th>
<th>Professor</th>
<th>Evaluations Taken</th>
<th>Total Enrollment</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>201520</td>
<td>EN</td>
<td>EECS</td>
<td>EEEN 5333 001 20359</td>
<td>Prin of VLSI Circuit Design Zhaohui Wang</td>
<td>85</td>
<td>85</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

The Course Avg will be green if over 10% of the Course Mean, and red if less than 10% of the Course Mean.

<table>
<thead>
<tr>
<th>Instructor &amp; Course Questions</th>
<th>Strongly Agree Total</th>
<th>Strongly Disagree N/A (%)</th>
<th>Strongly Agree Mean</th>
<th>Strongly Disagree Mean</th>
<th>N/A Mean</th>
<th>Std Dev</th>
<th>Instr Overall Mean</th>
<th>Dept Mean</th>
<th>Div Mean</th>
<th>Univ Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptions</td>
<td>Total Agree (%)</td>
<td>Total Neutral (%)</td>
<td>Total Disagree (%)</td>
<td>Strongly Agree (%)</td>
<td>Agree (%)</td>
<td>Neutral (%)</td>
<td>Disagree (%)</td>
<td>Strongly Agree (%)</td>
<td>N/A (%)</td>
<td>Std Dev</td>
</tr>
<tr>
<td>Considerate of the students during class</td>
<td>85</td>
<td>28</td>
<td>35</td>
<td>26</td>
<td>6</td>
<td>5</td>
<td>3.76</td>
<td>1.07</td>
<td>3.76</td>
<td>4.10</td>
</tr>
<tr>
<td>Presents the subject matter in a clear and organized manner</td>
<td>85</td>
<td>22</td>
<td>36</td>
<td>20</td>
<td>13</td>
<td>8</td>
<td>3.52</td>
<td>1.20</td>
<td>3.52</td>
<td>3.88</td>
</tr>
<tr>
<td>Tests and other requirements cover the course description in the syllabus</td>
<td>85</td>
<td>33</td>
<td>42</td>
<td>14</td>
<td>8</td>
<td>2</td>
<td>3.95</td>
<td>1.00</td>
<td>3.95</td>
<td>4.25</td>
</tr>
<tr>
<td>Sets high academic standards</td>
<td>85</td>
<td>25</td>
<td>33</td>
<td>26</td>
<td>11</td>
<td>6</td>
<td>3.60</td>
<td>1.14</td>
<td>3.60</td>
<td>3.89</td>
</tr>
<tr>
<td>Follows the grading system outlined in the syllabus</td>
<td>85</td>
<td>35</td>
<td>42</td>
<td>15</td>
<td>6</td>
<td>1</td>
<td>4.05</td>
<td>0.92</td>
<td>4.05</td>
<td>4.24</td>
</tr>
<tr>
<td>Available during office hours</td>
<td>85</td>
<td>42</td>
<td>44</td>
<td>11</td>
<td>2</td>
<td>1</td>
<td>4.24</td>
<td>0.82</td>
<td>4.24</td>
<td>4.42</td>
</tr>
<tr>
<td>Lectures focus on the material outlined in the syllabus</td>
<td>84</td>
<td>38</td>
<td>39</td>
<td>15</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>4.05</td>
<td>1.00</td>
<td>4.05</td>
</tr>
<tr>
<td>Results are returned in a reasonable amount of time</td>
<td>85</td>
<td>31</td>
<td>44</td>
<td>16</td>
<td>5</td>
<td>5</td>
<td>3.91</td>
<td>1.04</td>
<td>3.91</td>
<td>4.17</td>
</tr>
<tr>
<td>Textbook support the course objectives</td>
<td>85</td>
<td>36</td>
<td>46</td>
<td>13</td>
<td>4</td>
<td>1</td>
<td>4.13</td>
<td>0.85</td>
<td>4.13</td>
<td>4.26</td>
</tr>
</tbody>
</table>

Exhibit-2(2)
Takes time to answer questions 85 20 28 25 20 7 3.34 1.20 3.34 3.22 3.34 3.42 3.88 4.30
Attempts to involve students in class discussions/activities 85 21 35 14 18 12 3.36 1.31 3.36 3.70 3.66 4.37 4.38 4.47
Required high quality work 84 12 30 32 19 7 1.20 1.10 3.20 3.33 3.20 3.66 4.05 4.34
Communicates the importance of the subject matter 85 22 36 21 13 7 3.54 1.17 3.54 3.88 3.54 4.43 4.43 4.48
Cannot be reached during posted office hours 83 7 18 24 33 18 2.64 1.18 2.64 2.47 2.64 2.45 2.45 2.45
Uses examples to help students understand 85 20 34 21 15 9 3.40 1.23 3.40 3.76 3.40 4.41 4.41 4.47

Additional Questions

<table>
<thead>
<tr>
<th>Description</th>
<th>Response Total</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of effort required to succeed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Same</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Lower</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Grade that I expect in this class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Reason for taking this course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required</td>
<td>78</td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Views on the quality of the instruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A detailed and clear explanation of the topics will be more helpful</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GOOD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>He is God and responsible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>He is good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have learned many important concepts in VLSI and extended my knowledge in the field of VLSI.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I think the lecture would be better if it is more elaborate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instructor is not teaching well.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Needs improvement in teaching method.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not required</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROFESSOR IS GOOD.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strength- the only strength he has is a professor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>weakness- he is not having proper communication with students and is not able to answer there questions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strengths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. He do lot of effort.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. He explains any difficult problem many times until student understand.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Good skills to conduct exams.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. He makes us understand many software also in a easy manner.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weakness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>He is too polite.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>THE INSTRUCTOR HAS BETTER KNOWLEDGE IN THIS SUBJECT AND ALSO PUNCTUAL, STRICT IN SUBMITTING ASSIGNMENTS ON TIME</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Exhibit-2(2)
The instructor should use examples to help students understand. The instructor attempts to involve students in discussions & activities is 0%.

The instructor's lecture is good, but the subject is not understandable as he uses less examples.

The matter covered for the subject during the class is up to the mark. Also the efforts taken by the prof. In order to make student understand the topic is very high. But I would prefer that he should take more examples in order to give more exposure to something which is not from the text book.

The professor did not reach our expectations.

The strength of this course is to help in learning the design of various circuit designs and I had a great exposure with a different kind of circuit design and submitted as projects for this course work.

The weakness of this course is it does not have a practical exposure related to this course work.

This course is very important for me as my major is VLSI but, Professor made it very lenient. He didn't teach fabrication of circuit in proper manner. He can't communicate well in English and that is why we are unable to understand what he taught. He always teach something different in class and ask something different in class tests.

Try to give more examples

View on quality of instruction: Sir is not teaching well. He is not able to communicate with students properly. He cannot explain the subject matter properly.

Strengths about this course: This course will help me improve in my future career.

Weakness of this course: I couldn't learn the new concepts from this course because instructor cannot explain the subject matter properly.

Y

excellent

good knowledge in subject but due to communication gap between students and teacher is high because the way sir pronounce the language cannot to understand

good teaching

he is good but communication skills must be improved a little bit

neutral and language problem

teaching good.

the instructor has a very good knowledge on the subject and the students can learn alot.

the quality of teaching is not up to the mark, concepts are hardly explained in the class, waste time in class and instructor is available during office hours, but dose-not answer to doubt properly.

weakness:

instructor not able to communicate to students.

not having clear concept of what he is teaching.

when went to instructor to ask for solutions, says to go through materials given instead solving problem.

Strength:

i did not find any strength.

You may reply to this e-mail with any questions or concerns about the system. Thank you!
Course Evaluation Results for: CSEN 5325 003 - Zhaohui Wang

TAMUK OIR <koir2000@tamuk.edu>

Tue 5/26/2015 2:19 PM

To: Zhaohui Wang <Zhaohui.Wang@tamuk.edu>;

Course Evaluation Report

Dear Faculty Member,

The Student Rating of Instruction system is now closed. The final results for your class are shown below: NOTE: It has come to our attention that these results play an important part in yearly evaluations; therefore, we recommend that these final email results be kept in a safe place. Once the semester closes and final emails are sent out, it becomes difficult to pull them off the program we are using.

<table>
<thead>
<tr>
<th>Term</th>
<th>Division</th>
<th>Department</th>
<th>Course ID</th>
<th>Course Description</th>
<th>Professor</th>
<th>Evaluations Taken</th>
<th>Total Enrollment</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>201520 EN</td>
<td>EECS</td>
<td>CSEN 5325 003 20285</td>
<td>Software Engineering Zhaohui Wang</td>
<td>68</td>
<td>74</td>
<td>91.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Course Avg will be **green** if over 10% of the Course Mean, and **red** if less than 10% of the Course Mean.

<table>
<thead>
<tr>
<th>Instructor &amp; Course Questions</th>
<th>Strongly Agree (%)</th>
<th>Agree (%)</th>
<th>Neutral (%)</th>
<th>Strongly Disagree (%)</th>
<th>N/A (%)</th>
<th>Std Dev</th>
<th>Instr Course Mean</th>
<th>Instr Overall Mean</th>
<th>Dept Mean</th>
<th>Div Mean</th>
<th>Univ Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considerate of the students during class</td>
<td>68</td>
<td>62</td>
<td>24</td>
<td>9</td>
<td>1</td>
<td>4</td>
<td>4.37 1.01</td>
<td>4.30 4.10</td>
<td>4.35 4.53</td>
<td>4.49 4.51</td>
<td></td>
</tr>
<tr>
<td>Presents the subject matter in a clear and organized manner</td>
<td>68</td>
<td>53</td>
<td>25</td>
<td>15</td>
<td>3</td>
<td>4</td>
<td>4.19 1.07</td>
<td>4.11 3.88</td>
<td>4.26 4.44</td>
<td>4.37 4.41</td>
<td></td>
</tr>
<tr>
<td>Tests and other requirements cover the course description in the syllabus</td>
<td>68</td>
<td>56</td>
<td>37</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4.43 0.83</td>
<td>4.46 4.25</td>
<td>4.46 4.51</td>
<td>4.48 4.52</td>
<td></td>
</tr>
<tr>
<td>Sets high academic standards</td>
<td>68</td>
<td>46</td>
<td>32</td>
<td>15</td>
<td>3</td>
<td>4</td>
<td>4.12 1.05</td>
<td>4.06 3.89</td>
<td>4.26 4.44</td>
<td>4.45 4.49</td>
<td></td>
</tr>
<tr>
<td>Follows the grading system outlined in the syllabus</td>
<td>68</td>
<td>53</td>
<td>40</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>4.38 0.86</td>
<td>4.36 4.24</td>
<td>4.36 4.47</td>
<td>4.46 4.52</td>
<td></td>
</tr>
<tr>
<td>Available during office hours</td>
<td>68</td>
<td>63</td>
<td>34</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4.57 0.67</td>
<td>4.53 4.42</td>
<td>4.47 4.51</td>
<td>4.47 4.49</td>
<td></td>
</tr>
<tr>
<td>Lectures focus on the material outlined in the syllabus</td>
<td>68</td>
<td>49</td>
<td>37</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>4.24 0.97</td>
<td>4.30 4.21</td>
<td>4.36 4.46</td>
<td>4.45 4.50</td>
<td></td>
</tr>
<tr>
<td>Results are returned in a reasonable amount of time</td>
<td>68</td>
<td>56</td>
<td>34</td>
<td>6</td>
<td>1</td>
<td>3</td>
<td>4.38 0.89</td>
<td>4.33 4.17</td>
<td>4.32 4.44</td>
<td>4.41 4.47</td>
<td></td>
</tr>
<tr>
<td>Textbook support the course objectives</td>
<td>68</td>
<td>53</td>
<td>32</td>
<td>12</td>
<td>3</td>
<td>3</td>
<td>4.32 0.90</td>
<td>4.35 4.26</td>
<td>4.39 4.42</td>
<td>4.43 4.48</td>
<td></td>
</tr>
</tbody>
</table>

Exhibit-2(3)
<table>
<thead>
<tr>
<th></th>
<th>Response Total</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Takes time to answer questions</td>
<td>66</td>
<td>3.21</td>
</tr>
<tr>
<td>Attempts to involve students in class discussions/activities</td>
<td>68</td>
<td>4.10</td>
</tr>
<tr>
<td>Required high quality work</td>
<td>64</td>
<td>3.36</td>
</tr>
<tr>
<td>Communicates the importance of the subject matter</td>
<td>68</td>
<td>4.21</td>
</tr>
<tr>
<td>Cannot be reached during posted office hours</td>
<td>61</td>
<td>2.15</td>
</tr>
<tr>
<td>Uses examples to help students understand</td>
<td>67</td>
<td>4.15</td>
</tr>
</tbody>
</table>

### Additional Questions

#### Amount of effort required to succeed

<table>
<thead>
<tr>
<th>Description</th>
<th>Response Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same</td>
<td>33</td>
</tr>
<tr>
<td>Higher</td>
<td>29</td>
</tr>
<tr>
<td>N/A</td>
<td>5</td>
</tr>
<tr>
<td>Lower</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Grade that I expect in this class

<table>
<thead>
<tr>
<th>Grade</th>
<th>Response Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>64</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Reason for taking this course

<table>
<thead>
<tr>
<th>Reason</th>
<th>Response Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required</td>
<td>67</td>
</tr>
<tr>
<td>Elective</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Views on the quality of the instruction

- As a CS student I am required to know how to develop a software as a team. I learned it very clearly in this class.
- Good professor teaches according to the way students understand. Clarifies doubts in the best way possible. I am totally happy with the way he teaches. I got some good knowledge about the course with his classes.
- He could not able to communicate the subject and its importance
- He is good
- He is very good in explanation
- Instructions provided by professor are good. He explains everything included in course materials.
- Must involve students while teaching
- Need to improve in teaching and involve students in gaining knowledge
- No weakness as such. Teaching is fine. Subject is well understood.
- The instruction in this course was practicable and with the various software design projects, we actually transformed the theoretical knowledge into working softwares.
- The instructor ensured that the course objectives were met.
- This course made me to know about the basics of software engineering. It taught me how the software companies are running and what the strategies should be followed to be a top company.
- an acceptable professor
- communication is very good, command on subject is high. No weaknesses to mention.
- he needs to explain the subject not only reading the slides out
- highly disagree with this professor as he don’t know what he is teaching in the class and always fail to answer student questions. Low standard teaching.
- hope to take up another subject in the future under you sir
- no comments
- professor is explaining well with good course schedule.

---

Exhibit-2(3)
strength: caring for students
weakness: none

You may reply to this e-mail with any questions or concerns about the system. Thank you!

Exhibit-2(3)
Course Evaluation Results for: CSEN 5325 005 - Zhaohui Wang

TAMUK OIR <koir2000@tamuk.edu>

Tue 5/26/2015 2:33 PM

To: Zhaohui Wang <Zhaohui.Wang@tamuk.edu>;

Course Evaluation Report

Dear Faculty Member,

The Student Rating of Instruction system is now closed. The final results for your class are shown below: NOTE: It has come to our attention that these results play an important part in yearly evaluations; therefore, we recommend that these final email results be kept in a safe place. Once the semester closes and final emails are sent out, it becomes difficult to pull them off the program we are using.

<table>
<thead>
<tr>
<th>Term</th>
<th>Division Department</th>
<th>Course ID</th>
<th>Course Description</th>
<th>Professor</th>
<th>Evaluations Taken</th>
<th>Total Enrollment</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>201520 EN</td>
<td>EECS</td>
<td>CSEN 5325 005 20287</td>
<td>Software Engineering Zhaohui Wang</td>
<td>57</td>
<td>57</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

The Course Avg will be green if over 10% of the Course Mean, and red if less than 10% of the Course Mean.

Instructor & Course Questions

<table>
<thead>
<tr>
<th>Description</th>
<th>Total Agree</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>N/A</th>
<th>Instr Std Mean</th>
<th>Instr Overall Mean</th>
<th>Course Mean</th>
<th>Dept Mean</th>
<th>Div Mean</th>
<th>Univ Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considerate of the students during class</td>
<td>57</td>
<td>53</td>
<td>32</td>
<td>7</td>
<td>4</td>
<td>5</td>
<td>4.23</td>
<td>1.08</td>
<td>4.30</td>
<td>4.10</td>
<td>4.35</td>
<td>4.53</td>
<td>4.49</td>
</tr>
<tr>
<td>Presents the subject matter in a clear and organized manner</td>
<td>57</td>
<td>40</td>
<td>40</td>
<td>9</td>
<td>2</td>
<td>9</td>
<td>4.02</td>
<td>1.16</td>
<td>4.11</td>
<td>3.88</td>
<td>4.26</td>
<td>4.44</td>
<td>4.37</td>
</tr>
<tr>
<td>Tests and other requirements cover the course description in the syllabus</td>
<td>57</td>
<td>61</td>
<td>32</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4.51</td>
<td>0.73</td>
<td>4.46</td>
<td>4.25</td>
<td>4.46</td>
<td>4.51</td>
<td>4.48</td>
</tr>
<tr>
<td>Sets high academic standards</td>
<td>57</td>
<td>42</td>
<td>33</td>
<td>11</td>
<td>11</td>
<td>4</td>
<td>4.00</td>
<td>1.12</td>
<td>4.06</td>
<td>3.89</td>
<td>4.26</td>
<td>4.44</td>
<td>4.45</td>
</tr>
<tr>
<td>Follows the grading system outlined in the syllabus</td>
<td>57</td>
<td>58</td>
<td>26</td>
<td>9</td>
<td>5</td>
<td>2</td>
<td>4.33</td>
<td>0.96</td>
<td>4.36</td>
<td>4.24</td>
<td>4.36</td>
<td>4.47</td>
<td>4.46</td>
</tr>
<tr>
<td>Available during office hours</td>
<td>57</td>
<td>65</td>
<td>25</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>4.47</td>
<td>0.88</td>
<td>4.53</td>
<td>4.42</td>
<td>4.47</td>
<td>4.51</td>
<td>4.47</td>
</tr>
<tr>
<td>Lectures focus on the material outlined in the syllabus</td>
<td>57</td>
<td>56</td>
<td>32</td>
<td>7</td>
<td>4</td>
<td>2</td>
<td>4.37</td>
<td>0.89</td>
<td>4.30</td>
<td>4.21</td>
<td>4.36</td>
<td>4.46</td>
<td>4.45</td>
</tr>
<tr>
<td>Results are returned in a reasonable amount of time</td>
<td>57</td>
<td>53</td>
<td>32</td>
<td>7</td>
<td>7</td>
<td>2</td>
<td>4.26</td>
<td>0.98</td>
<td>4.33</td>
<td>4.17</td>
<td>4.32</td>
<td>4.44</td>
<td>4.41</td>
</tr>
<tr>
<td>Textbook support the course objectives</td>
<td>56</td>
<td>52</td>
<td>38</td>
<td>9</td>
<td>2</td>
<td>2</td>
<td>4.38</td>
<td>0.79</td>
<td>4.35</td>
<td>4.26</td>
<td>4.39</td>
<td>4.42</td>
<td>4.43</td>
</tr>
</tbody>
</table>

Exhibit-2(4)
Takes time to answer questions  56  16  27  18  29  11  2  3.09  1.27  3.16  3.22  3.12  3.42  3.88  4.30
Attempts to involve students in class discussions/activities  57  37  25  16  9  14  3.61  1.41  3.88  3.70  4.12  4.37  4.38  4.47
Required high quality work  57  26  23  21  18  12  3.33  1.36  3.35  3.33  3.31  3.66  4.05  4.34
Communicates the importance of the subject matter  57  40  30  18  5  7  3.91  1.19  4.07  3.88  4.25  4.43  4.43  4.48
Cannot be reached during posted office hours  57  19  7  11  33  30  2.53  1.46  2.33  2.47  2.33  2.45  2.46  2.45
Uses examples to help students understand  56  34  30  23  4  9  2  3.77  1.21  3.98  3.76  4.20  4.41  4.41  4.47

Additional Questions

<table>
<thead>
<tr>
<th>Description</th>
<th>Response Total</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of effort required to succeed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Same</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Lower</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Grade that I expect in this class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Reason for taking this course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Views on the quality of the instruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Everything regarding the instructor and the subject is good.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good Project work, and Quizzes help in revising what we have learnt. Good way to conduct exams.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good and can communicate efficiently on the important topics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good knowledge on subject</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good professor. Can understand him very well.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Its a good course by this professor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Na</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No comments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not at all satisfied with his class because i dont like the pratten of exam that he conducts and also difficult to understand his language . And he reads the ppt's in class rather than explaining so we are dissatisfied not only me the whole class is to be feel the same .</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thank you</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Software Engineering is a core subject of Computer Science, as it deals with Software and hardware sciences. Here, professor is really enthusiastic in teaching this subject moreover, he explains and clarifies doubts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The course material is very much useful for the course.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Try to understand student views and provide some time to students in office hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>i really learnt a great knowledge from the class and the project work given by him enriches my knowledge in programming.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>never had the software engineering related basics before registering to your subject,thanku for teaching this subject in an understandable way.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>the quizzes i have taken in this class are very useful for me to learn the subject.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Exhibit-2(4)
Course Evaluation Results for: EEEN 5339 001 - Zhaohui Wang

TAMUK OIR <koir2000@tamuk.edu>

Tue 8/11/2015 2:15 PM

Inbox

To: Zhaohui Wang <Zhaohui.Wang@tamuk.edu>

Course Evaluation Report

Dear Faculty Member,

The Student Rating of Instruction system is now closed. The final results for your class are shown below: NOTE: It has come to our attention that these results play an important part in yearly evaluations; therefore, we recommend that these final email results be kept in a safe place. Once the semester closes and final emails are sent out, it becomes difficult to pull them off the program we are using.

<table>
<thead>
<tr>
<th>Term</th>
<th>Division</th>
<th>Department</th>
<th>Course ID</th>
<th>Course Description</th>
<th>Professor</th>
<th>Evaluations Taken</th>
<th>Total Enrollment</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>201530 EN</td>
<td>EECS</td>
<td>EEEN 5339 001 40453</td>
<td>Embedded System Design Zhaohui Wang</td>
<td></td>
<td></td>
<td>74</td>
<td>79</td>
<td>93.7</td>
</tr>
</tbody>
</table>

The Course Avg will be green if over 10% of the Course Mean, and red if less than 10% of the Course Mean.

Instructor & Course Questions

<table>
<thead>
<tr>
<th>Description</th>
<th>Strongly Agree Total</th>
<th>Strongly Agree (%)</th>
<th>Strongly Disagree (%)</th>
<th>Neutral (%)</th>
<th>Strongly Disagree (%)</th>
<th>N/A (%)</th>
<th>Std Dev</th>
<th>Instr Course Mean</th>
<th>Instr Overall Mean</th>
<th>Course Mean</th>
<th>Dept Mean</th>
<th>Div Mean</th>
<th>Univ Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considerate of the students during class</td>
<td>74</td>
<td>34</td>
<td>35</td>
<td>20</td>
<td>4</td>
<td>3.88</td>
<td>1.08</td>
<td>3.88</td>
<td>4.13</td>
<td>3.88</td>
<td>4.53</td>
<td>4.50</td>
<td>4.62</td>
</tr>
<tr>
<td>Presents the subject matter in a clear and organized manner</td>
<td>74</td>
<td>34</td>
<td>30</td>
<td>23</td>
<td>8</td>
<td>5</td>
<td>3.78</td>
<td>1.15</td>
<td>3.78</td>
<td>4.02</td>
<td>3.78</td>
<td>4.44</td>
<td>4.38</td>
</tr>
<tr>
<td>Tests and other requirements cover the course description in the syllabus</td>
<td>74</td>
<td>34</td>
<td>42</td>
<td>18</td>
<td>4</td>
<td>3</td>
<td>4.00</td>
<td>0.96</td>
<td>4.00</td>
<td>4.20</td>
<td>4.00</td>
<td>4.51</td>
<td>4.48</td>
</tr>
<tr>
<td>Sets high academic standards</td>
<td>74</td>
<td>27</td>
<td>36</td>
<td>24</td>
<td>8</td>
<td>4</td>
<td>3.74</td>
<td>1.07</td>
<td>3.74</td>
<td>4.06</td>
<td>3.74</td>
<td>4.44</td>
<td>4.45</td>
</tr>
<tr>
<td>Follows the grading system outlined in the syllabus</td>
<td>74</td>
<td>34</td>
<td>39</td>
<td>20</td>
<td>7</td>
<td>4</td>
<td>4.00</td>
<td>0.90</td>
<td>4.00</td>
<td>4.26</td>
<td>4.00</td>
<td>4.47</td>
<td>4.46</td>
</tr>
<tr>
<td>Available during office hours</td>
<td>74</td>
<td>36</td>
<td>41</td>
<td>19</td>
<td>4</td>
<td>4</td>
<td>4.09</td>
<td>0.84</td>
<td>4.09</td>
<td>4.27</td>
<td>4.09</td>
<td>4.50</td>
<td>4.47</td>
</tr>
<tr>
<td>Lectures focus on the material outlined in the syllabus</td>
<td>74</td>
<td>35</td>
<td>38</td>
<td>19</td>
<td>7</td>
<td>1</td>
<td>3.99</td>
<td>0.97</td>
<td>3.99</td>
<td>4.18</td>
<td>3.99</td>
<td>4.45</td>
<td>4.46</td>
</tr>
<tr>
<td>Results are returned in a reasonable amount of time</td>
<td>74</td>
<td>28</td>
<td>50</td>
<td>16</td>
<td>5</td>
<td>4</td>
<td>4.01</td>
<td>0.81</td>
<td>4.01</td>
<td>4.16</td>
<td>4.01</td>
<td>4.44</td>
<td>4.42</td>
</tr>
</tbody>
</table>

Exhibit-3(1)

https://outlook.office365.com/owa/
Textbook support the course objectives
Takes time to answer questions       74  23  22  32  20  3  3.42  1.13  3.42  3.23  3.42  3.38  3.83  3.94
Attempts to involve students in class discussions/activities 74  30  26  24  12  8  3.57  1.25  3.57  3.88  3.57  4.37  4.38  4.55
Required high quality work    74  20  28  27  18  7  3.38  1.18  3.38  3.40  3.38  3.62  4.00  4.06
Communicates the importance of the subject matter 74  30  34  24  8  4  3.77  1.08  3.77  4.02  3.77  4.43  4.43  4.57
Cannot be reached during posted office hours       73  14  11  29  34  12  1 2.79  1.20  2.79  2.61  2.79  2.45  2.46  2.33
Uses examples to help students understand        74  31  26  28  7  8  3.65  1.21  3.65  3.91  3.65  4.41  4.41  4.55

Additional Questions

<table>
<thead>
<tr>
<th>Description</th>
<th>Response Total</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of effort required to succeed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>Same</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Lower</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Grade that I expect in this class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Reason for taking this course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Views on the quality of the instruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cannot properly communicate with students.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good I appreciate his way of teaching which is professional in the class.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>He teaches well but he has to speak louder in class.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need extra material for the course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need to cover all topics.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No comments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality Of Instruction: The instructor is not able to communicate with students properly.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strengths of this Course: The strengths of this course is that it is helpful for the future development.Embedded system design is helpful for the electronic industry.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weaknesses of this course : The instructor is not able to teach the subject matter properly. He is not able to communicate with students properly. So money wasted and zero knowledge.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strength: The professor is well planned,organised,provides good notes in the form lecture slides, text material and the lab session conducted by him are very helpful for programming.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weakness: The professor could be even more audible and louder.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strengths: He work hard for students to learn and understand the concept. He makes us learn software.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Exhibit-3(1)
This time he makes us learn practically by going to the lab.

Weakness:
He need to be strict otherwise student would not listen to him.
The instruction has the knowledge of the subject matter but is not able to communicate with the students properly.
cannot hear properly
sometimes professor doesn't know the topic details.
good
good
good professor
strengths:
nil
weakness:
no stuff on specific subject

You may reply to this e-mail with any questions or concerns about the system. Thank you!
Course Evaluation Reporting

Courses for: Zhaohui Wang

If no results are listed below, clear the fields above, select a term, and press search.
If you change any fields in the above input or checkboxes, press the search button to refresh.
Move the mouse over any underlined prompt above to get more detailed help for that option.
Click on the number under "Evaluations Taken" to see the results for that class.
If the "Reporting Disabled" checkmark is present, detailed results are not available yet.

Instructor & Course Questions

<table>
<thead>
<tr>
<th>Description</th>
<th>Strongly Agree</th>
<th>Strongly Disagree</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considerate of the students during class</td>
<td>70</td>
<td>1</td>
<td>1048</td>
</tr>
<tr>
<td>Presents the subject matter in a clear organized manner</td>
<td>70</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tests and other requirements cover the course description in the syllabus</td>
<td>70</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Sets high academic standards</td>
<td>70</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Follows the grading system outlined in the syllabus</td>
<td>71</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Available during office hours</td>
<td>71</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Lectures focus on the material outlined in the syllabus</td>
<td>70</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Results are returned in a reasonable amount of time</td>
<td>71</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Textbook support the course objectives</td>
<td>70</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Takes time to answer questions</td>
<td>70</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Attempts to involve students in class discussions/activities</td>
<td>70</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Required high quality work</td>
<td>68</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Communicates the importance of the subject matter</td>
<td>70</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Cannot be reached during posted office hours</td>
<td>67</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Uses examples to help students understand</td>
<td>70</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Additional Questions

<table>
<thead>
<tr>
<th>Description</th>
<th>Total</th>
<th>Avg</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of effort required to succeed</td>
<td>10</td>
<td>1</td>
<td>0.32</td>
</tr>
<tr>
<td>Grade that I expect in this class</td>
<td>10</td>
<td>1</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Exhibit-3(2)
Reason for taking this course
Elective
Required

Views on the quality of the instruction
- Appreciate your efforts
- Course is very good and it can be very good.
- Good
- Good
good course material covered.
More quizzes could have helped in preparing for actual exam.
- Good elective
- Good quality in course work
- Keep the good work going
- N/A
- The class experience was good.
- This course is very helpful to learn more
classes are organized very well and knowledge gained very well
good

Exhibit-3(2)
Course Evaluation Results for: CSEN 5303 018 - Zhaohui Wang

TAMUK OIR <koir2000@tamuk.edu>

Tue 8/11/2015 2:14 PM
Inbox
To: Zhaohui Wang <Zhaohui.Wang@tamuk.edu>;

Course Evaluation Report

Dear Faculty Member,

The Student Rating of Instruction system is now closed. The final results for your class are shown below: NOTE: It has come to our attention that these results play an important part in yearly evaluations; therefore, we recommend that these final email results be kept in a safe place. Once the semester closes and final emails are sent out, it becomes difficult to pull them off the program we are using.

<table>
<thead>
<tr>
<th>Term</th>
<th>Division</th>
<th>Department</th>
<th>Course ID</th>
<th>Course Description</th>
<th>Professor</th>
<th>Evaluations Taken</th>
<th>Total Enrollment</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>201530 EN</td>
<td>EECS</td>
<td>CSEN 5303 018 40967</td>
<td>T:Programming Languages Zhaohui Wang</td>
<td>67</td>
<td>79</td>
<td>84.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Course Avg will be green if over 10% of the Course Mean, and red if less than 10% of the Course Mean.

<table>
<thead>
<tr>
<th>Instructor &amp; Course Questions</th>
<th>Description</th>
<th>Strongly Agree</th>
<th>Agree(%)</th>
<th>Neutral(%)</th>
<th>Disagree(%)</th>
<th>Strongly Disagree</th>
<th>N/A</th>
<th>N/A</th>
<th>Std Dev</th>
<th>Instr Course Mean</th>
<th>Instr Overall Mean</th>
<th>Course Mean</th>
<th>Dept Mean</th>
<th>Div Mean</th>
<th>Univ Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Considerate of the students during class</td>
<td>66</td>
<td>47</td>
<td>26</td>
<td>20</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>4.09</td>
<td>1.05</td>
<td>4.27</td>
<td>4.13</td>
<td>4.54</td>
<td>4.50</td>
<td>4.62</td>
</tr>
<tr>
<td></td>
<td>Presents the subject matter in a clear and organized manner</td>
<td>66</td>
<td>42</td>
<td>26</td>
<td>20</td>
<td>8</td>
<td>5</td>
<td>2</td>
<td>3.94</td>
<td>1.15</td>
<td>4.15</td>
<td>4.02</td>
<td>4.50</td>
<td>4.44</td>
<td>4.38</td>
</tr>
<tr>
<td></td>
<td>Tests and other requirements cover the course description in the syllabus</td>
<td>66</td>
<td>44</td>
<td>39</td>
<td>12</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>4.21</td>
<td>0.88</td>
<td>4.31</td>
<td>4.20</td>
<td>4.53</td>
<td>4.51</td>
<td>4.48</td>
</tr>
<tr>
<td></td>
<td>Sets high academic standards</td>
<td>66</td>
<td>45</td>
<td>27</td>
<td>20</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>4.08</td>
<td>1.05</td>
<td>4.23</td>
<td>4.06</td>
<td>4.45</td>
<td>4.44</td>
<td>4.56</td>
</tr>
<tr>
<td></td>
<td>Follows the grading system outlined in the syllabus</td>
<td>66</td>
<td>50</td>
<td>35</td>
<td>11</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>4.27</td>
<td>0.93</td>
<td>4.40</td>
<td>4.26</td>
<td>4.47</td>
<td>4.46</td>
<td>4.58</td>
</tr>
<tr>
<td></td>
<td>Available during office hours</td>
<td>66</td>
<td>48</td>
<td>38</td>
<td>11</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4.30</td>
<td>0.83</td>
<td>4.36</td>
<td>4.27</td>
<td>4.54</td>
<td>4.50</td>
<td>4.47</td>
</tr>
<tr>
<td></td>
<td>Lectures focus on the material outlined in the syllabus</td>
<td>66</td>
<td>45</td>
<td>39</td>
<td>9</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>4.23</td>
<td>0.90</td>
<td>4.29</td>
<td>4.18</td>
<td>4.48</td>
<td>4.45</td>
<td>4.46</td>
</tr>
<tr>
<td></td>
<td>Results are returned in a reasonable amount of time</td>
<td>66</td>
<td>39</td>
<td>41</td>
<td>15</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>4.12</td>
<td>0.93</td>
<td>4.23</td>
<td>4.16</td>
<td>4.52</td>
<td>4.44</td>
<td>4.58</td>
</tr>
<tr>
<td></td>
<td></td>
<td>66</td>
<td>52</td>
<td>30</td>
<td>17</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4.30</td>
<td>0.85</td>
<td>4.33</td>
<td>4.22</td>
<td>4.48</td>
<td>4.42</td>
<td>4.57</td>
</tr>
</tbody>
</table>

Exhibit-3(3)
Textbook support the course objectives

<table>
<thead>
<tr>
<th>Description</th>
<th>Response Total</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Takes time to answer questions</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Attempts to involve students in class discussions/activities</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>Required high quality work</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Communicates the importance of the subject matter</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td>Cannot be reached during posted office hours</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>Uses examples to help students understand</td>
<td>66</td>
<td></td>
</tr>
</tbody>
</table>

Additional Questions

<table>
<thead>
<tr>
<th>Description</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of effort required to succeed</td>
<td></td>
</tr>
<tr>
<td>Higher</td>
<td>32</td>
</tr>
<tr>
<td>Same</td>
<td>25</td>
</tr>
<tr>
<td>N/A</td>
<td>9</td>
</tr>
<tr>
<td>Lower</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade that I expect in this class</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>59</td>
</tr>
<tr>
<td>B</td>
<td>4</td>
</tr>
<tr>
<td>N/A</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reason for taking this course</td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>55</td>
</tr>
<tr>
<td>Required</td>
<td>12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Views on the quality of the instruction</td>
<td></td>
</tr>
<tr>
<td>Doctor Wang is good</td>
<td></td>
</tr>
<tr>
<td>Explains the concepts clearly.</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Nice</td>
<td></td>
</tr>
<tr>
<td>No comments</td>
<td></td>
</tr>
<tr>
<td>Programming language is one of the major course for the computer science students...thus course help me to learn something abt the compiler design in detail and it helps me a lot to improve my technical knowledge.</td>
<td></td>
</tr>
<tr>
<td>THE INSTRUCTOR IS GOOD IN ALL ASPECTS.</td>
<td></td>
</tr>
<tr>
<td>The instructor provides good quality of instruction.</td>
<td></td>
</tr>
<tr>
<td>The teaching provided by the faculty is not worth than paying our fee</td>
<td></td>
</tr>
<tr>
<td>professor is good</td>
<td></td>
</tr>
<tr>
<td>uses examples to help students</td>
<td></td>
</tr>
</tbody>
</table>

You may reply to this e-mail with any questions or concerns about the system. Thank you!
# Course Evaluation Reporting

**Courses for: Zhaohui Wang**

<table>
<thead>
<tr>
<th>CRN</th>
<th>Term</th>
<th>College</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>12310</td>
<td>Fall 2015 TAMUK</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If no results are listed below, clear the fields above, select a term, and press search.

If you change any fields in the above input or checkboxes, press the search button to refresh.

Move the mouse over any underlined prompt above to get more detailed help for that option.

Click on the number under "Evaluations Taken" to see the results for that class.

If the "Reporting Disabled" checkmark is present, detailed results are not available yet.

## Instructor & Course Questions

<table>
<thead>
<tr>
<th>Description</th>
<th>Strongly Agree (%)</th>
<th>Neutral (%)</th>
<th>Strongly Disagree (%)</th>
<th>N/A (%)</th>
<th>Std Dev</th>
<th>Instr Course Mean</th>
<th>Instr Overall Mean</th>
<th>Course Mean</th>
<th>Dept Mean</th>
<th>Div Mean</th>
<th>Univ Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considerate of the students during class</td>
<td>72</td>
<td>46</td>
<td>10</td>
<td>3</td>
<td>4</td>
<td>4.18</td>
<td>4.19</td>
<td>4.22</td>
<td>4.19</td>
<td>4.52</td>
<td>4.50</td>
</tr>
<tr>
<td>Presents the subject matter in a clear and organized manner</td>
<td>72</td>
<td>40</td>
<td>17</td>
<td>6</td>
<td></td>
<td>4.13</td>
<td>4.08</td>
<td>4.10</td>
<td>4.08</td>
<td>4.44</td>
<td>4.38</td>
</tr>
<tr>
<td>Tests and other requirements cover the course description in the syllabus</td>
<td>72</td>
<td>42</td>
<td>11</td>
<td></td>
<td></td>
<td>4.31</td>
<td>4.23</td>
<td>4.29</td>
<td>4.51</td>
<td>4.48</td>
<td>4.42</td>
</tr>
<tr>
<td>Sets high academic standards</td>
<td>72</td>
<td>38</td>
<td>18</td>
<td>6</td>
<td></td>
<td>4.08</td>
<td>4.05</td>
<td>4.05</td>
<td>4.43</td>
<td>4.45</td>
<td>4.52</td>
</tr>
<tr>
<td>Follows the grading system outlined in the syllabus</td>
<td>72</td>
<td>42</td>
<td>10</td>
<td>1</td>
<td></td>
<td>4.29</td>
<td>4.26</td>
<td>4.27</td>
<td>4.47</td>
<td>4.46</td>
<td>4.55</td>
</tr>
<tr>
<td>Available during office hours</td>
<td>72</td>
<td>49</td>
<td>8</td>
<td></td>
<td></td>
<td>4.40</td>
<td>4.38</td>
<td>4.42</td>
<td>4.38</td>
<td>4.50</td>
<td>4.47</td>
</tr>
<tr>
<td>Lectures focus on the material outlined in the syllabus</td>
<td>72</td>
<td>40</td>
<td>13</td>
<td>4</td>
<td></td>
<td>4.19</td>
<td>4.24</td>
<td>4.25</td>
<td>4.45</td>
<td>4.45</td>
<td>4.52</td>
</tr>
<tr>
<td>Results are returned in a reasonable amount of time</td>
<td>72</td>
<td>47</td>
<td>8</td>
<td>1</td>
<td></td>
<td>4.36</td>
<td>4.30</td>
<td>4.32</td>
<td>4.43</td>
<td>4.41</td>
<td>4.48</td>
</tr>
<tr>
<td>Textbook support the course objectives</td>
<td>72</td>
<td>47</td>
<td>13</td>
<td></td>
<td></td>
<td>4.35</td>
<td>4.27</td>
<td>4.28</td>
<td>4.42</td>
<td>4.43</td>
<td>4.50</td>
</tr>
<tr>
<td>Takes time to answer questions</td>
<td>72</td>
<td>21</td>
<td>26</td>
<td>18</td>
<td>8</td>
<td>3.33</td>
<td>3.23</td>
<td>3.17</td>
<td>3.23</td>
<td>3.36</td>
<td>3.81</td>
</tr>
<tr>
<td>Attempts to involve students in class discussions/activities</td>
<td>72</td>
<td>35</td>
<td>32</td>
<td>6</td>
<td>3</td>
<td>3.94</td>
<td>3.90</td>
<td>3.95</td>
<td>3.47</td>
<td>4.38</td>
<td>4.50</td>
</tr>
<tr>
<td>Required high quality work</td>
<td>72</td>
<td>18</td>
<td>27</td>
<td>1</td>
<td>6</td>
<td>3.38</td>
<td>3.35</td>
<td>3.35</td>
<td>3.35</td>
<td>3.59</td>
<td>3.98</td>
</tr>
<tr>
<td>Communicates the importance of the subject matter</td>
<td>72</td>
<td>33</td>
<td>39</td>
<td>4</td>
<td>3</td>
<td>3.96</td>
<td>3.91</td>
<td>4.00</td>
<td>3.91</td>
<td>4.42</td>
<td>4.43</td>
</tr>
<tr>
<td>Cannot be reached during posted office hours</td>
<td>70</td>
<td>10</td>
<td>14</td>
<td>41</td>
<td>21</td>
<td>3.24</td>
<td>2.51</td>
<td>2.51</td>
<td>2.44</td>
<td>2.46</td>
<td>2.42</td>
</tr>
<tr>
<td>Uses examples to help students understand</td>
<td>72</td>
<td>36</td>
<td>32</td>
<td>25</td>
<td>6</td>
<td>1</td>
<td>3.96</td>
<td>3.94</td>
<td>3.98</td>
<td>4.40</td>
<td>4.41</td>
</tr>
</tbody>
</table>

**Exhibit-4(1)**
### Additional Questions

<table>
<thead>
<tr>
<th>Description</th>
<th>Response Total</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount of effort required to succeed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Same</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Lower</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Grade that I expect in this class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Reason for taking this course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Required</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Views on the quality of the instruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent Teaching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good coursework.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>His teaching is good and very apt.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am privileged having found such an efficient professor.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In my view i think the instructor has to provide the course content with much more details and examples to understand with ease.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interesting subject taught by good professor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledgeable instructor and is a good teacher</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No comment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ok.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professor is good at everything</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The course is excellent. The depth of teaching is apt for the course and inclusion of projects is giving better idea about the course and adding the practicality of the course</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very good syllabus and course work. But professor is having hard time speaking English. very bad communication skills.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very good teaching, easily understandable.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>can't control the students</td>
<td></td>
<td></td>
</tr>
<tr>
<td>communication in class needs to be more clear.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strengths : Presentations done in class is helpful.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>good instructor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>good instructor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>good presenting in class rom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>his way of teaching is not up to the mark, should communicate in a good way</td>
<td></td>
<td></td>
</tr>
<tr>
<td>teaching is good</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Course Evaluation Reporting

Courses for: Zhaohui Wang

CRN  Term  College  Department
12311  Fall 2015 TAMUK

Schedule Code  Instr Method  Campus  Section Status  Faculty Type

Sort By 1  Sort By 2  Output  Records  Excel
Results  500  Search

If no results are listed below, clear the fields above, select a term, and press search.
If you change any fields in the above input or checkboxes, press the search button to refresh.
Move the mouse over any underlined prompt above to get more detailed help for that option.
Click on the number under "Evaluations Taken" to see the results for that class.
If the "Reporting Disabled" checkmark is present, detailed results are not available yet.

Term  Course End Date  Coll  Dept  Sch  Instr  Camp  Stat  Fac Type  Course  CRN  Description  Professor  Evals  Total Enroll  % Comp  Reporting Disabled
Fall 2015 TAMUK 12/10/2015  EECS LEC  TR  M  A  EEN 5321 002  12311  Digital Computer Design  Zhaohui Wang  78  80  97.5
Total:  78  80  98%

Records: 1 Time: 0.02 Seconds

The Course Avg will be green if over 10% of the Course Mean, and red if less than 10% of the Course Mean.

Instructor & Course Questions

<table>
<thead>
<tr>
<th>Description</th>
<th>Strongly Agree(%)</th>
<th>Agree(%)</th>
<th>Neutral(%)</th>
<th>Strongly Disagree(%)</th>
<th>Disagree(%)</th>
<th>N/A(%)</th>
<th>Average</th>
<th>Std Dev</th>
<th>Instr Course Mean</th>
<th>Instr Overall Mean</th>
<th>Course Mean</th>
<th>Dept Mean</th>
<th>Div Mean</th>
<th>Univ Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considerate of the students during class</td>
<td>78</td>
<td>41</td>
<td>41</td>
<td>14</td>
<td>4</td>
<td>4.19</td>
<td>0.82</td>
<td>4.19</td>
<td>4.22</td>
<td>4.19</td>
<td>4.52</td>
<td>4.50</td>
<td>4.53</td>
<td></td>
</tr>
<tr>
<td>Presents the subject matter in a clear and organized manner</td>
<td>78</td>
<td>38</td>
<td>37</td>
<td>17</td>
<td>5</td>
<td>3</td>
<td>4.04</td>
<td>0.99</td>
<td>4.08</td>
<td>4.10</td>
<td>4.08</td>
<td>4.44</td>
<td>4.38</td>
<td>4.42</td>
</tr>
<tr>
<td>Tests and other requirements cover the course description in the syllabus</td>
<td>78</td>
<td>37</td>
<td>45</td>
<td>15</td>
<td>3</td>
<td>4.17</td>
<td>0.77</td>
<td>4.23</td>
<td>4.29</td>
<td>4.23</td>
<td>4.51</td>
<td>4.48</td>
<td>4.53</td>
<td></td>
</tr>
<tr>
<td>Sets high academic standards</td>
<td>78</td>
<td>35</td>
<td>38</td>
<td>23</td>
<td>3</td>
<td>1</td>
<td>4.03</td>
<td>0.89</td>
<td>4.05</td>
<td>4.09</td>
<td>4.05</td>
<td>4.43</td>
<td>4.45</td>
<td>4.52</td>
</tr>
<tr>
<td>Follows the grading system outlined in the syllabus</td>
<td>78</td>
<td>42</td>
<td>41</td>
<td>14</td>
<td>3</td>
<td>4.23</td>
<td>0.78</td>
<td>4.26</td>
<td>4.27</td>
<td>4.26</td>
<td>4.47</td>
<td>4.46</td>
<td>4.55</td>
<td></td>
</tr>
<tr>
<td>Available during office hours</td>
<td>78</td>
<td>49</td>
<td>38</td>
<td>13</td>
<td>4</td>
<td>4.36</td>
<td>0.70</td>
<td>4.38</td>
<td>4.42</td>
<td>4.38</td>
<td>4.50</td>
<td>4.47</td>
<td>4.50</td>
<td></td>
</tr>
<tr>
<td>Lectures focus on the material outlined in the syllabus</td>
<td>78</td>
<td>44</td>
<td>41</td>
<td>15</td>
<td>4</td>
<td>4.28</td>
<td>0.71</td>
<td>4.24</td>
<td>4.25</td>
<td>4.24</td>
<td>4.45</td>
<td>4.45</td>
<td>4.52</td>
<td></td>
</tr>
<tr>
<td>Results are returned in a reasonable amount of time</td>
<td>78</td>
<td>40</td>
<td>45</td>
<td>15</td>
<td>4</td>
<td>4.24</td>
<td>0.70</td>
<td>4.30</td>
<td>4.32</td>
<td>4.30</td>
<td>4.43</td>
<td>4.41</td>
<td>4.48</td>
<td></td>
</tr>
<tr>
<td>Textbook support the course objectives</td>
<td>78</td>
<td>40</td>
<td>40</td>
<td>21</td>
<td>4</td>
<td>4.19</td>
<td>0.75</td>
<td>4.27</td>
<td>4.28</td>
<td>4.27</td>
<td>4.42</td>
<td>4.43</td>
<td>4.50</td>
<td></td>
</tr>
<tr>
<td>Takes time to answer questions</td>
<td>77</td>
<td>17</td>
<td>21</td>
<td>31</td>
<td>21</td>
<td>10</td>
<td>3.13</td>
<td>1.22</td>
<td>3.23</td>
<td>3.17</td>
<td>3.23</td>
<td>3.36</td>
<td>3.81</td>
<td>4.31</td>
</tr>
<tr>
<td>Attempts to involve students in class discussions/activities</td>
<td>78</td>
<td>31</td>
<td>38</td>
<td>22</td>
<td>4</td>
<td>5</td>
<td>3.86</td>
<td>1.06</td>
<td>3.90</td>
<td>3.95</td>
<td>3.90</td>
<td>4.37</td>
<td>4.38</td>
<td>4.50</td>
</tr>
<tr>
<td>Required high quality work</td>
<td>77</td>
<td>21</td>
<td>22</td>
<td>35</td>
<td>13</td>
<td>9</td>
<td>3.32</td>
<td>1.20</td>
<td>3.35</td>
<td>3.35</td>
<td>3.35</td>
<td>3.59</td>
<td>3.98</td>
<td>4.34</td>
</tr>
<tr>
<td>Communicates the importance of the subject matter</td>
<td>78</td>
<td>29</td>
<td>38</td>
<td>24</td>
<td>4</td>
<td>4</td>
<td>3.86</td>
<td>1.01</td>
<td>3.91</td>
<td>4.00</td>
<td>3.91</td>
<td>4.42</td>
<td>4.43</td>
<td>4.50</td>
</tr>
<tr>
<td>Cannot be reached during posted office hours</td>
<td>75</td>
<td>8</td>
<td>13</td>
<td>28</td>
<td>25</td>
<td>25</td>
<td>4.53</td>
<td>1.23</td>
<td>2.51</td>
<td>2.47</td>
<td>2.51</td>
<td>2.44</td>
<td>2.46</td>
<td>2.42</td>
</tr>
<tr>
<td>Uses examples to help students understand</td>
<td>78</td>
<td>33</td>
<td>35</td>
<td>27</td>
<td>1</td>
<td>4</td>
<td>3.92</td>
<td>1.00</td>
<td>3.94</td>
<td>3.98</td>
<td>3.94</td>
<td>4.40</td>
<td>4.41</td>
<td>4.49</td>
</tr>
</tbody>
</table>

Exhibit-4(2)
### Additional Questions

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Response Total</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amount of effort required to succeed</strong></td>
<td>Higher</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Same</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td><strong>Grade that I expect in this class</strong></td>
<td>A</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N/A</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td><strong>Reason for taking this course</strong></td>
<td>Required</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td><strong>Views on the quality of the instruction</strong></td>
<td>Course work is good.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Everything is good.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gives good standard of application knowledge which makes student efficient for application of the subject in real world</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>He is a good professor. I strongly appreciate his knowledge and the way he delivers the subject in the class. Thank you sir</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Much satisfied by his subject.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Okay</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Poor lecturing skills, just reads from the course slide. I think he has little knowledge of the course. Stall at some problems. For me, the quality is really poor for just a course in masters level and every student that took it must be feeling so empty as well as me, generally a waste of fees.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>good</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>good</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>good</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>he has communication problem he is unable to explain to students properly</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i am completely satisfied with the professor</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>instructor is has good experience in the field.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>prof is very talented</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>professor provides a well organised material and coursework for students.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Course Evaluation Reporting

### Courses for: Zhaohui Wang

<table>
<thead>
<tr>
<th>CRN</th>
<th>Term</th>
<th>College</th>
<th>Department</th>
</tr>
</thead>
<tbody>
<tr>
<td>12316</td>
<td>Fall 2015 TAMUK</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Instructor & Course Questions

<table>
<thead>
<tr>
<th>Description</th>
<th>Strongly Agree %</th>
<th>Strongly Disagree %</th>
<th>Agree %</th>
<th>Neutral %</th>
<th>Strongly Agree %</th>
<th>Strongly Disagree %</th>
<th>Total</th>
<th>N/A</th>
<th>Avg</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Considerate of the students during class</td>
<td>72</td>
<td></td>
<td>46</td>
<td>10</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.29</td>
</tr>
<tr>
<td>Presents the subject matter in a clear and organized manner</td>
<td>72</td>
<td></td>
<td>40</td>
<td>11</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.14</td>
</tr>
<tr>
<td>Tests and other requirements cover the course description in the syllabus</td>
<td>72</td>
<td></td>
<td>51</td>
<td>8</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.40</td>
</tr>
<tr>
<td>Sets high academic standards</td>
<td>72</td>
<td></td>
<td>42</td>
<td>14</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.17</td>
</tr>
<tr>
<td>Follows the grading system outlined in the syllabus</td>
<td>72</td>
<td></td>
<td>53</td>
<td>13</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.28</td>
</tr>
<tr>
<td>Available during office hours</td>
<td>72</td>
<td></td>
<td>57</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.51</td>
</tr>
<tr>
<td>Lectures focus on the material outlined in the syllabus</td>
<td>72</td>
<td></td>
<td>47</td>
<td>16</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.26</td>
</tr>
<tr>
<td>Results are returned in a reasonable amount of time</td>
<td>72</td>
<td></td>
<td>47</td>
<td>10</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.38</td>
</tr>
<tr>
<td>Textbook support the course objectives</td>
<td>72</td>
<td></td>
<td>47</td>
<td>14</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.31</td>
</tr>
<tr>
<td>Takes time to answer questions</td>
<td>72</td>
<td></td>
<td>14</td>
<td>18</td>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.04</td>
</tr>
<tr>
<td>Attempts to involve students in class discussions/activities</td>
<td>72</td>
<td></td>
<td>38</td>
<td>38</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.07</td>
</tr>
<tr>
<td>Required high quality work</td>
<td>71</td>
<td></td>
<td>24</td>
<td>20</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.34</td>
</tr>
<tr>
<td>Communicates the importance of the subject matter</td>
<td>72</td>
<td></td>
<td>38</td>
<td>47</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.19</td>
</tr>
<tr>
<td>Cannot be reached during posted office hours</td>
<td>70</td>
<td></td>
<td>9</td>
<td>4</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.23</td>
</tr>
<tr>
<td>Uses examples to help students understand</td>
<td>72</td>
<td></td>
<td>33</td>
<td>43</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.06</td>
</tr>
</tbody>
</table>

### Additional Questions

**Exhibit-4(3)**
### Amount of effort required to succeed

<table>
<thead>
<tr>
<th>Description</th>
<th>Response Total</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Same</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Lower</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

### Grade that I expect in this class

<table>
<thead>
<tr>
<th>Description</th>
<th>Response Total</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

### Reason for taking this course

<table>
<thead>
<tr>
<th>Description</th>
<th>Response Total</th>
<th>Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>

### Views on the quality of the instruction

- Gives good standard of application knowledge which makes student efficient for application of the subject in real world.
- Good
- Good instructor
- Good.
- I am privileged having found such an efficient professor.
- I like this subject
- N/A
- Requires more attention to the discipline of the students
- Teaching was good it was organised.I learned lot of things from the class
- The instructor is good and knowledgeable person.
- The lectures are taught very well. The professor stressed the concepts wherever it is essential. The pace at which the subject is taught was understandable. As an aspiring student I understood the subject very well that can solve the real world problems.
- Very good teaching, easily understandable.
- Excellent teaching
- Good teaching.
- He is good
- No comments

---

Copyright © 1998-2015 Runner Technologies, Inc. All rights reserved. 12/15/2015 0:45
Texas A&M University-Kingsville
UNDERGRADUATE CURRICULUM PROPOSAL APPROVAL FORM

Program Code: BSEE
Date Submitted: 11/06/15
Date Resubmitted:

Please attach one of these forms per set of proposals.
Please place an “A” for approved or a “D” for disapproved. Sign at bottom for appropriate committee.

<table>
<thead>
<tr>
<th>Proposal Number</th>
<th>Department Committee</th>
<th>Department Chair</th>
<th>College Committee</th>
<th>College Dean</th>
<th>University Curriculum Committee</th>
<th>Provost</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEEN-15-U-4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dept. Committee:  
Dept. Chair:  
College Committee Chair:  
College Dean:  
Univ. Committee Chair:  
Provost:  

Provost 12/12

Exhibit-5(1), 1
UNDERGRADUATE CURRICULUM PROPOSAL IDENTIFIER AND ROUTING SHEET

Please complete the information requested below and place on the front of the proposal. Complete one of these for each proposal.

1. This is page 1 of ___ pages of proposal number EEEN-15-U-4.

2. ___ EN ___ College (AgNRHS, AS, BA, EDHP, EN,)

3. ___ BSEE ___ Department or program area (please specify, using catalog prefix: e.g., STAT, HSCI, HIST, etc.)

4. Type of Request:
   ___ Add new program/degree/major
   ___ Modify program/degree/major
   ___ Delete program/degree/major
   ___ Add/Change lab fee
   ___ Add new course to catalog/inventory
   ___ Reinstate course to catalog/inventory
   ___ Delete course from catalog/inventory
   ___ Change course number and delete prior course from catalog/inventory
   ___ Changed course number replaces prior course
   ___ Change course title
   ___ Change course credit, class, and/or lab hours
   ___ Change course description
   ___ Change course prerequisites
   ___ Review for non-traditional/distance learning delivery
   ___ Other (please specify):

5. If this change could affect other department(s), please attach a memo from each department stating the name of chair/authorized person and the opinions of that department.

6. Submission procedures:
   Proposal should be submitted to department/area and include:
   (a) CURRICULUM PROPOSAL APPROVAL FORM. One form per set of proposals is necessary.
   (b) CURRICULUM PROPOSAL IDENTIFIER AND ROUTING SHEET. One per proposal.
   (c) PROPOSAL (one or more pages describing in detail the proposal following the prescribed format).

7. Deadlines: Fall
   College Curriculum Committee – September 15
   University Curriculum Committee – October 15
   Provost - November 15
   Registrar’s Office for Implementation – December 15

*aNew courses and significant changes to existing course descriptions require a syllabus/course outline to be attached. A syllabus/course outline must be attached when the course is to be offered through distance learning.

Provost 12/12

Exhibit-5(1), 2
Proposal No: EEEN-15-U-4

PROPOSAL SYNOPSIS:
Addition of new ‘Medical Imaging Principles’ course to the Undergraduate Electrical Engineering curriculum under the existing course number EEEN 4336 Selected Topics in Electrical Engineering is proposed.

PROPOSED CATALOG MATERIAL: See page 2 of this proposal.

SUMMARY OF PROPOSED CHANGES:
(1) Add ‘Medical Imaging Principles’ course to the Undergraduate Electrical Engineering curriculum under the existing course number EEEN 4336 Selected Topics in Electrical Engineering.

RATIONALE:
(1) Medical imaging principles provide basic knowledge of the commonly used and emerging biomedical imaging modalities including X-ray/CT, nuclear medicine, ultrasound, magnetic resonance imaging and optical imaging.
(2) Students at Texas A & M University-Kingsville will have the opportunity, for the first time, to learn this course from Dr. Zhaohui Wang.
(3) It is offered in many universities.
(4) Dr. Wang’s main research interest is in biomedical imaging. He has been working on this field for the last 10 years and has many journal papers and conference proceedings in this field.

PRESENT CATALOG MATERIAL:
EEEN 4336: Selected Topics in Electrical Engineering. V:1-3
One or more topics of electrical engineering. May be repeated when topic changes.
Prerequisite: consent of instructor.

PROPOSED CATALOG MATERIAL:
EEEN 4336: Selected Topics in Electrical Engineering. V:1-3
One or more topics of electrical engineering. May be repeated when topic changes.
Prerequisite: consent of instructor.

There is no change in CATALOG MATERIAL.

CATALOG PAGE(S) INVOLVED:
Page 301 in Undergraduate Catalog 2014-2016.

SYLLABUS
See attached.

NATURE OF COURSE
This course is given in lecture format.
GENERAL INFORMATION
The course is offered according to the schedule of the Frank H. Dotterweich College of Engineering. The expected enrollment is 10-20 undergraduate students.

PRECEDENT
Electrical engineering undergraduate and graduate programs at such universities as Stanford University (EE369C), University of Michigan (EECS 516), University of Louisville (ECE 641), University of California, Irvine (ENGRECE 237A), Southern Illinois University (ECE 467), Dartmouth College (ENGG 167), University of Georgia (ENGG 4620/6620), University of New Mexico (EECE 595), and many other universities offer this course.
EEEN 4336 SELECTED TOPICS IN ELECTRICAL ENGINEERING-Section 00X– Medical Imaging Principles 3(3-0)

Catalog Data:  EEEN 4336 3(3-0), One or more selected topics. May be repeated when topic changes. (Credit may not be obtained in both EEEN 4336 and CSEN 4335 courses if the topic is the same)

Course Description: This course is designed to introduce the mathematical, physical, engineering and biological principles important to a variety of biomedical cross-sectional imaging modalities. Modalities covered include x-ray radiography, computed tomography (CT), ultrasound imaging, positron emission tomography (PET) and magnetic resonance imaging (MRI). MATLAB is required in assignments for computer-aided analysis and design.

Prerequisite or Co-requisite: permission of the instructor.

Instructor:  Dr. Zhaohui Wang, Visiting Assistant Professor
            Email: zhaohui.wang@tamuk.edu
            Office Hours: EC208

Website Location: https://blackboard.tamuk.edu

TEXTBOOK:

REFERENCES


Policies:  1. Grading:
            Homework                             15%
            Attendance and class participation    10%
            Report/Presentation                   15%
            First Exam                           30%
            Second Exam                          30%
            Total                                100%

Tentative Exam Schedule:
            First Exam                        Week 8, TBD

Exhibit-5(1), 5
Second Examination: TBD as per University Final Exam Schedule

2. No late work will be accepted without university approved absence or instructor’s approval.
3. No make-up exams will be given.
4. Cell phone use will not permitted in class.
5. No early finals will be given. The final exam is as scheduled above.
6. No cell phones will be allowed during exams.
7. There will be no sharing of calculators on examinations.

Course Learning Outcomes (CLO)/Expected Performance Criteria:
By the end of the semester, students who pass this course should be able to:
1. identify the major medical imaging methods used in biomedical research
2. describe the physical processes underlying major medical imaging modalities including Positron emission tomography (PET) and single photon emission computed tomography (SPECT) Ultrasound imaging X-ray imaging and X-ray computed tomography (CT) Magnetic resonance imaging (MRI)
3. understand the essential mathematical concepts of image formation and reconstruction
4. describe methods for generating 2D and 3D medical images
5. explain the properties of medical images
6. describe a variety of applications of medical imaging techniques

At least 70% of students who pass this course will achieve these outcomes with the rating of at least 3.0 on the 1-4 scale (1-unsatisfactory; 2-developing, 3-satisfactory, 4-exemplary)

Relevant Student Learning Outcomes (ABET criterion 3):
(a) An ability to apply knowledge of mathematics, science, and engineering
(b) Ability to apply relevant scientific and engineering principles to solve real world medical imaging problems.

Tentative Topical Course Outline/Course Schedule:
Topics Covered:

<table>
<thead>
<tr>
<th>Week(Dates)</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2</td>
<td>Basic imaging principles: Fourier analysis, sampling theory, filter design, and MATLAB usage</td>
</tr>
<tr>
<td>3, 4</td>
<td>X-ray and computed tomography</td>
</tr>
<tr>
<td>5, 6, 7</td>
<td>Ultrasound imaging</td>
</tr>
<tr>
<td>8, 9, 10</td>
<td>Magnetic resonance imaging</td>
</tr>
<tr>
<td>11, 12</td>
<td>Optical coherence tomography</td>
</tr>
<tr>
<td>13, 14</td>
<td>Nuclear medicine imaging</td>
</tr>
</tbody>
</table>

Attendance Policy: No more than three unexcused absences will be allowed.

Computer usage: The use of MATLAB for computer-aided analysis and design is integrated into student assignments. Some original data and MATLAB example codes will be presented in the class and uploaded to the
Blackboard, so that the students can understand the principles.

Disability statement:
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disability. If you believe you have a disability requiring an accommodation please contact the Disability Resource Center (DRC) as early as possible in the term. DRC is located in the Life Service and Wellness building at 1210 Retama Drive, or call (361) 593-3024.

Academic misconduct statement:
You are expected to adhere to the highest academic standards of behavior and personal conduct in this course and all other courses. Students who engage in academic misconduct are subject to university disciplinary procedures. Make sure you are familiar with your Student Handbook, especially the section on academic misconduct, which discusses conduct expectations and academic dishonesty rules.

Forms of academic dishonesty:
1) Cheating: Using unauthorized notes or study aids, allowing another party to do one’s work/exam and turning in that work/exam as one’s own; submitting the same or similar work in more than one course without permission from the course instructors; deception in which a student misrepresents that he/she has mastered information on an academic exercise that he/she has not mastered; giving or receiving aid unauthorized by the instructor on assignments or examinations.
2) Aid of academic dishonesty: Intentionally facilitating any act of academic dishonesty. Tampering with grades or taking part in obtaining or distributing any part of a scheduled test.
3) Fabrication: Falsification or creation of data, research or resources, or altering a graded work without the prior consent of the course instructor.
4) Plagiarism: Portrayal of another’s work or ideas as one’s own. Examples include unacknowledged quotation and/or paraphrase of someone else’s words, ideas, or data as one’s own in work submitted for credit. Failure to identify information or essays from the Internet and submitting them as one’s own work also constitutes plagiarism.
5) Lying: Deliberate falsification with the intent to deceive in written or verbal form as it applies to an academic submission.
6) Bribery: Providing, offering or taking rewards in exchange for a grade, an assignment, or the aid of academic dishonesty.
7) Threat: An attempt to intimidate a student, staff or faculty member for the purpose of receiving an unearned grade or in an effort to prevent reporting of an Honor Code violation. Please be aware that the University subscribes to the Turnitin plagiarism detection service. Your paper may be submitted to this service at the discretion of the instructor.

Other Forms of Academic Misconduct:
1) Failure to follow published departmental guidelines, professor’s syllabi, and other posted academic policies in place for the orderly and efficient instruction of classes, including laboratories, and use of academic resources or equipment.
2) Unauthorized possession of examinations, reserved library materials, laboratory materials or other course related materials.
3) Failure to follow the instructor or proctor’s test-taking instructions, including but not limited to not setting aside notes, books or study guides while the test is in progress, failing to sit in designated locations and/or leaving the classroom/test site without permission during a test.
4) Prevention of the convening, continuation or orderly conduct of any class, lab or class activity.
Engaging in conduct that interferes with or disrupts university teaching, research or class activities such as making loud and distracting noises, repeatedly answering cell phones/text messaging or allowing pagers to beep, exhibiting erratic or irrational behavior, persisting in speaking without being recognized, repeatedly leaving and entering the classroom or test site without authorization, and making physical threats or verbal insults to the faculty member, or other students and staff.

5) Falsification of student transcript or other academic records; or unauthorized access to academic computer records.

6) Nondisclosure or misrepresentation in filling out applications or other university records.

7) Any action which may be deemed as unprofessional or inappropriate in the professional community of the discipline being studied.

Non-academic misconduct:
The university respects the rights of instructors to teach and of students to learn. Maintenance of these rights requires campus conditions that do not impede their exercise. Campus behavior that interferes with these rights will not be tolerated; examples include:

1) Interfering with the instructor's ability to conduct the class,

2) Causing inability of other students to profit from the instructional program, or

3) Any interference with the rights of others.

An individual engaging in such disruptive behavior may be subject to disciplinary action. Such incidents will be adjudicated by the Dean of Students under non-academic procedures.

Ongoing behaviors or single behaviors considered distracting (e.g., coming late to class, performing a repetitive act that is annoying, sleeping or reading a newspaper in class, etc.) will be addressed by the faculty member initially either generally or individually. Cases in which such annoying behavior becomes excessive and the student refuses to respond to the faculty member’s efforts can be referred to the Dean of Students. In the case of serious disruptive behavior in a classroom the instructor may first request compliance from the student and if it is not received, an instructor has the authority to ask the student to leave the classroom. If the student fails to leave after being directed to do so, assistance may be obtained from other university personnel, including University Police Department. An individual engaging in such disruptive behavior is subject to disciplinary action. Such incidents will be adjudicated by the Dean of Students under non-academic procedures to determine if the student should be allowed to return to the classroom.

Harassment /Discrimination:
Texas A&M University-Kingsville will investigate all complaints that indicate sexual harassment, harassment, or discrimination may have occurred by the facts given by the complainant. Sexual harassment of anyone at Texas A&M University-Kingsville is unacceptable and will not be tolerated. Any member of the university community violating this policy will be subject to disciplinary action. A person who believes he/she has been the victim of sexual harassment, harassment, or discrimination may pursue either the informal or the formal complaint resolution procedure. A complaint may be initially made to the complainant’s immediate supervisor, a department head, any supervisory employee, the Dean of Students (593-3606), or the Office of Compliance (593-4758). Regardless of who the complaint is filed with, the Compliance Office will be notified of the complaint so it can be investigated.

Sexual misconduct: See Student Code of Conduct section of the Student Handbook, which can be accessed from the Dean of Students website: http://osa.tamuk.edu/dean/.

Student Learning Outcomes:
Introduction to Medical Imaging Principles Outcomes

Outcome A: Our students have an ability to apply knowledge of mathematics, science, and engineering.

Outcome E: Our students have an ability to identify, formulate, and solve engineering problems.

**Program Outcome (a):** Our students have an ability to apply knowledge of mathematics, science, and engineering.

<table>
<thead>
<tr>
<th>Rubrics for Program Outcome (a): Ability to apply knowledge of mathematics, science, and engineering.</th>
<th>Unsatisfactory 1</th>
<th>Developing 2</th>
<th>Satisfactory 3</th>
<th>Exemplary 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apply of Mathematics and Science</strong></td>
<td>Has conceptual problem and cannot apply math and science of medical imaging principles to engineering problems.</td>
<td>Minimally understands and tries to apply math and science principles toward solving engineering problems.</td>
<td>Adequately understands and applies appropriate math and science principles. Handles algebra, trigonometry and calculus with minor error.</td>
<td>Understands and applies appropriate math and science principles. Handles algebra, trigonometry and calculus with almost no error.</td>
</tr>
<tr>
<td><strong>Apply of Engineering Topics</strong></td>
<td>Does not recall or incorrectly applies fundamental engineering knowledge in medical imaging principles.</td>
<td>Tries to identify and understand problems. Solves problems with frequent errors.</td>
<td>Frequently identifies and understands problems. Solves problems with minor error</td>
<td>Always identifies and understands problems. Solves problems with almost no error.</td>
</tr>
</tbody>
</table>

**Assessment Measure 1:** At least 70% of students will achieve the ability rating of at least 3 on the 1-4 scale from the rubrics that are specifically devised to measure the course learning outcomes that are linked to Program Outcome (a).

**Program Outcome (e):** Our students have an ability to identify, formulate, and solve engineering problems.

<table>
<thead>
<tr>
<th>Rubrics for Program Outcome (e): Ability to identify, formulate, and solve engineering problems.</th>
<th>Unsatisfactory 1</th>
<th>Developing 2</th>
<th>Satisfactory 3</th>
<th>Exemplary 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Identifies Engineering Problems</strong></td>
<td>No conceptual understanding of the problem.</td>
<td>Minimal conceptual understanding of the problem.</td>
<td>Basic conceptual understanding of the problem.</td>
<td>Complete understanding of the problem.</td>
</tr>
<tr>
<td><strong>Formulates Engineering Problems</strong></td>
<td>Cannot describe the problem.</td>
<td>Simple formulation with limited errors.</td>
<td>A correct formulation of the problem.</td>
<td>A clear, correct statement indicating the nature and purpose of each factor in the formulation.</td>
</tr>
<tr>
<td><strong>Solves Engineering Problems</strong></td>
<td>Unable to solve the problem.</td>
<td>Reasonable attempt at solution.</td>
<td>Correct solution to formulation.</td>
<td>Correct solution presented and interpreted in a broader context.</td>
</tr>
</tbody>
</table>

**Assessment Measure 1:** At least 70% of students will achieve the ability rating of at least 3 on the 1-4 scale from the rubrics that is specifically devised to measure the course learning outcomes that are linked to Program Outcome (e).

Prepared by Dr. Zhaohui Wang

November 04, 2015
A. PROPOSAL:
Addition of new advanced topic Medical Imaging Principles and Applications to the Graduate Electrical Engineering curriculum is proposed.

B. EEEN 5303(X) Advanced Topics in Electrical Engineering: Medical Imaging Principles and Applications 3(3-0) introduces the mathematical, physical, engineering and biological principles and multi-disciplinary applications of a variety of emerging biomedical imaging modalities. Modalities covered include magnetic resonance electrical impedance tomography, magnetoacoustic tomography, ultrasound elasticity imaging, ultrasound thermal strain imaging, ultrasound shear wave imaging, ultrasound Doppler imaging, acoustoelectric effect, photoacoustic imaging, optical coherence tomography, microscopy, fluorescence imaging, and positron emission tomography etc.

C. TEXTBOOK:
Medical Imaging Signals and Systems, by J. L. Prince et al, Pearson Prentice Hall, 2006
REFERENCES:
Principles of Medical Imaging, by K. K. Shung et al., Academic Press, 1992
The Essential Physics of Medical Imaging, 2/E, by J. T. Bushberg et al, 2001
Photoacoustic imaging and spectroscopy, by L. V. Wang, CRC Press, 2009

D. SYLLABUS
See attached.

E. NATURE OF COURSE
This course is given in lecture format. Library holdings are adequate.

F. GENERAL INFORMATION
The course is offered according to the schedule of the Frank H. Dotterweich College of Engineering. The expected enrollment is 10-20 undergraduate students. Dr. Zhaohui Wang is available to teach this course.

G. PRECEDENT
Electrical engineering undergraduate and graduate programs at such universities as Stanford University (EE369C), University of Michigan (EECS 516), University of Louisville (ECE 641), University of California, Irvine (ENGRECE 237A), Southern Illinois University (ECE 467), Dartmouth College (ENGG 167), University of Georgia
(ENGG 4620/6620), University of New Mexico (EECE 595), and many other universities offer this course.
Catalog Data:  EEEN 5303. 3(3-0) One or more advanced topics. May be repeated when topic changes. (Credit may not be obtained in both EEEN 5303 and CSEN 5303 courses if the topic is the same)

Course Description: EEEN5303 Medical Imaging Principles and Applications 3(3-0) introduces the mathematical, physical, engineering and biological principles and multi-disciplinary applications of a variety of emerging biomedical imaging modalities. Modalities covered include magnetic resonance electrical impedance tomography, magnetoacoustic tomography, ultrasound elasticity imaging, ultrasound thermal strain imaging, ultrasound shear wave imaging, ultrasound Doppler imaging, acoustoelectric effect, photoacoustic imaging, optical coherence tomography, microscopy, fluorescence imaging, and positron emission tomography etc.

Instructor:  Dr. Zhaohui Wang, Visiting Assistant Professor
Office:  EC 208
Phone:  (361) 593 - 4973
Email:  zhaohnui.wang@tamuk.edu

Office Hours: TBD


References:  

Policies:
1. Grading:
   Homework 10%
   Attendance and class participation 10%
   Report/Presentation 20%
   First Exam 30%
   Second Exam 30%
   Total 100%

   Tentative Exam Schedule:
   First Exam  Week 8, TBD
   Second Exam  TBD as per University Final Exam Schedule
2. Final grade determined based on a percentage of the total possible:
   A = 90-100%; B = 80-89%; C = 70-79%; D = 60-69%; F = $<60\%$.
3. Late work without university approved absence or my prior approval will not be accepted.
4. No make-up exams will be given. The Final Exam will take the place of a missed exam for university approved absences.
5. Attendance will be taken.
6. Cell phones should be turned off or placed in silent mode. No texting in class. No talking in class.
7. No early finals will be given. The final exam is as scheduled above.
8. No cellphones and no books/class notes on desks during exams.
9. There will be no sharing of calculators on exams.

**Course Learning Outcomes (CLO)/Expected Performance Criteria:**

By the end of the semester, students who pass this course should be able to:
1. identify the major medical imaging methods used in biomedical research
2. describe the physical processes underlying major medical imaging modalities including
   a. Optical coherence tomography (OCT)
   b. Ultrasound: elasticity imaging, thermal strain imaging, Doppler imaging
   c. Magnetoacoustic tomography (MAT)
   d. Magnetic resonance imaging (MRI)
3. understand the essential mathematical concepts of image formation and reconstruction
4. describe methods for generating 2D and 3D medical images
5. explain the properties of medical images
6. describe a variety of applications of medical imaging techniques

At least 70% of students who pass this course will achieve these outcomes with the rating of at least 3.0 on the 1-4 scale (1-unsatisfactory; 2-developing, 3-satisfactory, 4-exemplary)

**Student Learning Outcomes:**

Students will gain the following:

- **SLO 1.1.** an ability to apply knowledge of mathematics, science, and engineering.
- **SLO 2.1.** an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**Tentative Topical Course Outline/Course Schedule:**

<table>
<thead>
<tr>
<th>Week (Dates)</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 3</td>
<td>Ultrasound: elasticity imaging, shear wave imaging, thermal strain imaging, Doppler imaging</td>
</tr>
<tr>
<td>4, 5</td>
<td>Acoustoelectric effect, photoacoustic imaging</td>
</tr>
<tr>
<td>6, 7</td>
<td>Optical coherence tomography</td>
</tr>
<tr>
<td>8, 9</td>
<td>Molecular imaging: microscopy, fluorescence imaging</td>
</tr>
<tr>
<td>10, 11</td>
<td>Magnetoacoustic tomography</td>
</tr>
<tr>
<td>12, 13</td>
<td>Magnetic resonance electrical impedance tomography</td>
</tr>
<tr>
<td>14, 15</td>
<td>Positron emission tomography</td>
</tr>
</tbody>
</table>
Attendance Policy: No more than three unexcused absences will be allowed.

Computer usage: The use of JAVA/MATLAB for computer-aided analysis and design is integrated into student assignments. Some original data and MATLAB example codes will be presented in the class and uploaded to the Blackboard, so that the students can understand the principles.

Disability statement: The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disability. If you believe you have a disability requiring an accommodation please contact the Disability Resource Center (DRC) as early as possible in the term. DRC is located in the Life Service and Wellness building at 1210 Retama Drive, or call (361) 593-3024.

Academic misconduct statement: You are expected to adhere to the highest academic standards of behavior and personal conduct in this course and all other courses. Students who engage in academic misconduct are subject to university disciplinary procedures. Make sure you are familiar with your Student Handbook, especially the section on academic misconduct, which discusses conduct expectations and academic dishonesty rules.

Forms of academic dishonesty:
1) Cheating: Using unauthorized notes or study aids, allowing another party to do one’s work/exam and turning in that work/exam as one’s own; submitting the same or similar work in more than one course without permission from the course instructors; deception in which a student misrepresents that he/she has mastered information on an academic exercise that he/she has not mastered; giving or receiving aid unauthorized by the instructor on assignments or examinations.
2) Aid of academic dishonesty: Intentionally facilitating any act of academic dishonesty. Tampering with grades or taking part in obtaining or distributing any part of a scheduled test.
3) Fabrication: Falsification or creation of data, research or resources, or altering a graded work without the prior consent of the course instructor.
4) Plagiarism: Portrayal of another’s work or ideas as one’s own. Examples include unacknowledged quotation and/or paraphrase of someone else’s words, ideas, or data as one’s own in work submitted for credit. Failure to identify information or essays from the Internet and submitting them as one’s own work also constitutes plagiarism.
5) Lying: Deliberate falsification with the intent to deceive in written or verbal form as it applies to an academic submission.
6) Bribery: Providing, offering or taking rewards in exchange for a grade, an assignment, or the aid of academic dishonesty.
7) Threat: An attempt to intimidate a student, staff or faculty member for the purpose of receiving an unearned grade or in an effort to prevent reporting of an Honor Code violation. Please be aware that the University subscribes to the Turnitin plagiarism

Exhibit-5(2), 5
Other Forms of Academic Misconduct:

1) Failure to follow published departmental guidelines, professor’s syllabi, and other posted academic policies in place for the orderly and efficient instruction of classes, including laboratories, and use of academic resources or equipment.

2) Unauthorized possession of examinations, reserved library materials, laboratory materials or other course related materials.

3) Failure to follow the instructor or proctor’s test-taking instructions, including but not limited to not setting aside notes, books or study guides while the test is in progress, failing to sit in designated locations and/or leaving the classroom/test site without permission during a test.

4) Prevention of the convening, continuation or orderly conduct of any class, lab or class activity. Engaging in conduct that interferes with or disrupts university teaching, research or class activities such as making loud and distracting noises, repeatedly answering cell phones/text messaging or allowing pagers to beep, exhibiting erratic or irrational behavior, persisting in speaking without being recognized, repeatedly leaving and entering the classroom or test site without authorization, and making physical threats or verbal insults to the faculty member, or other students and staff.

5) Falsification of student transcript or other academic records; or unauthorized access to academic computer records.

6) Nondisclosure or misrepresentation in filling out applications or other university records.

7) Any action which may be deemed as unprofessional or inappropriate in the professional community of the discipline being studied.

Non-academic misconduct:
The university respects the rights of instructors to teach and of students to learn. Maintenance of these rights requires campus conditions that do not impede their exercise. Campus behavior that interferes with these rights will not be tolerated; examples include:

1) Interfering with the instructor's ability to conduct the class,

2) Causing inability of other students to profit from the instructional program, or

3) Any interference with the rights of others.

An individual engaging in such disruptive behavior may be subject to disciplinary action. Such incidents will be adjudicated by the Dean of Students under non-academic procedures.

Ongoing behaviors or single behaviors considered distracting (e.g., coming late to class, performing a repetitive act that is annoying, sleeping or reading a newspaper in class, etc.) will be addressed by the faculty member initially either generally or individually. Cases in which such annoying behavior becomes excessive and the student refuses to respond to the faculty member’s efforts can be referred to the Dean of Students. In the case of serious disruptive behavior in a classroom the instructor may request compliance from the student and if it is not received, the instructor has the authority to ask the student to leave the classroom. If the student fails to leave after being directed to do so, assistance may be obtained from other university personnel, including University Police Department. An individual engaging in such disruptive behavior is subject to disciplinary action. Such incidents will be adjudicated by the Dean of Students under non-academic procedures to determine if the student should be allowed
to return to the classroom.

**Harassment /Discrimination:**
Texas A&M University-Kingsville will investigate all complaints that indicate sexual harassment, harassment, or discrimination may have occurred by the facts given by the complainant. Sexual harassment of anyone at Texas A&M University-Kingsville is unacceptable and will not be tolerated. Any member of the university community violating this policy will be subject to disciplinary action. A person who believes he/she has been the victim of sexual harassment, harassment, or discrimination may pursue either the informal or the formal complaint resolution procedure. A complaint may be initially made to the complainant’s immediate supervisor, a department head, any supervisory employee, the Dean of Students (593-3606), or the Office of Compliance (593-4758). Regardless of who the complaint is filed with, the Compliance Office will be notified of the complaint so it can be investigated.

**Sexual misconduct:** See *Student Code of Conduct* section of the Student Handbook, which can be accessed from the Dean of Students website: [http://osa.tamuk.edu/dean/](http://osa.tamuk.edu/dean/).

**Student Learning Outcome 1.1 Ability to apply knowledge of mathematics, science, and engineering.**

<table>
<thead>
<tr>
<th></th>
<th>Unsatisfactory</th>
<th>Developing</th>
<th>Satisfactory</th>
<th>Exemplary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apply of Mathematics and Science</strong></td>
<td>Has conceptual problem and cannot apply math and science <em>(course specific topics)</em> to engineering problems.</td>
<td>Minimally understands and tries to apply math and science principles toward solving engineering problems.</td>
<td>Adequately understands and applies appropriate math and science principles. Handles algebra, trigonometry and calculus with minor error.</td>
<td>Understands and applies appropriate math and science principles. Handles algebra, trigonometry and calculus with almost no error.</td>
</tr>
<tr>
<td><strong>Apply of Engineering Topics</strong></td>
<td>Does not recall or incorrectly applies fundamental engineering knowledge in <em>(course specific topics)</em>.</td>
<td>Tries to identify and understand problems. Solves problems with frequent errors.</td>
<td>Frequently identifies and understands problems. Solves problems with minor error</td>
<td>Always identifies and understands problems. Solves problems with almost no error.</td>
</tr>
</tbody>
</table>

Prepared by Dr. Zhaohui Wang  
Nov. 09, 2015.
Manuscript Submission Number UMB-D-15-00710

Christy Holland <Christy.Holland@uc.edu>  
To: wangzhh@ustc.edu, zhwang7@gmail.com

Mon, Dec 21, 2015 at 5:06 PM

Ref.: Ms. No. UMB-D-15-00710  
Complementary Detection of Multiple Electrical Sources in Tissue Using Acoustoelectric Effect  
Ultrasound in Medicine and Biology

Dear Dr. Wang,

Thank you for submitting your manuscript entitled, "Complementary Detection of Multiple Electrical Sources in Tissue Using Acoustoelectric Effect" for publication in Ultrasound in Medicine and Biology. The review process has now been completed and, guided by the referees' advice, I have decided that the paper should not be accepted for publication in the journal without major revision. Copies of the referees' recommendations are appended below. If for some reason they are not, please contact me as soon as possible.

I very much hope that you and your colleagues will find the referees' comments to be both helpful and constructive. I also hope that you will be willing to revise the manuscript extensively after giving careful consideration to the points that the referees' have made.

To assist you with meeting all of the formatting requirements for revised submissions, here is the link to our revision checklist:

http://ees.elsevier.com/umb/img/umb_revision_checklist.xls

Please point your browser to http://ees.elsevier.com/umb/ and log in as an Author to resubmit the entire revised manuscript, including figures. You will see a menu item called Submission Needing Revision, as well as your submission record there. A Detailed Response to Reviewer letter accompanying this resubmission is required. This document should show each reviewer comment followed by your response. Each response should state whether there are any changes in the revision (citing page #/line#) and should explain the nature of the changes.

The Journal has a policy that revisions must be submitted within two months, or else the paper will be regarded as de facto rejected. It is required that your revision be received by Feb 19, 2016.

If you have reasons for not being able to make this deadline, please send an e-mail message as soon as practicable to umbeditor@uc.edu explaining why. You may or may not be granted an extension, based on the substance of the request.

With kind regards,

Christy K. Holland, Ph.D.  
Editor-in-Chief  
Ultrasound in Medicine and Biology  
U.C. Cardiovascular Center, Room 3988  
231 Albert Sabin Way  
Cincinnati, OH 45267-0586  
USA

UMB Editorial Office Phone: +1 (513) 558-2508

Exhibit-6(1)-1, 1
Reviewer #1: Introduction
The mathematical notation is somewhat ambiguous and would benefit from some explanation of the types of objects (e.g., scalars, vectors, tensors) and the operations performed (e.g., convolution).

Methods
The pulse length ("short") needs to be stated explicitly.
Why was the tissue not degassed?
Why were experiments carried out at room temperature instead of physiological temperature?

Discussion
This is the most important deficiency: the authors need to discuss the difference in ion flow between propagating nerve signals and injected current in tissue.

Conclusion
The claim "no matter how close" is unsupported by the data. The authors should be quantitative in their claims.

Figures
Figure 3(b) - the authors should consider a logarithmic scale to better show the thickness data, or else inset a smaller graph with an expanded scale for the thickness data.

Reviewer #2: Review on "Complementary Detection of Multiple Electrical Sources in Tissue Using Acoustoelectric Effect"

This article describes a design of electrodes to map electrical impedance of tissue using acoustoelectric effect. The design includes two complementary Wheatstone bridge circuits to get two separate current flows. These two currents can be added or subtracted to get relevant information. The article describes the theoretical background of this idea and then validates it with both experimental and numerical studies. Some parts of the article are tedious to read, especially the results and discussion part, and the figures need to be improved. Many results have already been published in a previous proceeding. The article seems nevertheless technically rigorous and presents an interest for UMB readership.

Major comments
1. An important part of the study has been published in a previous proceeding from the authors (Detection of multiple electrical sources in tissue using ultrasound current source density imaging, Wang et al, Proc SPIE, Medical Imaging 2010). In particular, many figures are exactly identical: Figures 1c, 1d, 2a, 3a (schematics), 5a (photograph), 4a, 4b, 4c, 4d, 4e, 5b, 5c, 5d (results). I would have appreciated to have more new results.
2. The results and discussion section is currently tedious to read. There many references to subfigures and some subfigures are even referred numerous times (for example, fig 1c is referred 6 times throughout the article). I suggest presenting each figure with the following structure (note the purpose is only to provide an example of presentation, these sentences are not a requirement): "Figure XX presents [...] . We can observe that [...] . We deduce that [...] ". The article would then probably be easier to read.
3. Figures should be improved: images quality is poor (I see compression artifacts; this might be due to conversion by the uploading?); some figures are redundant (figures 1a, 1b, 2a and 3a could easily be merged into two detailed images, maybe even one); many unclear abbreviations are used; figures should be more self-consistent, without need to read the legends to understand them (legend of figures should focus on briefly presenting the figures and potentially report one or two relevant observations); I would also add that when printed in black and white, most pictures are hard to read, especially the photographs (Figures 2b, 2c and 5a). Specific figures comments are detailed in a dedicated section.
4. The article is introduced by presenting "electrical sources" mapping techniques, but introduce in fact some electrical impedance mapping techniques (EIT, MAT/MAT-MI), which is different.
5. Part of the simulation parameters are placed in the results section (p8, l171-175 for example): methods and related parameters should be included in the methods section
6. Figure 4e: a parasite signal of same frequency as AE signal seems present: could the authors comment on that?
7. The simulation is based on the assumption of constant current density and uniform distribution of lead field inside the tissue: to which extend is it a valid approximation? Was this assumption studied in a previous study? (reference would be welcomed in this case)

Figure-specific comments
8. Figures 1a, 1b, 2a, 3a could be merged into two (maybe one) figure.
9. Figure 1b is hard to read. Authors could put arrows next to text, to understand to which object they are referring to. Shadows are unnecessary. Dotted lines and numbers are not explained. Abbreviation like sw1, sw2 should be avoided.
10. Figure 2a: I do not understand why figure 1b presented tissue slabs above each set of electrodes and why figure 2a presents tissue slabs between the two sets of electrodes: which one is correct? Also, two black lines are present between the two tissues, are they connected with wires? Figures should also avoid color-coded description if possible, as they can be mixed when shown in black and white and could be missed by colorblind readers - arrows should be sufficient in this particular case.
11. Figure 2b and 2c: it is hard to properly distinguish the setup on the photograph, other shots are required (a good one should be sufficient). Main elements should be defined (rack, electrodes, etc)
12. Figures 3c and 3d: no abbreviation should be used (freq, FWHM). Size unit is missing (I understand that the numbers indicates the "n" but it is unclear). Sensitivity unit is missing. Authors should write MHz instead of MHz.
13. Figure 4a: Title should indicate that it is the basis of the simulation ("phantom" word suggests that it is experimental).
14. Figures 4b, 4c, 4d: abbreviations should be avoided, especially PE.
15. Figure 4e: Authors should mention on the graph that it corresponds to the x=0 mm line.
16. Figure 5a: it is hard to properly distinguish anything on the photograph. It could be removed, or another shot could be provided.
17. Figures 5b, 5c, 5e should have a title, like figures 4a,4b,4c and 4d
18. Figures 5e: abbreviations should be avoided
19. Figures 6a, 6b, 6c, 6d: proper names should be used (instead of sim_1st, sim_add etc), and titles should be added.
20. Figures 7a, 7b, 7c, 7d: same comments as above. A colorbar should be added, at least for the AE signal, and values should be removed from the legend.
21. If I am not mistaken, Figure 7b is not described nor used: if it has no interest for the reader, it should be removed.
22. Legends of Figures 6 and 7 seem to have been inverted.

Minor comments
23. Authors have cited "epilepsy" as a keyword of their article ; epilepsy appears however only one time in the article core : either more details should be provided, either this keyword should be removed
24. (p3, l39) "Hall Effect Imaging" name is not used any more, as it has been stated that no Hall effect is involved in the technique (Comments on Hall Effect Imaging, Roth et al, IEEE Trans. Biomed. Imag., 1998). A mention of that would be appreciated.
25. Authors are reviewing electrical impedance imaging techniques in the introduction, by presenting EIT and "Hall Effect Imaging" in reverse mode/MAT/MAT-MI. They should also mention "Hall Effect Imaging" in direct mode, currently named MAET (Magneto-acousto-electrical tomography, Haider et al., Physiol. Meas., 2008) or LFEIT (Lorentz force Electrical Impedance Tomography, Grasland-Mongrain et al., IRBM, 2013); and also MREIT (see below).
26. (p3, l40) Liu et al. 2009 article is about MREIT, not MAT. In this technique, an electrical current is injected through electrodes and magnitude throughout the body is measured with a MRI system, which allows reconstructing electrical impedance of the body. It would be worth to be mentioned.
27. (p3, l47) For a non-familiar reader, UCSDI technique description might be unclear, as it is both brief and technical. Also, differences between Acousto-Electric Tomography (p3, l56) and UCSDI are unclear at this stage. Please rephrase.
28. (p5, l45) symbol * (scalar product) should be defined

Exhibit-6(1)-1, 3
29. (p3, l52) Past and present tense are alternatively used, authors should be coherent.
30. (p4, l84) "Lead theory" should be referenced, as it could be unknown for some non-familiar readers.
31. (p5, l92) The references to Olafsson 2007 and Wang 2011 are unnecessary for this sentence - these two references are naturally relevant to the present article, but should be introduced somewhere else.
32. (p5, l97) \( \langle \rho \rangle \) and \( \langle \rho \rangle > 0 \) should be defined here, and not in the introduction section
33. (p5, l100) What are the cut-off frequencies of the bandpass filter? (at least approximately)
35. (p5, l107), (p7, l160), (p7, l163), (p7, l165 x2), (p8, l166) Proper reference of the material should be provided (model, manufacturer name, location and country)
36. (p6, l118) Why was the \( \approx \) (approximately) symbol used? It seems to be exactly equal.
37. (p6, l119) \( k_x, k_y, k_z \) have not been defined
38. (p7, l150) What does "1% saline" exactly means? If it is a saline solution, it is 0.9% NaCl; if it is 1% NaCl, it is not a saline solution.
39. (p7, l152) "The interaction constants are in the same order": about which values?
40. (p8, l165) Was the pressure measure by the Onda hydrophone? If yes, this material should be presented here (instead of p5, l107)
41. (p8, l171) Matlab version and reference to the manufactures are missing
42. (p8, l178), (p8, l181) References to Wang et al. 2010 and 2013 do not support these sentences.
43. (p9, l190 and l205) Symbols like \( < \) and \( > \) should be avoided in titles
44. (p9, l196) SNR equation should be properly written, not with such inline formula
45. (p9, l197) Abbreviations like p-p should be avoided
46. (p9, l198-204) This paragraph describing figure 4 seems to be better placed before the previous paragraph which discusses the results shown in figure 4.
47. (p9, l212) Authors should quote explicitly "Figures 5, 6 and 7" (not a misleading "Fig. 5-7").
48. (p9, l214) Hot color is not present in figures 6, sentence seems to be misplaced.
49. (p9, l214) Descriptions of the figure 6 are strange: "to create two new groups of data by addition (fig. 6c) and substraction (fig. 6d)": I read exp._1st and exp._2nd in fig 6c, suggesting it is experimental data; "the two tissues can be separated clearly in the computed images": I don't see any images in figure 6; etc.
50. (p10, l235) Please remove "Matlab TM" or replace by "Matlab simulations"
51. (p13, l303), (p13, l308) Reference seems incomplete for SPIE proceedings (Biomedical Optics and Medical Imaging respectively are missing)
Complementary Detection of Multiple Electrical Sources in Tissue

Using Acoustoelectric Effect

Zhaohui Wang\textsuperscript{1*}, Rajab Challoo\textsuperscript{1}, Weida Hao\textsuperscript{1}, Chung S. Leung\textsuperscript{1}, and Russell S. Witte\textsuperscript{2,3,4}

\textsuperscript{1}Department of Electrical Engineering and Computer Science, Texas A&M University-Kingsville, Kingsville, Texas, USA

\textsuperscript{2}Department of Medical Imaging, University of Arizona, Tucson, AZ 85724 USA

\textsuperscript{3}Department of Optical Sciences, University of Arizona, Tucson, AZ 85724 USA

\textsuperscript{4}Department of Biomedical Engineering, University of Arizona, Tucson, AZ 85724 USA

*Correspondence to: Zhaohui Wang, PhD

Department of Electrical Engineering and Computer Science, Texas A&M University-Kingsville, USA

MSC 192, 700 University Blvd., Kingsville, Texas 78363

Phone: (412)623-9753

Email: zhaohui.wang@tamuk.edu
Abstract—Three dimensional accurate mapping of multiple bioelectric sources in intertwined nerve fibers with high spatial resolution is challenging for the diagnosis and treatment of a variety of neural abnormalities. Ultrasound current source density imaging (UCSDI) based on the acousto-electric (AE) effect, an interaction between electrical current and acoustic pressure waves propagating through a conducting material, has distinct advantages over conventional electrophysiology (i.e., without ultrasound) to map electrical current flow in tissue. UCSDI and two complementary Wheatstone bridge circuits were used to detect simultaneously two separate current flows induced in tissue phantoms. It is proved that addition and subtraction of the AE signals acquired by the two circuits are independent components, no matter whether the two sources are positioned at the same or different depths. In the ultrasound field, the AE signal from bridge circuits is stronger with higher SNR than without using bridge circuit. Both experimental and simulated AE images depended on the magnitude and direction of the current, as well as the geometry (shape and thickness) and location of the current sources in the ultrasound field (2.25MHz transducer). The experimental results are consistent with simulations consisting of multiple current sources. Real-time 3-D UCSD images of multiple current flows co-registered with anatomical (pulse echo, PE) ultrasound potentially facilitates monitoring neurological disorders.

Keywords: Acousto-electric, bioelectric, electrophysiology, mapping, epilepsy
I. INTRODUCTION

Three dimensional mapping of bioelectric sources in the body with high spatial resolution is important for
diagnosis and treatment of a variety of cardiac and neurological disorders. Mapping of electrical sources has many
applications in biomedical research. Electrical impedance tomography applied currents through electrodes attached
to the surface of the body and measured the resulting voltages to reconstruct approximate pictures of the electric
conductivity inside the body (Cheneyy et al. 1999). In Hall effect imaging (HEI) (Wen et al. 1998) and
magnetoacousto tomography (MAT) (Liu et al. 2009), the electrical current in biological tissue that was placed in a
static magnetic field generated acoustic vibrations inside tissue volume because of the Lorentz force. Acoustic
signals were then measured around the object for inverse reconstruction. The conductivity distribution of head-brain
tissue were reconstructed by considering the charge accumulating on the interfaces. In magnetoacousto tomography
with magnetic induction (MAT-MI) (Liu et al. 2005), instead of using electrical stimulation, the eddy current was
induced in tissue by the time-varying magnetic field and interact with the static magnetic field to create acoustic
vibrations. However, these methods based on inverse solution are ambiguous in localizing source signal arising from
the deep regions. Three dimensional ultrasound current source density imaging (UCSDI) (Olafsson et al. 2007)
potentially overcomes limitations with conventional electrophysiology (i.e., no ultrasound) by providing enhanced
spatial resolution determined by the ultrasound focus combined with less invasive detection schemes (Wang et al.
2014, 2011). The voltage signal between two recording electrodes can be detected with higher SNR by UCSDI
according to Ohm's law and the acousto-electric (AE) effect.

The acousto-electric signal was proportional to the applied pressure and current density and sensitive to the
direction of current flow. The AE effect (Fox et al. 1946, Lavandier et al. 2000) is the interaction between a
propagating acoustic wave and charged particles in a material (saline solution, gel, graphite, metal, etc.), and \( \Delta \rho / \rho_0 = -K_I \Delta P \), where \( \Delta \rho \) is the resistivity change, \( \rho_0 \) is the direct current resistivity, \( \Delta P \) is the acoustic pressure, \( K_I \) is the
interaction constant with an order of \( 10^{-9} \text{ Pa}^{-1} \) in saline. Acousto-electric tomography (Zhang et al. 2004) could image
the electric impedance properties of biological tissue with a high spatial resolution, and the contrast was determined
by electrical impedance, media dependent modulation coefficient, and acoustic properties.

Neural disorders, such as arrhythmia in heart and epilepsy in brain, would greatly benefit from this new
diagnostic tool that noninvasively map conduction in abnormal tissue. UCSDI had been used to quickly map cardiac
activation waves in live rabbit heart, and the conduction velocity of the heart was estimated from the shifts as being
0.25±0.05 mm/ms (Olafsson et al. 2009, 2006). Therefore the ultrasound is fast enough to image the neuronal pulse
signal. To overcome the limitation of weak AE signal associated with the electrocardiogram, the effects of the
electrode configuration and ultrasound frequency on the magnitude of the AE signal and quality of UCSDI were also
investigated using rabbit Langendorff heart preparation (Qin et al. 2015). It was found that the AE signal was much
stronger at 0.5MHz than 1.0MHz, and a clinical lasso catheter placed on the epicardium exhibited excellent
sensitivity without penetrating the tissue.

Tracking different pathways of multiple intertwined nerve fibers is still a challenging topic to the diagnosis of
cardiac and neural abnormalities. Electron micrograph that reflects density differences was used to analyze fine
structure nerve tissue, but it required ultrathin sectioning of the nervous tissue, and fixative in avoiding shrinkage and
in producing the most delicate coagulum (Pease et al. 2005). Diffusion tensor MRI fiber tracking can give
information about nerve connectivity, but this technique relies on the use of good-quality diffusion weighted images
and a suitable algorithm to generate the track, and its validation is not straightforward due to the lack of a gold
standard (Tournier et al. 2002). Based on AE effect, two complementary bridge tissue circuits, each of which is
similar to Wheatstone bridge, are proposed here for the first time to simultaneously map multiple current flows
induced in two conducting tissue phantoms positioned at any depth. They can detect the relative position of the two
tissue phantoms transmitting current in different directions by applying simple addition and subtraction to the
measured UCSDI.

In this study, the simulation of AE signal was made based on the lead theory, and used to analyze the
dimensional effects over sensitivity and frequency spectrum. The proposed complementary circuit theory is provided
in the appendix section and evaluated by in silico simulation, which is further compared with in vitro experiments
using a single element ultrasound transducer.

II. METHODS

The custom simulation program developed in Matlab™ is based on ultrasound field and lead field theory using
known properties of the ultrasound transducer and dielectric properties of the test phantoms to complement the
experimental model and further characterize the relationship between the ultrasound beam and electrical properties
of the tissue.
A. Acoustoelectric Equations

In fig. 1, the center of the tissue slab is \( C(0, 0, 0) \), and the center of the transducer is \( T(x_0, y_0, z_0) \). In the experiment, the phantoms are put at the focus of the transducer, \( z_0 = -z_f \), where \( z_f \) is the focal length. Any point \( P \) in the ultrasound pressure field \((x, y, z)\) can be described in the electric coordinate system or lead field as \((x+x_0, y+y_0, z+z_0)\), or \( CT + TP \) (Olafsson et al. 2007, Wang et al. 2011). In the electric field, due to a distributed current source \( J_I = J_L(x, y, z) \), the voltage \( V \) measured by detector at coordinate \((x_0, y_0, z_0)\) can be expressed in three-dimensional equation using reciprocal theory, given the assumption of far field detection of the AE signal (Malmivuo et al. 1995).

\[
V(x_0, y_0, t) = \int \int \rho(x, y, z, t) (\mathbf{J}^L \cdot \mathbf{J}^I)(x+x_0, y+y_0, z+z_0) dx dy dz = \int \int (\mathbf{J}^L \cdot \mathbf{J}^I) \rho_0 dx dy dz + \int \int (\mathbf{J}^L \cdot \mathbf{J}^I)(-K_I \rho_0, p) dx dy dz
\]

(1)

where \( \mathbf{J}^I(x, y, z) \) is the electric lead field due to unit reciprocal current along the tissue slab between two detecting electrodes, and \( \mathbf{J}^L = \mathbf{L}^I(x, y, z) \) with \( I \) denoting the injected current, \( \rho = \rho(x, y, z, t) = \rho_0 (1 - K_I p) \) is the resistivity whose distribution is under the modulation of ultrasound pressure \( p = \Delta P \). In (1), \( V \) has low frequency component (1st term) and high frequency component (2nd term) that is the useful AE signal \( V^{AE} \) (Olafsson et al. 2007).

For both simulated data and measured data, the AE signal \( V^{AE} \) is filtered by a band-pass filter around the center frequency of transducer to achieve higher SNR. \( p(x, y, z, t) \) can be expanded into its subcomponents such that

\[
p(x, y, z, t) = P_0 b(x, y, z) a (t - \frac{z}{c})
\]

(2)

with ultrasound beam pattern \( b(x, y, z) \) defined with respect to the transducer at the origin, pressure pulse amplitude \( P_0 \), pulse waveform \( a(t) \), and speed of sound \( c \). For AE effect simulation, it is assumed that one element 2.25MHz concave transducer is excited by a pulse obtained from the signal generator, and then the ultrasound pressure field \( p(x, y, z, t) \) can be created by Field II simulation software (Wang et al. 2010). The impulse response to the transducer was obtained from the AE signal of commercial Onda hydrophone. The AE voltage \( V^{AE} \) measured by a tissue slab under the modulation of transducer at coordinate \((x_0, y_0, z_0)\) in the electric field can be expressed in three dimensions.

\[
V^{AE}(x_0, y_0, t) = P_0 \int \int K_I \rho_0 (\mathbf{J}^L \cdot \mathbf{J}^I)(x+x_0, y+y_0, z+z_0) \left[ b(x, y, z) a \left( t - \frac{z}{c} \right) \right] dx dy dz
\]

(3)

Based on the above equation, the calculation of \( V^{AE} \) can be speeded up greatly by applying inverse Fourier transform of the product between current density distribution and ultrasound field in frequency domain. To improve the computing velocity of cross-correlation, Fourier transform can finish 3D convolution in frequency domain at high

Exhibit-6(1)-2, 5
speed. As \( K_i = K_i(x, y, z) \), \( \rho_0 = \rho_0(x, y, z) \) both depend on the material properties, they can be combined together with

\[
J^l(x, y, z) \quad \text{and} \quad J^l(x, y, z), \quad \text{so that}
\]

\[
w(x, y, z) = K_i(x, y, z) \rho_0(x, y, z) \frac{\partial^2}{\partial x^2} J^l(x, y, z) \\
V^{AE} \quad \text{(x}_0, y_0, t) \quad \text{involves three correlations of} \quad w(x, y, z) \quad \text{and} \quad p(x, y, z, t), \quad \text{so it can be calculated quickly by 3-D}
\]

Fourier transform to accelerate the computing of correlation.

\[
V^{AE}(x_0, y_0, t) \approx \int \int \int w(x + x_0, y + y_0, z + z_0) p(x, y, z, t) \frac{\partial^2}{\partial x^2} F_{x, y, z}^{-1} \left[ W(k_x, k_y, k_z) F_{x, y, z}^* \right] \left[ p(x, y, z, t) \right]
\]

where \( z_0 = z_0 \) is 3D inverse Fourier transform over \( (k_x, k_y, k_z) \), \( W \) the 3D Fourier transform of \( w(x, y, z) \),

\[
F_{x, y, z}, \quad \text{3D Fourier transform over} \quad (x, y, z), \quad \text{and} \quad F_{x, y, z}^* \quad \text{the conjugate of} \quad F_{x, y, z} \quad \text{over} \quad k_x, k_y \quad \text{and} \quad k_z.
\]

As the long tissue slab is uniform along longitudinal direction (y), simulated A-line \( V^{AE} \) can be obtained by applying correlation of ultrasound field over current distribution in tissue along x-z cross-section.

B. Two Complementary Bridge Circuits

The two complementary bridge circuits (fig. 1c and d) are both similar to Wheatstone bridge, where the best detecting position of each branch is on the midpoint. If the axial distance between the two tissue slabs in ultrasound field is larger than one acoustic pulse length, the AE signals in each tissue slab can be detected and isolated when ultrasound pulse passes through at different times using only the 1st bridge circuit. If the axial distance is smaller than one pulse length, the two AE signals in fig. 1c and fig. 1d overlap, and it is not possible to separate them using one bridge circuit. Two complementary bridge circuits, however, can effectively isolate the AE signal of each source from the mixture.

From the Appendix, when the ultrasound beam is located on the left two electrodes (fig. 1b), the A-line is filtered by a band-pass filter with the same center frequency as the ultrasound, then

\[
\frac{u_1 + u_2}{2} = V_a, \quad \frac{u_1 - u_2}{2} = -V_b
\]

where \( u_1, u_2, v_\alpha, \) and \( v_\beta \) are the AC components of \( U_1, U_2, V_\alpha \), and \( V_\beta \). \( V_a \) and \( V_\beta \) are the voltage drops caused by the ultrasound modulation on segments \( \alpha R_1 \) and \( \beta R_2 \). \( U_1 \) and \( U_2 \) are the signals measured by the differential amplifier using the 1st circuit (fig. 1c) and 2nd circuit (fig. 1d). \( v_\alpha \) and \( v_\beta \) are two independent components because \( \alpha \) and \( \beta \) are independent to each other.

When the ultrasound beam focuses on the right part of the slabs (fig. 1b),
where \( u_1,\ u_2,\ v_1-\alpha, \) and \( v_1-\beta \) are the AC components of \( U_1,\ U_2,\ V_1,\) and \( V_1,\) respectively. \( V_1-\alpha \) and \( V_1-\beta \) are the voltage drops caused by the ultrasound modulation on segments \( (1-\alpha)R_1 \) and \( (1-\beta)R_2.\) \( v_1-\alpha \) and \( v_1-\beta \) are also two independent components.

From (6) and (7), the AC component of voltage drop on each segment can be reconstructed directly from the addition or subtraction of the filtered signals measured by two complementary bridge circuits. The reconstructed voltage drops on two tissue slabs in the ultrasound pressure field are two independent components. Therefore, the two tissue slabs can be separated by two complementary circuits even though they are at the same depth.

C. Experimental Setup

Each of two plastic racks was fabricated hollow in the center, forming an empty rectangular area with width of 15 mm and length of 80 mm (fig. 2b). The steel electrodes, with length of 30 mm and radius of 0.5 mm, were arranged parallel with interval 5mm on the surface of rack. The two turkey tissue (muscle) slabs, each approximately 1mm×4mm (thickness×width), were soaked in 1% saline for one hour, long enough for saline to enter inside, and the DC (direct current) resistance of the tissue phantoms was in the 1 to 10 kOhm range. Saline-soaked turkey tissue slab was used to approximate the nerve fiber because their interaction constants are in the same order. On the bottom of mineral oil tank, one rectangular acoustic window was opened and covered with mylar film, so that the transducer pulse can pass through the film to modulate the current on the nerve phantoms. The transducer was put in the water and beneath the mineral oil tank, and it can move along x-y-z direction under the control of motors.

The phantoms (tissue slabs) were placed in contact with stainless steel electrodes in racks, and positioned at different distances from the acoustic focus. The tissues were aligned horizontally at the same or different depths and submerged in mineral oil and separated from the ultrasound transducer placed in diH\(_2\)O by an acoustic window. In fig. 2a two turkey slices (cut into long, thin rectangles) were injected with different current levels (determined by the resistance of each slice using a common voltage source, Agilent 33220A). To detect the AE signal, two complementary bridge circuits were used. The connections can be seen in fig. 1b, c and d. Each tissue slab was connected to three electrodes spaced 5mm apart, with the center electrode on each phantom connected to a differential amplifier (Lecroy 1855DA). The AE signal of the two phantoms was measured by the differential amplifier, regardless of the distance between the two phantoms, and was amplified, band-pass filtered and captured by a 12bit data acquisition (DAQ) board (Signatec, Inc.). Excited by a square-wave pulser/receiver (Olympus NDT,
Model 5077PR, a single-element focused transducer (2.25MHz, f/1.8, $\lambda=658\mu$m, focal length 70 mm) emitted short pulse and received echo signal. The maximum (90 degree) or minimum (270 degree) current injection was synchronized with the DAQ board and the pulser/receiver. Common mode noise can be reduced by subtracting two AE signals with opposite phases. The pressure on the focus of ultrasound field is about 258kPa.

III. RESULTS AND DISCUSSION

Simulation software on the AE effect was developed in Matlab™ to complement the experimental model and further characterize the relationship between the ultrasound beam and electrical properties of the tissue. Both experimental and simulated images depended on the magnitude and direction of the current, as well as the geometry (shape and thickness) and location of the current sources in the ultrasound field. The simulation is based on the assumption of constant current density and uniform distribution of lead field $J^L$ inside each tissue slab.

A. The effect of size

The effect of width $W$ of the tissue slab on the sensitivity and spectrum are made by changing the width $W$ from 0.025 mm to 7.025 mm (Wang et al. 2010, 2013). In time domain, the peak positions of $V^{AE}$ is maintained constant and the sensitivity reaches maximal value when lateral width is larger than the beam size.

The effect of thickness $H$ of the tissue slab on the sensitivity and spectrum are made by changing the thickness $H$ along the cross-section with constant width (shown in Wang et al. 2013). In the time domain, if the thickness is changed from $0.04\lambda$ to $0.5\lambda$, the amplitude increases linearly. The thickness has important effect of the spectrum of AE signal. When thickness increases from 0, the 1st harmonic magnitude decreases and reaches lowest at thickness $=0.5\lambda$; if thickness $>0.5\lambda$, the 1st harmonic begins increasing, and shifting to lower frequency; if thickness is larger than $\lambda$, the 1st harmonic component is lost, putting the center frequency of main lobe smaller (Wang et al. 2013).

The center frequency of AE signal decreases with the increase of thickness and width. In fig. 3c, the slope of shifting center frequency is about $-1.0435\lambda$/MHz to changing width, and $-9.082\lambda$/MHz to changing thickness. In fig. 3d, the FWHM of bandwidth decreases with the increase of thickness, about 2.0478 MHz to $\lambda/2$, and 1.3652 MHz to $1.026\lambda$; while the FWHM of bandwidth does not change with the width, about 2.044 MHz to any width.
B. Two Tissue Slabs with Long Distance (> pulse length)

If the phantoms for simulation are configured as the same size of the real tissues, the simulated AE images and measured AE images appear similar. For two tissue slabs with large distance (≥λ, fig. 4a), the 2D simulated AE (fig. 4b) and the measured AE images (fig. 4c) showed the same wave shape and peak position (fig. 5). The two bottom peaks around 56.7 mm and two top peaks around 67.8 mm demonstrate the position of surfaces on the tissue slabs. In fig. 4, the simulated AE signal is very close to measured experimental data. Both experiment and simulation signals are filtered around 2.25 MHz to increase SNR. For the slab at 56.7 mm, the SNR (\(=20\log_{10}(S/N)\), S is peak-peak value of signal, N is the p-p value of noise) is 24 dB (fig. 4d).

Fig. 4a shows the case of two tissue slabs separated by a distance larger than one pulse length. The two slabs with large separate distance can be differentiated easily if only the 1st bridge circuit is applied. Fig. 4c is the B-mode images reconstructed from the measured AE signals, and supported by the simulated AE data (fig. 4b). AE image can provide the structure information of tissue in high quality, as the top and bottom surfaces of each slab can be recognized at ease; while pulse-echo (PE) image cannot reveal the information of the current (fig. 4d). From fig. 4e, the simulated AE signal (A-line) at x=0 mm is consistent with the AE signal obtained in the experiment. The AE signals on the two surfaces of one tissue slab is strong, while weak in the inner area.

C. Two Tissue Slabs with Small Distance (< pulse length)

To verify the feasibility of two complementary bridge circuits, mylar plastic film was used to approximate the close distance (<λ). In fig. 5a-b, the two tissue slabs are both 4 mm wide and 0.8 mm thick, and each stuck to one side of mylar film, so that the slabs were separated by 0.2 mm (the thickness of mylar film, shorter than the acoustic pulse length), and the currents through two tissues can be set up according to the chosen bridge circuit. The mylar film together with the tissue slabs was fixed between two racks (fig. 2c). The 2.25 MHz transducer moved from below along x-y direction with 61 steps in each dimension to form 3D AE+PE images.

Fig. 5- fig. 7 show the case of two slabs with distance shorter than one pulse length. Data from two groups of 2D scans were separately acquired by two complementary bridge circuits (fig. 6a and b), and further used to create two new groups of data by addition (fig. 6c) and subtraction (fig. 6d). The hot color of AE signals shows the detected currents in tissue slabs, and it is displayed on the top of PE signal to co-register with the spatial information of pulse-echo ultrasound. In fig. 6a, the top and bottom tissues are so close that three peaks are seen in the X-Z and
Y-Z images, while fig. 6b only provides residue information. The two tissues can be separated clearly in the computed images. In the reconstructed images, fig. 6c provides the sensing area of the top tissue; fig. 6d shows the two boundaries of the bottom tissue, except that its relative position is shift up a little, and fig. 7d shows the sensing areas of the bottom tissue. Therefore, 3-D UCSD images of current flow can be co-registered with anatomical (pulse echo) ultrasound.

Acquired by the 1st circuit in experiment and simulation(fig. 7a and c, fig. 6a), the AE signals on the two surfaces, the bottom surface of top slab and top surface of bottom slab, are mixed together, and the phase information of the middle two surfaces deviates heavily (fig. 7c); while the complementary 2nd bridge circuit can provide additional phase information (fig. 7a and c, fig. 6b). The SNR of the AE signal from the 1st circuit is 50 dB, and 13.8 dB from the 2nd circuit (fig. 7c); the SNR of the addition component is 40 dB, and 25.1 dB for subtraction component (fig. 7d).

IV. CONCLUSION

Three dimensional mapping of bioelectric sources in the body can realize higher spatial resolution than conventional electrophysiology (i.e., without ultrasound). Two complementary bridge circuits reduced common-mode noise and enabled AE signal detection with only two pairs of stainless steel recording electrodes and one pair of stimulating wires. This novel design can effectively distinguish two groups of currents in tissue no matter how close they are. Using the two complementary bridge tissue circuits to detect the ultrasound pressure, the branches of current flows in nerve phantoms can be separated simultaneously by applying simple addition and subtraction to UCSDI. These results are consistent with simulations consisting of multiple current sources. Simulations (Matlab™) of tissue slabs provide accurate numerical solutions relating the measured voltage to the field current density and the displacement velocity caused by ultrasound. Both experimental and simulated UCSD images depended on the magnitude and direction of the current, as well as the geometry (shape and thickness) and location of the current sources in the ultrasound field. The experimental and analytical model described in this study provides a platform for developing multi-dimensional imaging of current flow based on UCSDI.

There are a few difficulties ahead when potentially applied to clinical application. This technique requires three points on each fiber to map the whole nerve signal conduction path, however for the case the source locations are unknown, it is very difficult to locate all three points on one fiber. Co-registered anatomical (pulse echo) ultrasound
can help to determine the positions of the detection electrodes, by tracing from one end to the other two points on each branch. For the case of many intertwined nerve fibers, more delicate connection will be required by separating fibers into multiple two-fiber groups and each group outputs one differential AE signal. Real-time 3-D UCSD images of multiple current flows co-registered with anatomical (pulse echo) ultrasound potentially facilitates the monitoring of neural abnormalities.

V. ACKNOWLEDGMENTS

This study was supported by grants NIH (R01EB009353), Technology and Research Initiative Fund (TRIF) and Advanced Research Institute for Biomedical Imaging (ARIBI).

APPENDIX

From the basic principles of AE effect, the resistance $R$ of tissue slab under the modulation of ultrasound is related to the ultrasound pressure as in (A1).

$$R = \rho_0 \left(1 - K_j \Delta P\right) \frac{l}{A} = \left(1 - K_j \Delta P\right) R_0 = (1 + x) R_0$$  \hspace{1cm} (A1)

which $l$ and $A$ are the length and cross-sectional area of a slab, $x=-K_j \Delta P$, and $R_0$ is the static resistance without pressure applied.

In fig. 1c-d, the voltage source applied on the two ends of the tissue slabs is $V$, so the static currents in two tissue slabs with resistances $R_1$ and $R_2$ are $I_1=V/R_1$ and $I_2=V/R_2$, respectively. The voltage drops, $V_\alpha$, $V_{1-\alpha}$, $V_\beta$, and $V_{1-\beta}$, caused by the ultrasound modulation on segments $\alpha R_1$, $(1-\alpha) R_1$, $\beta R_2$ and $(1-\beta) R_2$ can be expressed as follows.

$$V_\alpha = \frac{(1+x) \alpha R_1}{(1+x) \alpha R_1 + (1-\alpha) R_1} V = \frac{(1+x) \alpha}{x \alpha + 1} V,$$  \hspace{1cm} (A2)

$$V_{1-\alpha} = \frac{(1+x) (1-\alpha) R_1}{(1+x) (1-\alpha) R_1 + \alpha R_1} V = \frac{(1+x) (1-\alpha)}{1 + x (1-\alpha)} V,$$  \hspace{1cm} (A3)

$$V_\beta = \frac{(1+x) \beta R_2}{(1+x) \beta R_2 + (1-\beta) R_2} V = \frac{(1+x) \beta}{x \beta + 1} V,$$  \hspace{1cm} (A4)

$$V_{1-\beta} = \frac{(1+x) (1-\beta) R_1}{(1+x) (1-\beta) R_1 + \beta R_1} V = \frac{(1+x) (1-\beta)}{1 + x (1-\beta)} V.$$  \hspace{1cm} (A5)

From (A2)-(A5), when $\alpha=\beta=0.5$, the four voltage drops have the same value, therefore, the optimal position of detecting electrode on each branch is at the midpoint.
When the ultrasound beam focuses on the left part of the slab (fig. 1b), then \( aR_1 \) and \( \beta R_2 \) will be modulated by pressure when the pulse propagates to reach them. The detected signals by the differential amplifiers using the 1st circuit (fig. 1c) and 2nd circuit (fig. 1d) are \( U_1 \) and \( U_2 \).

\[
U_1 = V_\alpha - V_\beta, \quad (A6)
\]

\[
U_2 = V_\alpha - (V - V_\beta), \quad (A7)
\]

The two signals \( U_1 \) and \( U_2 \) detected by two circuits are added and subtracted as in (A8) to reconstruct voltage drops on the segments \( aR_1 \) and \( \beta R_2 \).

\[
\frac{U_1 + U_2}{2} = \frac{V_\alpha - V}{2}, \quad \frac{U_1 - U_2}{2} = \frac{-V_\beta + V}{2}, \quad (A8)
\]

If the A-line is filtered by a band-pass filter with the same center frequency as the ultrasound, then

\[
\frac{u_1 + u_2}{2} = \frac{v_\alpha}{2}, \quad \frac{u_1 - u_2}{2} = -\frac{v_\beta}{2}, \quad (A9)
\]

where \( u_1, u_2, v_\alpha, v_\beta \) are the AC components of \( U_1, U_2, V_\alpha, V_\beta \). As \( \alpha \) and \( \beta \) are independent to each other, \( v_\alpha \) and \( v_\beta \) are two independent components.

When the ultrasound is positioned on the left (fig. 1b), then \( (1-\alpha)R_1 \) and \( (1-\beta)R_2 \) will be modulated by pressure when the pulse propagates to reach them. The detected signals by the differential amplifiers using the 1st circuit (fig. 1c) and 2nd circuit (fig. 1d) are \( U_1 \) and \( U_2 \).

\[
U_1 = (V - V_{1-\alpha}) - (V - V_{1-\beta}) = -V_{1-\alpha} + V_{1-\beta}, \quad (A10)
\]

\[
U_2 = (V - V_{1-\alpha}) - V_{1-\beta} = V - V_{1-\alpha} - V_{1-\beta}, \quad (A11)
\]

The two signals \( U_1 \) and \( U_2 \) detected by two circuits are added and subtracted as in (A12) to reconstruct the voltage drops on the segments \( (1-\alpha)R_1 \) and \( (1-\beta)R_2 \).

\[
\frac{U_1 + U_2}{2} = -\frac{V_{1-\alpha}}{2}, \quad \frac{U_1 - U_2}{2} = V_{1-\beta} - \frac{V}{2}, \quad (A12)
\]

If each A-line is filtered by the band-pass filter, then

\[
\frac{u_1 + u_2}{2} = -\frac{v_{1-\alpha}}{2}, \quad \frac{u_1 - u_2}{2} = v_{1-\beta}, \quad (A13)
\]

where \( u_1, u_2, v_{1-\alpha}, v_{1-\beta} \) are the AC components of \( U_1, U_2, V_{1-\alpha}, V_{1-\beta} \). \( v_{1-\alpha} \) and \( v_{1-\beta} \) are also two independent components.
REFERENCES


1916.


Fig. 1. (a) Schematic of the acousto-electric effect on the tissue slab. $C(0, 0, 0)$ is at the center of the electric coordinate system or lead field. Transducer center is $T(x_0, y_0, z_0)$, and any point $P$ in the ultrasound pressure field $(x, y, z)$ can be described in the electric field as $(x+x_0, y+y_0, z+z_0)$, or $C\vec{P}=CT+TP$. (b) is the two complementary bridge circuits with ultrasound modulating the electric field from the bottom. (c) is the 1st case (circuit 1), when switches in (b) are set to position 1, and (d) is the 2nd case (circuit 2), when switches in (b) are set to position 2. $aR_1$ and $\beta R_2$ are the segments of tissue slabs 1 and 2, whose resistances are modulated with the ultrasound pressure, while $R_1$ and $R_2$ are the constant resistance of the two tissue slabs. The AE signals in tissue slabs 1 and 2 can be rebuilt individually by addition and subtraction of (c) and (d).

Fig. 2. Experimental setup for ultrasound current density imaging of two tissue slabs aligned horizontally at different depth in the mineral oil tank. (a) The tank bottom was open and covered with plastic film to isolate mineral oil from the diH$_2$O. The bottom tissue slab was fixed inside the oil tank, whereas the position of the top tissue slab could be variably adjusted. The focused transducer was immersed in water, providing the ultrasound pressure to the two conducting phantoms. (b) Plastic rack was fabricated hollow in the center, forming an empty rectangular area with width of 15 mm and length of 80 mm. The steel electrodes, with length of 30 mm and radius of 0.5 mm, were arranged parallel with interval 5mm on the surface of rack. The top black color supporter helps to fix the tissue slab on the electrodes for the case of two tissue slabs with large distance (> pulse length). (c) is the setup for the case of two tissue slabs with small distance (< pulse length).

Fig. 3. Simulation results: the size analysis for the tissue slab is made by ranging thickness from $\lambda/25$ to $\lambda$ and width from $\lambda/25$ to $11\lambda$. (a) is the schematic of changing the size of tissue slab. (b) is the plot of sensitivity approaching a saturation value that is related to the wave length, the sensitivity reaches half maximum value at $0.2\lambda$ to thickness and $1.7\lambda$ to width. (c) and (d) are the analyses of the center frequency and FWHM over the spectrum of the simulated AE A-lines. The center frequency of transducer is 2.25MHz (wavelength $\lambda=658\mu$m).

Fig. 4. The simulated AE image is consistent with the AE image obtained in the experiment using the 1st circuit (fig. 1b). (b) is the simulated AE image based on the setup (a). (c) and (d) are separately the measured AE image and PE.
image using the 2.25MHz single-element annular concave transducer. (e) The simulated AE signal (A-line) is compared with the AE signal obtained in the experiment (x=0 mm).

Fig. 5. The simulation and experiment setup for the separation of two nerves with small distance (< pulse length). (a) is the two turkey slices on the two faces of mylar; while (b) is the phantom for simulation, where two nerve phantoms are both 4mm wide and 0.8mm thick, and separated by 0.2mm. (c) is the simulated AE B-mode image. (d) The A-mode signals obtained from experiment and simulation are measured at x=0mm and plotted in one axis. (e) PE image shows the structure information of the experiment setup using a gray colormap with range [-20,0]dB.

Fig. 6. Y-Z display of 3-D data of two tissue slabs on racks separated by a small distance (< pulse length). 3-D AE data were obtained from bridge circuit 1 (a) and bridge circuit 2 (b) by moving 2.25MHz transducer 61×61 steps in area 20mm×20mm from the bottom of tissue slabs. (c) is the reconstructed 3-D images for the top tissue slab using addition, while (d) is for the bottom tissue slab using subtraction. The AE signal is displayed using hot colormap with range [-13,0]dB, and PE signal is overlaid using a gray colormap with range [-20,0]dB. The gray color of PE signal shows the position of tissue racks and slabs. The hot color of AE signal is the detected current, and is displayed on the top of PE signal to co-register with the spatial information of pulse-echo ultrasound. The cross-sectional plots are through the point (0.50991,-3.9234, 71.4593) mm located by crossing lines in figures.

Fig. 7. The A-line signals obtained from simulation and experiment reconstruct new signals using addition or subtraction when two tissue slabs are separated with small distance (< pulse length). The inlet in (a) is the phantom for simulation, where two nerve phantoms are both 4 mm wide and 0.8 mm thick, and separated by 0.2 mm. The two curves in (a) are the simulated A-mode signals through lateral position at x=0.5 mm for two complementary circuits, respectively. The two curves in (b) are the reconstructed A-mode signals from simulated data in (a) using addition or subtraction, respectively. In the experiment, two turkey slices were set on the two faces of mylar film. (c) is the A-mode signals measured by two complementary circuits at the point (x=0.5, y=-3.92) mm in fig. 7; (d) is the reconstructed A-mode signals from measured data using addition and subtraction.
Figure 6
Click here to download high resolution image
A Study of Doppler Algorithms in Fourier Imaging Method

Zhaohui Wang
Department of Electrical Engineering and Computer Science, Texas A&M University - Kingsville, Kingsville, TX 78363

ABSTRACT

High frame rate imaging uses limited diffraction beam to illuminate the object field and reconstruct the field using Fourier method. Doppler algorithms were applied to the high frame rate imaging to estimate the velocity by extracting the frequency shift from the reconstructed two-dimensional images instead of one A-line. In this study, multiple algorithms are compared on computing performance. Based on the analysis of Doppler algorithms on the high frame rate images reconstructed from simulated and in-vivo echo signals, we conclude that radial averaging improves the performance of the autocorrelation method, while the cross-correlation method is significantly better than the autocorrelation method for high pulse bandwidth.

Keywords: Fourier imaging method, Doppler imaging, cross-correlation

1. INTRODUCTION

High frame rate imaging uses limited diffraction beam to illuminate the object field and reconstruct the field using Fourier method [1]. Auto-correlation method was applied to the high frame rate images to estimate the velocity magnitude by extracting the frequency shift from the reconstructed two-dimensional images instead of one A-line [4].

Several algorithms were introduced to compute the Doppler frequency shift from the RF echo signals. Auto-correlation was applied to the complex demodulated signal from each range gate along the transmitted beam to extract the frequency shift [5]. The pulse-to-pulse cross-correlation function of the RF signal can also be used to estimate the shift in time delay of the received echoes [6].

In this study, computing performance of Doppler frequency shift of these algorithms is compared on the reconstructed high frame rate images. The initial analysis showed that the cross-correlation method showed much smoother color flow image than auto-correlation method.

2. METHODS

With the X-wave formula, the relationship between the Fourier transforms of an object function and the RF echo signal was described as follows [1].

\[
\tilde{R}_{k_x}^{k_y, k_x + k_y} (\omega) = \frac{A(k)T(k)H(k)}{c^2} \int_{V} f(\vec{r}_0) e^{i \vec{k}^R \cdot \vec{r}} d\vec{r}_0 = \frac{A(k)T(k)H(k)}{c^2} F(\vec{k}^R + \vec{k}^T)
\]

where \( \tilde{R}_{k_x}^{k_y, k_x + k_y} (\omega) \) is the Fourier transform of the time varying RF echo signal when the transducer receive aperture is weighted at the spatial frequencies \( k_x \) and \( k_y \), \( \vec{r}_0 = [x_0, y_0, z_0] \) is the spatial position of the scatter, \( f(\cdot) \) and \( F(\cdot) \) are a 3D object function and its Fourier transform, \( A(k) \) and \( T(k) \) are the transmit and receive transfer functions, respectively, \( \vec{k}^R = (k_x, k_y, k_z) \) and \( \vec{k}^T = (k_x, k_y, k_z) \) are reception and transmission wave vectors, respectively.

Simulation was made in Field II software with one broadband linear array transducer of 128 elements, 5 MHz center frequency, 38.4-mm aperture, and 5-mm elevation width. An in-vivo experiment was also made on the artery blood vessel with Verasonics acquisition system.

The slow motion introduces low frequency shift in the echo spectrum. One-tap finite impulse response (FIR) was used to reduce the effects of slow motion from the surrounding tissues and vessel walls. Sixteen transmissions are used to reduce the noise in creating one frame blood flow vector image.
Several Doppler algorithms, such as autocorrelation and cross-correlation, were used to estimate frequency shift. Autocorrelation can extract the frequency shift by analyzing the complex demodulated signal from each range gate along the transmitted beam. The pulse-to-pulse cross-correlation function of the RF signal can also estimate the shift in time delay of the received echoes.

In the auto-correlation method, the mean angular frequency is approximated as follows.

\[ \bar{\omega} = \frac{\phi(T)}{T}, \]

where \( \bar{\omega} \) is the frequency shift, \( \phi(T) \) is the phase of auto-correlation value, and \( T \) denotes the emission interval of ultrasonic pulses. The variance \( \sigma^2 \) may be represented by the following:

\[ \sigma^2 = \frac{1}{T^2} \left[ 1 - \frac{R(T)}{R(0)} \right], \]

where \( R(\cdot) \) is the auto-correlation value.

Radial averaging can improve the performance of the autocorrelation method. We also verified that the cross-correlation method is significantly better than the autocorrelation method for high pulse bandwidth.

Areas with large spectral spreads tend to be turbulent flow. Blue and red are used to depict blood velocity toward and away from the transducer. Green color is also added to the red/blue color in proportional to the amount of spectral spread.

3. CONCLUSIONS AND FUTURE WORK

Based on the analysis of Doppler algorithms on the high frame rate images reconstructed from simulated and in-vivo echo signals, we conclude that radial averaging improves the performance of the autocorrelation method, while the cross-correlation method showed much smoother color flow image than the autocorrelation method for high pulse bandwidth. High frame rate imaging combined with Doppler imaging can be used to extract fast motion in clinical application of cardiac diseases.

4. ACKNOWLEDGMENTS

This study was supported by grants Technology and Research Initiative Fund (TRIF).

Figure 1. Reconstructed B-mode image of artery on the right arm using Fourier imaging method.
Figure 2. Magnitude of the velocity component image reconstructed with cross-correlation method.

REFERENCES


Polarity Algorithms in Ultrasound Current Source Density Imaging

Zhaohui Wang
Department of Electrical Engineering and Computer Science, Texas A&M University - Kingsville, Kingsville, TX 78363

ABSTRACT

Ultrasound Current Source Density Imaging (UCSDI) is based on Ohm’s Law and the acoustoelectric (AE) signal, an interaction between pressure and electrical resistivity as an acoustic wave propagates through a conducting material. Four dimensional UCSDI of a time varying electric dipole in saline used as few as one distant electrode and ground. The detected AE signal is related to the inner product of the lead field of the detector and the dipole field of the injected current. The current direction and amplitude are encoded in the phase and amplitude of the AE signal. Based on the analysis of polarity algorithms on the simulated and in-vitro ultrasound current source density images, it is concluded that the cross-correlation method is significantly better than the autocorrelation method to extract the frequency shift for high pulse bandwidth.

Keywords: ultrasound current source density imaging, acousto-electric, ECG, cardiac arrhythmia, epilepsy

1. MOTIVATION/BACKGROUND

Ultrasound Current Source Density Imaging (UCSDI) is based on Ohm’s Law and the acoustoelectric (AE) signal, an interaction between pressure and electrical resistivity as an acoustic wave propagates through a conducting material [1]. Four dimensional UCSDI of a time varying electric dipole in saline used as few as one distant electrode and ground. The detected AE signal is related to the inner product of the lead field of the detector and the dipole field of the injected current. The current direction and amplitude are encoded in the phase and amplitude of the AE signal.

In [1], the determination of center frequency was made manually. The total volume (3D) or area (2D) of anodes and cathodes was maximized to optimize the shift frequency, rendering the cathode and anode on the images large and uniform.

Several algorithms for Doppler analysis on blood flow vector imaging can be used to compute the frequency shift in UCSDI. Auto-correlation was applied to the complex demodulated signal from each range gate along the transmitted beam to extract the frequency shift caused by polarity of injecting electrodes ([2], [3]). The pulse-to-pulse cross-correlation function of the RF signal can also be used to estimate the shift in time delay of the received echoes [4].

2. METHODS

Ultrasound current density imaging (UCSDI) is based on the acoustoelectric (AE) effect and reciprocal theory. The ultrasound beam pattern and pulse waveform were introduced to describe the AE signal using the following equation [1]:

\[ V_i^{AE}(x,y,t_s,t_s) = -P_0 \int \frac{dV}{dt} \left[ J_i^T(x,y,z,t) \right] \left[ J_i(x+y,z,t) \right] dx dy dz, \]

where \( P_0 \) is the amplitude of the pressure pulse, \( K_i \) is the interaction constant, whose value is on the order of \( 10^{-9} \) Pa\(^{-1}\) in saline, \( \rho_0 \) is direct current resistivity, \( J_i(x,y,z) \) is the electric lead field due to unit reciprocal current formed by the detector \( i \), \( b(x,y,z) \) is the ultrasound beam pattern defined with respect to the transducer, \( a(t-z/c) \) is the pulse waveform, \( c \) is the speed of sound, \( t \) is the ultrasound fast time, \( t_s \) is the physiologic slow time with \( t_s = t + mT \), where \( T = 1/\text{PRF} \) and \( m \) is the integer number of bursts.

The AE voltage can be described by the inner product of the gradient of potentials in the dipole electric field and lead field of detector \( i \).

\[ V_i(x,y,z,t_s) = -P_0 K_i \rho_0 J_i^T(x,y,z) \cdot J_i(x,y,z,t_s) = -P_0 K_i \sigma \nabla V_i \cdot \nabla V' \]

In COMSOL the lead field of a 3-D dipole field was produced with a current of 6 mA between the exciting dipole. A 1MHz ultrasound beam was pulsed and focused to modulate the current distribution. Two pairs of electrodes around the
circular boundary were connected to detect the AE signals. The lead field created by each pair of recording electrodes was simulated to reconstruct the unknown dipole current distribution. The simulated AE signal was created by projecting the current vector of dipole simulated in COMSOL to that of each electrode pair.

One-tap finite impulse response (FIR) was used to reduce the effects of slow motion from the surrounding tissues and vessel walls. Sixteen transmissions are used to reduce the noise. Several polarity algorithms, such as autocorrelation and cross-correlation, were used to estimate frequency shift.

Auto-correlation can extract the frequency shift by analyzing the complex demodulated signal from each range gate along the transmitted beam, and the mean angular frequency is approximated as follows.

\[ \overline{\omega} = \frac{\phi(T)}{T} \]

where \( \overline{\omega} \) is the frequency shift, \( \phi(T) \) is the phase of auto-correlation value, \( R(T) \) is the auto-correlation value, and \( T \) denotes the emission interval of ultrasonic pulses. The variance \( \sigma^2 \) may be represented by the following:

\[ \sigma^2 = \frac{1}{T^2} \left\{ 1 - \left| \frac{R(T)}{R(0)} \right| \right\}. \]

Radial averaging can improve the performance of the autocorrelation method [5]. It was also verified that the cross-correlation method is significantly better than the autocorrelation method for high pulse bandwidth.

Areas with large spectral spreads tend to be turbulent current flow. Blue and red are used to depict dipole polarity with current flow in between. Green color is also added to the red/blue color in proportional to the amount of spectral spread.

3. CONCLUSIONS AND FUTURE WORK

Based on the analysis of polarity algorithms on the simulated and in-vitro ultrasound current source density images, it is concluded that radial averaging improves the performance of the autocorrelation method, while the cross-correlation method is significantly better than the autocorrelation method for high pulse bandwidth. Hybrid imaging with UCSDI potentially provides real-time 4D images of current flow (UCSDI) combined with anatomy (co-registered conventional ultrasound) and standard electrophysiology to facilitate and enhance corrective procedures for cardiac and neural abnormalities.

4. ACKNOWLEDGMENTS

This study was supported by grants Technology and Research Initiative Fund (TRIF).

Figure 1. UCSDI of dipole and its deconvolution result.
REFERENCES


The service learning course, CSEN 5325 Software Engineering: Medical Imaging, is designed for community service, with cooperation from the clinical doctors. It would facilitate mutually beneficial collaborations between our students and the community through service learning. In this course, the students are required to develop Web-based Analysis Software on medical images for a variety of imaging methods, such as magnetic resonance imaging (MRI), computed tomography (CT), ultrasound imaging, x-ray radiography and positron emission tomography (PET). This tool, combined with expert system at the convenience of website, can persuade the patients with necessity of treatment and provide the doctors with professional clinical suggestion.

1. University organization or course involved
This course is a modification of the current course, CSEN 5325 Software Engineering, which covers development life cycle models, inspection process, software quality metrics, testing, validation metrics, estimation and scheduling. From this course, the students will 1) learn advanced concepts of object-oriented software engineering using UML, patterns and Java, 2) learn iterative and evolutionary software development methods starting with evolutionary requirements, and 3) be knowledgeable of software evolution and methods for software maintenance including refactoring.

2. Faculty member(s) directing the project:
Dr. Zhaohui Wang
Visiting Assistant Professor
Office: EC208
Dep. of Electrical Engineering & Computer Science
Texas A&M Univ.-Kingsville
MSC 192, 700 University Blvd., Kingsville, TX 78363

3. Community member(s) participating in the project
StatCare Minor Emergency Clinic
Address: 500 E Caesar Ave, Kingsville, TX 78363

4. A description of the engagement activity or activities to be employed
This service learning course has requirements for service, reflection, growth, and the acquisition of knowledge. Service involves active participation in organized activity that meets identified community needs. Reflection involves contemplating the activity in such a way as to gain further understanding of course content, broader appreciation of the discipline, and greater recognition of one’s civic responsibility.

In CSEN 5325 Software Engineering: Medical Imaging, the students in a group are required to work closely in an agile method, using Java language to develop one module that applies algorithm analysis on one kind of medical images, including MRI, ultrasound and CT etc. Multiple modules or functions from several groups will construct the final Web-based Analysis Software. This software can manage the images through online server or Cloud. The embedded expert system with artificial intelligence will provide the doctor with professional suggestion.

5. A description of the intended student learning outcomes
Acquisition of knowledge and growth on both personal and professional levels on medical imaging principles are the student learning outcomes. The overall goal of this Service Learning Course is to improve student success through engagement that employs students’ knowledge, skills, and interests to address needs within the community. The objectives in support of this goal are to: (1) Create a hands-on learning environment for students, (2) Provide faculty development in support of service learning, and 3) Develop a stronger bond between the university, its students, and the surrounding community.
6. An estimate of the number of students to be involved in the project

About 150 graduate students from two classes will enroll in this project. Four students will form one group to develop one specific analysis tool for medical images, under the guidance of the instructor and hospital experts.

7. A timeline during which the project will be developed and implemented

The project will be developed Fall 2015 and offered Spring 2016. The instructor will cooperate closely with the experts from the hospital on the project topics. During the semester, the instructor will check the progress biweekly and helping the groups resolving questions in projects. The project is composed of seven phases, during each of which every group need report the progress of the project.

   1) Phase I: Forming research groups and distributing research topics among groups.
   2) Phase II: Usage of Java server programming
   3) Phase III: Usage of images in Java
   4) Phase IV: Algorithm 1 to the medical image processing
   5) Phase V: Algorithm 2 to the medical image processing
   6) Phase VI: Algorithm 3 to the medical image processing
   7) Phase VII: Final evaluation of the projects.

8. A brief description of assessment measures to be used to evaluate student success

The students need cooperate with instructor and experts from the hospital to work on technical questions from the medical image analysis software.

The evaluation is composed of weekly review by teaching assistant (TA) and biweekly review by the instructor. The TA arranges the weekly review schedule, checks and records the progress of each group, and send the report to the instructor before the biweekly review. Four hours one week is enough for TA to monitor the progress of all groups. The instructor will finish biweekly review in one day for one class.

Student success will be assessed by a seven-phase evaluation. The scores of the seven phases will contribute to the final grading. In each phase, the evaluation is based on several perspectives: originality, usage convenience, visual performance, source code structure and algorithm. Each evaluation perspective has a credit of 1-10, occupying about 20% of the total score.

<table>
<thead>
<tr>
<th>Evaluation Perspectives</th>
<th>Score, Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Originality</td>
<td>1-10, 20%</td>
</tr>
<tr>
<td>Usage convenience</td>
<td>1-10, 20%</td>
</tr>
<tr>
<td>Visual performance</td>
<td>1-10, 20%</td>
</tr>
<tr>
<td>Source code structure</td>
<td>1-10, 20%</td>
</tr>
<tr>
<td>Source code algorithm</td>
<td>1-10, 20%</td>
</tr>
</tbody>
</table>

9. Budget Request for financial support

This proposal requests financial support to develop and deliver the project.

<table>
<thead>
<tr>
<th>Items</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel funds for faculty or students</td>
<td>$500</td>
</tr>
<tr>
<td>Computer server with GPU card and DAQ board</td>
<td>$4,000</td>
</tr>
<tr>
<td>Experiment instruments (motors, transducer, pulser/receiver)</td>
<td>$4,000</td>
</tr>
<tr>
<td>Other supplies (software tools)</td>
<td>$500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$9,000</strong></td>
</tr>
</tbody>
</table>

10. The degree of support the community organization will contribute towards the project

The Department of Electrical Engineering and Computer Science will support me with 1/4 release time for this service learning course.

StatCare Minor Emergency Clinic will provide clinical professional suggestion to the data analysis of this software.
CSEN 5325-003 Software Engineering  
Spring 2016

Meeting:
Lecture: TR 05:00 pm - 06:15 pm, BESB 100

Instructor Information
Dr. Zhaohui Wang
Office: EC208
Department of Electrical Engineering and Computer Science
Email: eecs1.wang.tamuk@gmail.com

Scheduled Office Hours:
Mon., Wed.: 1:00 pm - 2:00 pm; 4:00-5:00 pm
Tue., Thur.: 1:00 pm -4:00 pm or by appointment.

Text Book:
It is extremely important that students take good class notes, as the instructor uses materials from numerous sources, not just from the text book or references.
Selected References:

Catalog Description:
CSEN 5325. Software Engineering 3(3-0)
Covers development life cycle models, inspection process, software quality metrics, testing, validation metrics, estimation and scheduling. Prerequisite: graduate standing in engineering.

Prerequisites by topic:
Graduate standing in Computer Science or another Engineering Discipline.

Student Learning Outcomes:
Students will
1) learn advanced concepts of object-oriented software engineering using UML, patterns and Java,
2) learn iterative and evolutionary software development methods starting with evolutionary requirements, and
3) be knowledgeable of software evolution and methods for software maintenance including refactoring.

MSCS Program Student Learning Outcomes:
SLO2.1 Our students have an ability to use current techniques, skills, and modern tools necessary for computing practice.

Course Topics:
1) Software processes.
2) Iterative software development.
3) Requirements engineering.
4) System modeling.
5) Architectural design.
6) Design and implementation using UML, Patterns and Java.
7) Software testing.
8) Software evolution.

Grading Procedure:
Letter grades will be given according to scheme specified in the catalog. The following four components will contribute to the final grade according to the specified weights:

Exhibit-7(1), 3
1) Quiz. 15%
2) Project. 30%
3) First Exam. 25%
4) Second Exam. 30%

Good attendance will help borderline students. Assessment activity will start at the beginning of the class. No late work will be accepted. There will be no make-up exams; rather, students with valid reasons will be excused from a missing exam, and the grade on the other exams will be substituted for the missing exam. Academic dishonesty will not be tolerated, and could result in a final course grade of F.

Course Policies:
1) Code of Conduct: As specified in the TAMUK Student Handbook.
2) Attendance: Students are expected to behave in a responsible manner so far as attendance in Lectures is concerned. Valid reasons for absence should be promptly brought to the attention of the Instructor. Regular attendance will favorably affect the decision of the Instructor in a marginal grading case.
3) Make-up Exam. and Early Second Examination: No make-up exam. will be given. Students should discuss their circumstances individually with the instructor.
4) Course Materials: Due to the lack of adequate storage space, exams., reports, and other course material will be retained only till the end of January 2015. After that, they will be sent for recycling.

Disability statement:
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disability.
If you believe you have a disability requiring an accommodation please contact the Disability Resource Center (DRC) as early as possible in the term at (361) 593-2904. DRC is located in the Life Service and Wellness building at 1210 Retama Drive.

Six-drop policy:
The following provision does not apply to students with Texas public college or university credits prior to Fall 2007. The Texas Senate Bill 1231 specifies the number of course drops allowed to a student without penalty. After a student has dropped six courses, a grade of OF will normally be recorded for each subsequent drop. Additional information on Senate Bill 1231 is available at the Registrar's Office at (361) 593-2811 and at http://www.tamuk.edu/registrar/droppolicy.html.

Academic misconduct statement:
You are expected to adhere to the highest academic standards of behavior and personal conduct in this course and all other courses. Students who engage in academic misconduct are subject to university disciplinary procedures.
Make sure you are familiar with your Student Handbook, especially the section on academic misconduct, which discusses conduct expectations and academic dishonesty rules.

Forms of academic dishonesty:
1) Cheating: Using unauthorized notes or study aids, allowing another party to do one's work/exam and turning in that work/exam as one's own; submitting the same or similar work in more than one course without permission from the course instructors; deception in which a student misrepresents that he/she has mastered information on an academic exercise that he/she has not mastered; giving or receiving aid unauthorized by the instructor on assignments or examinations.
2) Aid of academic dishonesty: Intentionally facilitating any act of academic dishonesty. Tampering with grades or taking part in obtaining or distributing any part of a scheduled test.
3) Fabrication: Falsification or creation of data, research or resources, or altering a graded work without the prior consent of the course instructor.
4) Plagiarism: Portrayal of another's work or ideas as one's own. Examples include unacknowledged quotation and/or paraphrase of someone else's words, ideas, or data as one's own in work submitted for credit. Failure to identify information or essays from the Internet and submitting them as one's own work also constitutes plagiarism.
5) Lying: Deliberate falsification with the intent to deceive in written or verbal form as it applies to an academic submission.
6) Bribery: Providing, offering or taking rewards in exchange for a grade, an assignment, or the aid of academic dishonesty.
7) Threat: An attempt to intimidate a student, staff or faculty member for the purpose of receiving an unearned grade or in an effort to prevent reporting of an Honor Code violation.
Please be aware that the University subscribes to the Turnitin plagiarism detection service. Your paper may be submitted to this service at the discretion of the instructor.

**Other Forms of Academic Misconduct:**

1. Failure to follow published departmental guidelines, professor's syllabi, and other posted academic policies in place for the orderly and efficient instruction of classes, including laboratories, and use of academic resources or equipment.
2. Unauthorized possession of examinations, reserved library materials, laboratory materials or other course related materials.
3. Failure to follow the instructor or proctor's test-taking instructions, including but not limited to not setting aside notes, books or study guides while the test is in progress, failing to sit in designated locations and/or leaving the classroom' test site without permission during a test.
4. Prevention of the convening, continuation or orderly conduct of any class, lab or class activity. Engaging in conduct that interferes with or disrupts university teaching, research or class activities such as making loud and distracting noises, repeatedly answering cell phones/text messaging or allowing pagers to beep, exhibiting erratic or irrational behavior, persisting in speaking without being recognized, repeatedly leaving and entering the classroom or test site without authorization, and making physical threats or verbal insults to the faculty member, or other students and staff.
5. Falsification of student transcript or other academic records; or unauthorized access to academic computer records.
6. Nondisclosure or misrepresentation in filling out applications or other university records.
7. Any action which may be deemed as unprofessional or inappropriate in the professional community of the discipline being studied.

**Non-academic misconduct:**
The university respects the rights of instructors to teach and of students to learn. Maintenance of these rights requires campus conditions that do not impede their exercise. Campus behavior that interferes with these rights will not be tolerated; examples include

1. interfering with the instructor's ability to conduct the class,
2. causing inability of other students to profit from the instructional program, or
3. any interference with the rights of others.

An individual engaging in such disruptive behavior may be subject to disciplinary action. Such incidents will be adjudicated by the Dean of Students under non-academic procedures.

Ongoing behaviors or single behaviors considered distracting (e.g., coming late to class, performing a repetitive act that is annoying, sleeping or reading a newspaper in class, etc.) will be addressed by the faculty member initially either generally or individually. Cases in which such annoying behavior becomes excessive and the student refuses to respond to the faculty member's efforts can be referred to the Dean of Students. In the case of serious disruptive behavior in a classroom the instructor may first request compliance from the student and if it is not received, an instructor has the authority to ask the student to leave the classroom. If the student fails to leave after being directed to do so, assistance may be obtained from other university personnel, including University Police Department. An individual engaging in such disruptive behavior is subject to disciplinary action. Such incidents will be adjudicated by the Dean of Students under non-academic procedures to determine if the student should be allowed to return to the classroom.

**Harassment Discrimination:**
Texas A&M University-Kingsville does not tolerate discrimination on the basis of race, color, religion, national origin, age, disability, genetic information, gender, gender identity or sexual orientation (or any other illegal basis) and will investigate all complaints that indicate sexual harassment, harassment, or discrimination may have occurred. Sexual harassment and sexual assault are types of sex discrimination. Such sexual misconduct is unacceptable and will not be tolerated. Any member of the university community violating this policy will be subject to disciplinary action. A person who believes he/she has been the victim of sexual misconduct harassment, harassment, or discrimination may pursue either the informal or the formal complaint resolution procedure. A complaint may be initially made to the Office of Compliance at (361)-593-4758, complainant's immediate supervisor, a department head, a supervisory employee, or the Dean of Students at (361)-593-3606 or the Office of Compliance at (361)-593-4758. Regardless of who the complaint is filed with, the Compliance Office will be notified of the complaint so it can be investigated.

**THE COURSE OUTLINE IS SUBJECT TO CHANGE.**
Requesting financial support to start my research

Zhaohui Wang

Sat 12/12/2015 2:51 PM

To: Rajab Challoo <Rajab.Challoo@tamuk.edu>

Hello Dr. Challoo,

I am requesting financial support for the items listed in the table to start my research on biomedical imaging. Thank you and have a nice weekend.

<table>
<thead>
<tr>
<th>Item Number</th>
<th>Description</th>
<th>No.</th>
<th>Unit</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lenovo-Ideacentre 700</td>
<td>Desktop - Intel Core i5 - 8GB Memory - 1TB+8GB Hybrid Hard Drive</td>
<td>1</td>
<td>$694.99</td>
<td>$694.99</td>
</tr>
<tr>
<td>27sv</td>
<td>HP - 27&quot; IPS LED HD Monitor</td>
<td>1</td>
<td>$199.99</td>
<td>$199.99</td>
</tr>
<tr>
<td>LY120DPY300M</td>
<td>300mm Optical Motorized Linear Stage Translation Stage Rotation Stages (X,Y)</td>
<td>2</td>
<td>$1,089.95</td>
<td>$2,179.90</td>
</tr>
<tr>
<td>N/A</td>
<td>Stepper motor controller motion controller</td>
<td>1</td>
<td>$376.83</td>
<td>$376.83</td>
</tr>
<tr>
<td>VT-DSO-2A20E</td>
<td>PC USB 10–16Bit 200MSPS 80MHz Oscilloscope, 12-bit 200MSPS 60MHz AWG Signal Generator</td>
<td>1</td>
<td>$419.95</td>
<td>$419.95</td>
</tr>
<tr>
<td>SAB182-T</td>
<td>18 in x 24 in x 3/4 in Thick Solid Aluminum Optical Breadboard</td>
<td>1</td>
<td>$429.51</td>
<td>$429.51</td>
</tr>
<tr>
<td>A392S</td>
<td>PANAMETRICS NDT A392S, 1MHz, Transducer</td>
<td>1</td>
<td>$614.00</td>
<td>$614.00</td>
</tr>
<tr>
<td>DPR002-S-HF/LF</td>
<td>SONIX DPR002-S-HF/LF Digitally Controlled Pulser/Receiver</td>
<td>1</td>
<td>$821.30</td>
<td>$821.30</td>
</tr>
<tr>
<td>HW-KIT4/M</td>
<td>M6 Setscrew and Hardware Kit</td>
<td>1</td>
<td>$97.10</td>
<td>$97.10</td>
</tr>
<tr>
<td>HW-KIT2/M</td>
<td>M6 Cap Screw and Hardware Kit</td>
<td>1</td>
<td>$109.00</td>
<td>$109.00</td>
</tr>
<tr>
<td>ESK11</td>
<td>BNC Adapters Essentials Kit, 62 Pieces</td>
<td>1</td>
<td>$841.00</td>
<td>$841.00</td>
</tr>
<tr>
<td>PH75V/M</td>
<td>Ø12.7 mm Post Holder with Hex-Locking Thumbscrew, L = 75mm, Vacuum Compatible</td>
<td>5</td>
<td>$33.75</td>
<td>$168.75</td>
</tr>
<tr>
<td>TR300/M</td>
<td>Ø12.7 mm Optical Post, SS, M4 Setscrew, M6 Tap, L = 300 mm</td>
<td>5</td>
<td>$10.82</td>
<td>$54.10</td>
</tr>
<tr>
<td>TR75/M-P5</td>
<td>Ø12.7 mm Optical Post, SS, M4 Setscrew, M6 Tap, L = 75 mm, 5 Pack</td>
<td>2</td>
<td>$24.39</td>
<td>$48.78</td>
</tr>
<tr>
<td>2249-C-120</td>
<td>BNC Coaxial Cable, BNC Male to BNC Male, 120° (3048 mm)</td>
<td>5</td>
<td>$21.80</td>
<td>$109.00</td>
</tr>
<tr>
<td>2249-C-60</td>
<td>BNC Coaxial Cable, BNC Male to BNC Male, 60° (1524 mm)</td>
<td>5</td>
<td>$18.50</td>
<td>$92.50</td>
</tr>
<tr>
<td>RA90/M-P5</td>
<td>Right-Angle Clamp for Ø1/2&quot; Posts, 5 mm Hex, 5 Pack</td>
<td>2</td>
<td>$48.80</td>
<td>$97.60</td>
</tr>
<tr>
<td>3D printer: Electrode Chamber</td>
<td></td>
<td>1</td>
<td>$200.00</td>
<td>$200.00</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td>$6,459.32</td>
</tr>
</tbody>
</table>

Exhibit-7(2)
Best regards
Zhaozhi Wang
2D-array Opto-acousto-electric Transducer for Real-time 3D Photoacoustic Imaging

Applicants: Dr. Zhaohui Wang

1.1. A statement of objectives

Real-time 3D photoacoustic imaging system is composed by analog signal acquisition unit and 2D-array opto-acousto-electric transducer, which is a combination of laser fiber array and acoustoelectric (AE) hydrophone array. These AE hydrophones arranged at high spatial density can realize the high resolution photoacoustic imaging of deep tissue.

1.2. Methods

Optical and MEMS techniques will be combined together to fabricate opto-acousto-electric transducer array that applies array laser fibers to illuminate the object/tissue and uses charged array sensors to detect the created high frequency ultrasound signals. The detectors are arranged at high spatial resolution above the object/tissue, and the detected wide-bandwidth signals are converted to digital signal at high sampling frequency. Therefore, this transducer array combines laser optical system and acousto-electric sensors in one unit, realizing high spatial resolution photo-acoustic imaging.

New light schemes are applied to enhance the laser beam penetration depth in tissue. The PA imaging depth is mainly limited by the attenuation of the source laser light at NIR ranges propagating through the soft tissues, and an optimal design of the light source and energy delivery method is pivotal for the deep tissue PA imaging. The effective penetration depth of the light is determined by the scattering and absorption coefficients of the tissues, the aperture of the incident beam, and the pigmentation of the skin. A large portion of light energy shining into the body of a human is reflected and lost at the skin surfaces. The amount of the reflected light increases with increasing the incidence angle, with that the least reflection occurs when the laser beam is directed perpendicular to the skin. If the incidence angle is 20° the percentage of the reflectance at 800 nm is about 22–29%. As the thickness of the skin increases from 0.43 mm to 1.6 mm, the percentage of the reflectance at 800 nm also increases from 19% to 32%. Collecting the reflected light energy and redirecting it onto the skin surfaces will increase the effective input energy, resulting in an increase of light penetration depth for the same light source without increasing the source power. The light catcher will also prevent the exposure of the scattered light to both the subject and the PA imaging operator, which otherwise will introduce safety concerns. Multiple random reflections inside the light catcher will also help distribute light energy more evenly to the skin surface, henceforth more uniform light distribution at depth is expected. In this way using a compact light catcher, input source light for PA imaging can be delivered over the extended area of imaging with higher efficiency, uniformity, and safety compared to other conventional methods such as direct illumination onto the skin using an expanded beam with higher source power. This concept to enhance the light propagation depth was previously proposed and evaluated only by in silico simulation under limited conditions.

The new opto-acousto-electric transducer requires a data acquisition unit with super channels, high sampling frequency, huge capacity of memory, ultra-wide band wireless communication, portable size and weight, and flexibility with common interface to multiple applications.

Based on the new techniques of VLSI, this signal processing unit takes the advantage of new system-on-chip design, and will be fabricated in smaller size with huge memory, supporting super-channel A/D converters and larger amount of I/O ports to communicate with external devices. The acquired data will be wirelessly transmitted to the computer at a bandwidth of more than 10Gbytes.

1.3. Products to be provided on the due date

Several products will be available in the market for the hospitals and research institutes in the United States.
1) Portable wireless super-channel analog signal acquisition units
2) 2D-array opto-acousto-electric transducers

1.4. Milestones of project

The process of design and fabrication is iterative and needs several loops to realize the final best performance.
1) Finish the initial design within 3 months,
2) Polish the design within 1 months
3) Fabricate the design within 1 months
4) Verify the design within 1 months
5) If there are errors or improvement, goto 2), otherwise finalize the project.

1.5. Amount funding for this project

It is assumed that the iterative process of design and fabrication is about 5 times.
Design fee: $10,000/time*3 times=$30,000
Fabrication fee: $10,000/time*3 times=$30,000
Processing fee: $10,000
Totally about $70,000 that will be updated according to the research requirement.

1.6. Reference

Exhibit-7(3), 0
**Ultrasound Current Source Density and Elasticity Imaging:
A New Modality to Noninvasively Map Cardiac Arrhythmia in Heart Patients**

**Innovation:** Conventional methods to detect arrhythmia and image electrical heart activity either suffer from poor spatial resolution (e.g., electrocardiography [ECG]) or require invasive surgery. For this PRMRP Concept Project directed at arrhythmia, we propose **Ultrasound Current Source Density and Elasticity Imaging (USCDEI)** as a novel diagnostic modality to noninvasively map electrical heart activity, and therefore heart function. USCDEI potentially enhances traditional electrocardiography by providing 1) superior spatial resolution determined by the size of the ultrasound focus (<1 mm³); 2) **volume images** of current flow, current source densities and neuropotentials without major assumptions regarding conductivity; 3) real-time imaging of functional heart areas or arrhythmias to quickly locate arrhythmia foci; 4) automatic and simultaneous **co-registration** of current density images with heart structure (pulse echo ultrasound), blood flow (transcranial Doppler) and mechanical heart vibration; and 5) **flexible imaging parameters** tailored to the patient (resolution, visualization area, frame rate). This proposal strives to demonstrate for the first time USCDEI of heart activity and arrhythmias in the rat. Because ultrasound frequencies below 2 MHz penetrate the human chest, a successful demonstration of the technology in the rat heart would be a major steppingstone towards a new modality to noninvasively map arrhythmias and evaluate heart function in patients.

**Hypothesis/Rationale/Purpose:** UCSDEI is based on Ohm's Law and the Acoustoelectric (AE) Effect, a well-known interaction between ultrasound pressure and tissue resistivity.\(^2\) We hypothesize that a focused ultrasound combined with traditional recording electrodes and appropriate acquisition hardware enables real-time, high resolution, volume imaging of arrhythmias and heart activity through the skull of rats and humans. Our rationale is based on the fact that the AE signal (and USCDEI) is proportional to both the local acoustic pressure and instantaneous current source density distribution.\(^3\) Signal processing for USCDEI is similar to pulse echo ultrasound, where the position of the beam and speed of sound provide spatial information. Compared to ECG, USCDEI resolution is determined by the size of the ultrasound focus (typically < 1 mm³) and controlled by the properties of the ultrasound transducer (i.e., center frequency and numerical aperture).\(^4\) Finally, frame rates for USCDEI potentially approach 1 kHz (2D) and 0.1 kHz (3D) with electronic steering of the US beam.

**Objectives:** The primary objectives are to 1) determine the sensitivity and spatial resolution of USCDEI for mapping focal arrhythmias and neocortical barrel activity through the skull of arrhythmia rats and 2) compare USCDEI to traditional evoked potential/ECG recording. These proof-of-concept experiments will be used to assess whether USCDEI can be scaled to arrhythmia patients, including those who have suffered traumatic heart injury.

**Methods:** USCDEI sensitivity and spatial resolution in neural tissue will be evaluated using several preparations: 1) artificial current in a heart model (1% Agarose™ gel in physiological saline); 2) evoked potentials in rat heart; and 3) focal arrhythmias through the chest of arrhythmia rodents. A head adapter will be designed to efficiently deliver ultrasound to the rat heart. Experiments will be complemented with USCDEI models for mapping dipoles in the heart. A variety of focused single element ultrasound transducers and linear arrays with a center frequency ranging from 1-10 MHz are available to develop USCDEI for neural imaging. A custom 16 channel recording system is also available to simultaneously acquire low frequency electrophysiology (<10 kHz) and high frequency AE signals (>0.5 MHz). This system will enable direct comparisons between multichannel ECG and USCDEI.

**Significance/Relevance:** Because ultrasound frequencies less than 2 MHz readily penetrate the human skull, a working prototype in the rat would be a major steppingstone towards a novel heart imaging technique to noninvasively map arrhythmias through the chest of arrhythmia patients. This approach would not only be useful for enhanced diagnosis and classification of arrhythmias, but it could also be a potentially useful tool for electrical heart mapping during neurosurgery or even combining USCDEI with high intensity focused ultrasound (HIFU) for image-guided treatment of severe arrhythmia (see "Concept Vision"--right).
Thank you for your review for the JUM

jum@aium.org <jum@aium.org> Thu, Feb 12, 2015 at 9:24 PM
To: zwang@email.arizona.edu

Dear Prof. Wang:

Your review of the manuscript, "Research on effect of ultrasound/SonoVue microbubble on CD4+CD25+ regulatory T cells viability and optimized parameters for its transfection," has been received. Thank you for your efforts in preparing this report. I appreciate your assistance, and I rejected this manuscript (albeit with the opportunity to resubmit). I look forward to your continued support of the journal.

Log into your Rapid Review account if you wish to see your review history, including the final decisions rendered for manuscripts you have reviewed.

Thank you, again.

Levon Nazarian, MD, Editor-in-Chief
Journal of Ultrasound in Medicine

******

Exhibit-8(1)
Thank you for your review for the JUM

jum@aium.org <jum@aium.org>  Sat, Jan 24, 2015 at 1:08 PM
To: zwang@email.arizona.edu

Dear Prof. Wang:

Your review of the manuscript, "Evaluation of Correlation between Carotid Artery Elasticity and Intima-media Thickness in Patients with Uremia by Echo Tracking," has been received. Thank you for your efforts in preparing this report. I appreciate your assistance, and I look forward to your continued support of the journal.

MS REJECTED.

Log into your Rapid Review account if you wish to see your review history, including the final decisions rendered for manuscripts you have reviewed.

Thank you, again.

Levon Nazarian, MD, Editor-in-Chief
Journal of Ultrasound in Medicine

******

REVIEWER 1:
Comments:
This paper investigates the study of using echo tracking to access the correlation between carotid artery elasticity and intima-media thickness in patients with uremia. However, the author should express his idea using professionally instead of translating Chinese word directly to English. Many sentences are misleading and confusing. I just listed a few for reference.

1) Page 3, line 17-18, the conclusion is not accurate, according to the analysis in the Result (line 14-16).
2) Page 5, line 9-10, the sentence is confusing.
3) Page 5, line 13-16, the sentence needs rewriting.
4) Page 6, line 9-14, the sentence needs rewriting.
5) Page 10, line 1-5, the sentence is confusing.
6) Page 12, line 19-21, the sentence needs rewriting.
7) Page 13, line 2-3, the sentence needs rewriting.
8) Page 15, line 3-13, the sentence needs rewriting.

There are also many typos in the draft. I just listed a few for reference.

9) Page 9, line 1, the threshold value 0.05 should be 0.01
10) Page 12, line 7, “the”
11) Page 13, line 14, “when”

REVIEWER 2:
Comments:
OVERALL
It seems that the authors have made measurements because the measurements were possible rather than because they are useful.
Please explain how high or low measurements might alter medical care.

TEXT

Exhibit-8(2)
"ET .... may offer useful information about ... arteriosclerosis"
COMMENT
Maybe this is true, but what "useful information"?

COMMENT
Although TG, LDL-C, HDL-C and ApoB were measured as continuous variables, there is no presentation of the relationship between these variables and the measured IMT, beta, AC, EP, PWV
Such results might be interesting.

TEXT
"last stage of all 1 kinds of kidney diseases"
COMMENT
This phrase suggests that the kinds of kidney diseases will be listed.
SUGGESTION
"last stage of kidney disease"
"last stage of renal failure, which often progresses rapidly"

TEXT
"media-adventitia joint of carotid"
COMMENT
A joint is an articulation
SUGGESTION
"media-adventitial interface"
"media-adventitial boundary"

TEXT
Results .. Reproducibility
Please put these values in a table.
The order of the 4 by 2 array is not obvious.

TEXT
"β,EP and PWVβ of 1 uremic group were higher"
"while of uremic group was lower than that of control group, but there was no significant difference between the two groups (t=-4.250, P=0.276)."
From Table 2
IMT(mm) β EP(Kpa) AC(mm 2/Kpa) PWVβ(m/s)
0.013 0.00 0.00 0.276 0.002
COMMENT
It looks like IMT was also different
The variable AC is missing from the sentence.

TEXT
"it is important to assess the arterial elastic function in patients with uremia at an early stage"

TEXT
"may offer useful information about the arteriosclerosis and heart and brain vascular diseases of uremic patients."
COMMENT
Both of the statements assert the importance of the measurement but neither explain why
If a measured parameter is "abnormal" how will the clinical care be changed?

TEXT
"the method for diagnosing the arteriosclerosis at an early stage is few reported."
SUGGESTION
"the method for diagnosing the arteriosclerosis at an early stage is rarely reported."

TEXT
"are dedicated to the diagnosis"
COMMENT
The meaning of "delicated"

TEXT
(ET), a relatively new ultrasonic technique9,10
COMMENT
1992 is not "relatively new"
SEE
AND

COMMENT
Although IMT is shown on Figures 3, 4, 5 and 6, some IMT values appear on some figures and not on others.

COMMENT
Please provide formulas for beta, AC, EP and PWV.
It is likely that the same measurement is used in all of these parameters so they are not independent

Review Notes
FIGURES
Figure 1 The carotid artery diameter curve and ET parameters measurements in control subjects
Figure 2 The carotid artery diameter curve and ET parameters measurements in uremic group
Figure 3 Correlation of $\beta$ with IMT of the uremic group positively
Figure 4 Correlation of EP with IMT of the uremic group positively
Figure 5 Correlation of PMV$\beta$ with IMT of the uremic group positively
Figure 6 Correlation of AC with IMT of the uremic group negatively

Review Notes
stiffness index beta
arterial compliance AC
Electricity Modulus EP
Pulse Wave Velocity PWV
Manuscript Number: Applied Physics Letters L15-07191

Title: "Fast Reconstruction of a Bounded Ultrasonic Beam using Acoustically induced Piezo-Luminescence"

Author: Mathias Kersemans, Philippe Smet, Nicolas Lammens, Joris Degrieck, and Wim Van Paepegem

Dr. Zhao Hui Wang
University of Pittsburgh Medical Center
Heart and Vascular Institute
3222 Juliet Street
Pittsburgh, PA 15213
United States of America

Dear Dr. Wang,

Thank you for your review of the above manuscript. We sincerely appreciate your time, expertise, and support of Applied Physics Letters.

A copy of your review is below for your reference.

Sincerely yours,

Applied Physics Letters

AIP Publishing LLC
Suite 300
1305 Walt Whitman Road
Melville, NY 11747-4300 USA

Phone: 516-576-2344
E-mail: apl-edoffice@aip.org

Manuscript #L15-07191:

Paper Interesting: No

Original Paper: Yes

Sufficient Physics: No

Well Organized: Yes

Exhibit-8(3)
Clear and Error Free: No
Conclusions Supported: Yes
Satisfactory English: No
Appropriate Title: Yes
Good Abstract: Yes
Clear Figures: Yes
Adequate References: Yes

OVERALL RATING: Good

Comments to the Author:
This draft investigates acoustically induced piezo-luminescence to visualize the radiation field of an ultrasound piston transducer in both the near field and the far field. There are a few grammar errors in this draft, and the author still need continue polishing in writing.
(1) Lines 48-51 are confusing and need to be rewritten.
(2) Lines 51-54 are confusing and need to be rewritten.
(3) Lines 69-71 are suggested to be rewritten.
(4) Lines 170-174, the method provided in is not persuasive. That method does not provide the consideration of the constrain of k^2=lx^2+lx^2+lx^2.
(5) Line 175-176, why "The periodic nature of the fast Fourier transform however results in reflections at the boundary of the numerical domain"? Please explain it in detail with reference.
(6) Line 215-217 are confusing and need to be rewritten.

Comments to the Editor:

RECOMMENDATION: Reconsider for APL after mandatory revision (major)

Review Revision (confidential): Yes, I would like to review a revised manuscript

Recommend Another Journal (confidential):

Applied Physics Letters retains the top spot as the most highly cited journal in Applied Physics, (Thomson Reuters, 2015).
APL: MS #L15-07191R Review Received for REVISED manuscript

apl-edoffice@aip.org <apl-edoffice@aip.org>                       Sun, Nov 22, 2015 at 7:43 PM
Reply-To: apl-edoffice@aip.org
To: wangzhh@ustc.edu
Cc: zhwang7@gmail.com


Title: Fast Reconstruction of a Bounded Ultrasonic Beam using Acoustically induced Piezo-Luminescence

Author(s): Mathias Kersemans, Philippe Smet, Nicolas Lammens, Joris Degrieck, and Wim Van Paepegem

Dear Prof. Dr. Wang,

Thank you for your review of the above manuscript. We sincerely appreciate your time, expertise, and support of Applied Physics Letters.

A copy of your review is below for your reference.

Sincerely yours,

Applied Physics Letters

AIP Publishing LLC
Suite 300
1305 Walt Whitman Road
Melville, NY 11747-4300 USA

Phone: 516-576-2344
E-mail: apl-edoffice@aip.org

==================================
Manuscript #L15-07191R:

Paper Interesting: No

Original Paper: Yes

Sufficient Physics: No

Well Organized: Yes

Clear and Error Free: Yes

Conclusions Supported: Yes

Satisfactory English: Yes

Exhibit-8(4)
Appropriate Title: Yes
Good Abstract: Yes
Clear Figures: Yes
Adequate References: Yes
OVERALL RATING: Very Good

Comments to the Author:
This version is better than previous version. It is ok to me.

Comments to the Editor:

RECOMMENDATION: Publish in APL as is
Review Revision (confidential): No, I do not wish/need to review a revised manuscript
Recommend Another Journal (confidential):

Applied Physics Letters retains the top spot as the most highly cited journal in Applied Physics, (Thomson Reuters, 2015).

EEEN5303-021 T- Studies On Current Research

Project Policies

1. Schedule

   1) One or two students can create one group, depending on their willingness. Each one group has to choose one specific topic, which needs three phases. Each phase corresponds to one project. At the end of each phase, the group need submit report and make presentation about the progress.

      ♦ phase 1: background research. This phase is to create one “review report on topic”. Its duration is about one month. The weekly report will contain one ppt file and 2 papers.

      ♦ phase 2: realizing the most frontier research. This phase is to create one “current research report”. Its duration is about one month. The weekly report will contain one ppt file and one supporting paper from the same research group.

      ♦ phase 3: providing his own idea based on the previous research and realizing his method. This phase is to create one “novel research report”. If the student cannot provide new idea, he/she should realize the 2nd frontier research that should not be similar to the 1st one. Its duration is about one month. The weekly report will contain one ppt file and one paper supporting your own new idea.

   2) In each class of phase 1, one group need investigate at least one journal paper that was published in recent years. I will also assign each group a few mandatory papers that are most important to that topic.

   3) At the end of each week, each group should submit me the ppt and papers that were investigated in that week, I will grade based on the weekly report.

   4) The total number of papers to be read by each group is at least 16 during this semester. The comprehension exam will be based on the journal papers that were investigated by the group. I will pick up part of them (about 8) for the comprehension exam.

   5) Each group submit paper-version report, I will evaluate the report together with each group, and mark the problems on the paper, later I will grade the report according to the evaluation results.

   6) No updated version is allowed. But each group can correct these errors in the next phase report.

Diagram of topic choices

Exhibit-9(1), 1
**2. Topics:**
All topics are simulation or design projects.

**Acoustics:**
1) Ultrasound Doppler Imaging  
   software: Field II  
2) Ultrasound Elasticity Imaging  
   software: Field II  
3) Fast frame rate imaging  
   software: C/C++

**Optics:**
4) Photoacoustic imaging  
   software: k-wave  
5) Multi-photon imaging system/ Laser  
   software: Monte Carlo, 2D->3D  
6) Optical Coherence Tomography  
   software: Zemax (design)

**MEMS:**
7) Biosensor Design  
8) Solar cell

**VLSI/FPGA:**
9) FPGA ultrasound imaging system  
   software: Designer (design)  
10) Wireless communication to medical devices  
    software: COMSOL (multiphysics)

**Computing Software:**
11) Microbubble  
    software: COMSOL (multiphysics)  
12) Computing software design: Elmer  
    software: Elmer (Linux)

**Others:**
13) Ultrasound Current Source Density Imaging  
    software: Matlab pdetool/ Comsol  
14) Acoustoelectric Hydrophone  
    software: Matlab pdetool / Comsol  
15) Remote Sensing classification  
    software: C/C++  
16) Remote Sensing compression  
    software: C/C++  
17) Computing software design: Impact  
    software: Impact
Degree Plan and Course Registration Process

Every student should submit initial degree plan and final degree plan to schedule his/her graduation. The initial plan is submitted at the beginning of the 1st semester when the student registers courses. This initial plan may be updated in the following semesters according to the change of course schedule and interest. The update of initial plan only needs the permission of graduate coordinator. The final plan needs to be submitted in the last one semester before graduation. It needs the permission from the graduate director, committee chair, and department head.

The student should decide if she or he will be pursuing a thesis or a project option. Graduate students pursuing a project option are required to complete a total of 33 credit hours of coursework by pursuing three tracks, two majors and one minor. Each major will have four courses and each minor has three courses. Exceptions will be allowed only by the permission of the graduate director. Students pursuing a thesis option are required to complete 24 credit hours of coursework, the courses will be determined in consultations with the thesis advisor, student, and graduate coordinator.

Graduate students cannot take more than three courses in one semester. In special cases, exceptions can be made for an additional course if the student has a GPA of at least 3.5.

Students cannot register for any course that has not been explicitly approved by the graduate coordinator. Strict disciplinary action will be taken if this policy is violated.

There are several stages of course registration: Priority Registration, Late Registration, Permission-required Registration, and Registration Deadline. In the first stage of registration process, the student should fill in the course registration form, and submit it, along with degree plan, to the graduate coordinator for permission. After permission, the student will need to deliver all the documents to the department office to register courses. If the student does not complete his/her initial registration by the late registration deadline, a $35 Late Registration Fee will be assessed to student. After the date of Permission-required Registration, a permission to register or change classes is required with signatures from the adviser and course instructor who is teaching that course. After the Deadline of Registration, students will be dropped from classes if they have not paid in full or made payment arrangements with the Business Office. There will be no reinstatement of classes and no additional Emergency Loans beyond this date.

![Diagram of course registration.](image-url)
EEEN5321_001_201610 (Digital Computer Design): Final exam, 11:00 am to 12:30 am on Dec. 7

Zhao Hui Wang - zhaohui.wang@tamuk.edu <do-not-reply@blackboard.com>

Sat 11/21/2015 12:23 AM

Hello All,

I will review homework and answer questions on Nov. 30, and the 4th homework is also due on Nov. 30.

The midterm exam of EEEN 5321-001 Digital Computer Design will be taken in the Room BUSA 227, starting from 11:00 am to 12:30 am on Dec. 7, 2015, totally about 90 minutes. The exam includes single-choice questions, multi-choice questions, filling-blank questions, and two analysis questions.

It is a closed book/note exam, covering materials (lectures and lab tutorials) of lecture 3 up to Lecture 5. I have uploaded the lectures for your reference.

Every student is assigned one number according to his/her last name registered in Blackboard. The seats in the classroom will be distributed on the exam day and shown on the screen. The students need hold the university badge in hand and take the assigned seat.

In the exam you are not allowed to go restroom, share calculator or any paper. The iphone, ipad, computer or other electronic devices are not allowed in the classroom. The cell phone shall not be on your body. The bag and papers shall put on the front desk. The University badge with your picture should be put on your front-left corner.

The students who were found cheating or taking picture of the papers in the exam will be graded zero. When the time is due, all students should stop writing, submit the answer papers to the front desk, and leave the exam hall without delay and discussion with other students. The students who violate the exam rules will be recorded for punishment, or stopped continuing the exam and even reported to the department.

Zhao Hui Wang