MR

ARIZONA STATE UNIVERSITY

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## GENERAL STUDIES PROGRAM COURSE PROPOSAL COVER FORM

**Courses submitted to the GSC between 2/1 and 4/30 if approved, will be effective the following Spring.**

**Courses submitted between 5/1 and 1/31 if approved, will be effective the following Fall.**

**(SUBMISSION VIA ADOBE.PDF FILES IS PREFERRED)**

DATE March 5, 2010

1. ACADEMIC UNIT: School of Mechanical, Aerospace, Chemical and Materials Engineering

2. COURSE PROPOSED: MAE 491 Experimental Mechanical Engineering 3
(prefix) (number) (title) (semester hours)

3. CONTACT PERSON: Name: Valana Wells Phone: 54777

Mail Code: 6106 E-Mail: valana@asu.edu

4. ELIGIBILITY: New courses must be approved by the Tempe Campus Curriculum Subcommittee and must have a regular course number. For the rules governing approval of omnibus courses, contact the General Studies Program Office at 965–0739.

5. AREA(S) PROPOSED COURSE WILL SERVE. A single course may be proposed for more than one core or awareness area. A course may satisfy a core area requirement and more than one awareness area requirements concurrently, but may not satisfy requirements in two core areas simultaneously, even if approved for those areas. With departmental consent, an approved General Studies course may be counted toward both the General Studies requirement and the major program of study. **(Please submit one designation per proposal)**

Core Areas

Literacy and Critical Inquiry–L ☒
Mathematical Studies–MA ☐ CS ☐
Humanities, Fine Arts and Design–HU ☐
Social and Behavioral Sciences–SB ☐
Natural Sciences–SQ ☐ SG ☐

Awareness Areas

Global Awareness–G ☐
Historical Awareness–H ☐
Cultural Diversity in the United States–C ☐

6. DOCUMENTATION REQUIRED.
(1) Course Description
(2) Course Syllabus
(3) Criteria Checklist for the area
(4) Table of Contents from the textbook used, if available

7. ***In the space provided below (or on a separate sheet), please also provide a description of how the course meets the specific criteria in the area for which the course is being proposed.***

CROSS-LISTED COURSES: ☒ No ☐ Yes; Please identify courses: _____

Is this amultisection course?: ☒ No ☒ Yes; Is it governed by a common syllabus? yes

Kyle D. Squires
Chair/Director (Print or Type)

Chair/Director (Signature)

Date: 3/12/2010

Rev. 1/94, 4/95, 7/98, 4/00, 1/02, 10/08

General Studies Mandatory Review: *MAE 491 Experimental Mechanical Engineering.*

**Course Description:** Experimental and analytical studies of phenomena and performance of fluid flow, heat transfer, thermodynamics, refrigeration, and mechanical power systems.

1. Seventy-two percent of the grade is based on student performance on 9 laboratory reports. Lab reports are graded for technical content and writing. The Grading Outline (attached) provides guidance for report style requirements.
2. The course involves designing and conducting experiments. Therefore, by virtue of the very nature of the course, the students are required to collect, interpret and evaluate data.
3. The students are required to write 10 laboratory reports, 9 of which make up 72% of the course grade. Each report is substantial in nature, as described in the Grading Outline. Reports must include Abstract, Introduction and Objectives, Experimental Setup and Procedure, Results and Discussion, Summary, References and Appendices.
4. The ten laboratories are distributed throughout the semester. Graded reports with feedback are returned to the students before the following report is due.

**Experimental Mechanical Engineering MAE 491**
**Course Syllabus, Spring 2010**

Instructor: Ronald J. Calhoun,
Associate Professor
School of Engineering of Matter, Transport and Energy
Arizona State University
Office: ISTB2-221
Phone: 480.727.7032
Email: Ron.Calhoun@asu.edu
Office Hours: Monday 9:30 – 12:30, or by appointment

Lecture: Sections 1 & 2, M 8:35-9:25 a.m., GWC 465
Lab Section 1 T/Th 7:30- 9:30, Urban Systems Eng. 176
Lab Section 2 W/F 7:30- 9:30, Urban Systems Eng. 176
Optional Text: Mechanical Measurements 6th Edition, by Beckwith, Maragoni, and Lienhard.

Course Description:
This is an experimental lab course that compliments your previous lecture classes in thermodynamics, heat transfer and fluid mechanics. This course is designed to provide an opportunity to apply the theoretical concepts learned in those classes. In addition, this course is designed to cover basic measurement techniques and methods for thermofluid systems. There will be a total of ten experiments lasting one week each. There will be introductory labs, labs on heat transfer, several labs on fluids, and labs on energy. A lab report will be due from each student the next lab section. This will typically be the following week, but during holidays you may have up to two weeks to complete the report. There will be a single midterm and a final exam. There will also be occasional pop quizzes given during the lecture period. Lectures will last one hour and include both sections (1 & 2) of the class. The lab sections will be primarily used for conducting experiments. The labs are conducted by teams (of approximately 7-8 students) with the assistance of a lab instructor. It is expected that all team members contribute and interact during and after the experiments.

Comment [v1]: C1, C2, C3, C4

Lab Reports:
The lab report will be due at 5:00 p.m., one week after the experiment was performed, unless noted otherwise. Although the recorded data can be shared, the narrative discussion in the report memos must be prepared independently by each student. Since this class carries the "L" designation, for technical writing content, the reports will be evaluated on both technical content and writing. Lab reports will be uploaded on Blackboard. You must upload a MS Word (.DOC) or PDF file. The file must be less than 10 MB. Copying from the web, books, previous reports, or your classmates is considered cheating and is not acceptable. Consulting previous or your classmates reports is considered academic dishonesty. Academic dishonesty and plagiarism will not be tolerated. The ASU Academic Integrity Policy will apply:
*http://www.asu.edu/studentaffairs/studentlife/judicial/academic_integrity.htm*

Comment [v2]: C1, C4

Safety and Integrity:
Safety is always a primary concern during laboratory testing, and it is essential that safety procedures are established, understood and followed. Some basic safety rules include:
1. Be mindful of safety: There are many items in the lab that can pose a possible danger to yourself and others around, but only if they are not treated with attention, knowledge, and discipline.
2. Do not wear loose clothing or jewelry that can be entangled with moving machinery.
3. Do not handle high-pressure gas cylinders or flammable liquids (they will be handled by laboratory technicians).
4. Do not operate any equipment and devices, until you learn its operation and consequences of operating them.
5. Do not handle any chemicals, until you know their contents and potential hazards.

Grading:
Lab Reports (9 x 8): 72%
Comment [v3]: C1, C3
Midterm 10% (open book and notes)
Final Exam 18% (open book and notes). Note: Your lowest lab score will be dropped, leaving 9 out of 10 labs for which you will receive a grade. Late lab reports will be accepted but the grade will be adjusted relative to the number of hours it is late. Late reports should be turned into the MAE main office (not the TA's or Prof.) and time stamped by the front office. The assigned grade will be governed by an exponential decay given as, *actual grade* = *grade* $e^{-\alpha t}$ where *grade* is the numerical score assigned by the teaching assistant (out of 100 points), $\alpha = 0.008$, and $t$ is time in hours. Since the lowest lab grade will be dropped, do not ask to be excused for a missed or late report, simply drop it or accept the late score.

Organization of Teams:
This course shares a common lecture, but has two sections. Section 1 is T/TH. Section 2 is W/F. You are enrolled in either section 1 or 2, and you cannot switch sections without changing your official course enrollment. Each section has been broken into 4 groups of 7-8 students (A to D), leaving a total of eight groups (1A, 1B, 1C, 1D, 2A, 2B, 2C, 2D). See separate handout for listing of groups. The lab schedule will primarily be held according to this schedule with some exceptions.

Monday: Lecture, all groups
Tuesday: 1A, 1B
Wednesday: 2A, 2B
Thursday: 1C, 1D
Friday: 2C, 2D

All team members must participate in each lab experiment. It is expected that each person in the team will contribute equally to each experiment. Please do your best at communicating effectively amongst yourselves to ensure that each team member is contributing to the success of the lab.

Schedule

The number in brackets [] is the lab you will perform.

| Week | Date | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|---|
| 1 | 1/18 | MLK day, week off... | | | |
| 2 | 1/25 | 1A[1] & IB[2] | 2A[1] & 2B[2] | 1C[1] & 1D[2] | 2C[1] & 2D[2] |
| 3 | 2/01 | 1A[2] & IB[1] | 2A[2] & 2B[1] | 1C[2] & 1D[1] | 2C[2] & 2D[1] |
| 4 | 2/08** | 1A[3] & IB[4] | 2A[3] & 2B[4] | 1C[3] & 1D[4] | 2C[3] & 2D[4] |
| 5 | 2/15 | 1A[4] & IB[3] | 2A[4] & 2B[3] | 1C[4] & 1D[3] | 2C[4] & 2D[3] |
| 6 | 2/22 | 1A[5] & IB[6] | 2A[5] & 2B[6] | 1C[5] & 1D[6] | 2C[5] & 2D[6] |
| 7 | 3/01 | 1A[6] & IB[5] | 2A[6] & 2B[5] | 1C[6] & 1D[5] | 2C[6] & 2D[5] |
| 8 | 3/08 | ---- Makeup week --- | | | |
| 9 | 3/15 | ***** Spring Break ****** | | | |
| 10 | 3/22 | 1A[7] & IB[8] | 2A[7] & 2B[8] | 1C[7] & 1D[8] | 2C[7] & 2D[8] |
| 11 | 3/29 | 1A[8] & IB[7] | 2A[8] & 2B[7] | 1C[8] & 1D[7] | 2C[8] & 2D[7] |
| 12 | 4/05++ | -----Makup week ----- | | | |
| 13 | 4/12 | 1A[9] & IB[10] | 2A[9] & 2B[10] | 1C[9] & 1D[10] | 2C[9] & 2D[10] |
| 14 | 4/19 | 1A[10] & IB[9] | 2A[10] & 2B[9] | 1C[10] & 1D[9] | 2C[10] & 2D[9] |
| 15 | 4/26 | ---- Makeup week --- | | | |
| 16 | 5/03 | Reading day and finals | | | |
| 17 | 5/10 | Final Exam: TBD | | | |

** Feb. 8 No Lecture, but go to labs!!

++ Apr. 5 Midterm

Comment [v4]: C4

Labs

Lab 1: Intro to Temperature
Lab 2: Intro to Flow Lab
Lab 3: Forced Convection
Lab 4: Fuel Heating Value
Lab 5: Cooling Tower
Lab 6: Aerodynamics
Lab 7: Gas Turbine
Lab 8: Hydrogen Fuel Cell
Lab 9: Water Pump
Lab 10: Photovoltaic Solar Cells

**MAE 491 Lab Report guidelines**

Each report should include the following sections. In bold is listed the points for each section.

1. Title (**3pt**)
   a. Title, your name, TA name, section and group number
2. Abstract (**5 pt**)
   a. Summarize your work and findings. Do not get into too much detail, only present the objectives and present key findings. The abstract should be able to be read independently from the main document. It should give the reader as much insight into the entire report as possible, given space limitations (< 500 words). It is safe to assume that your reader is knowledgeable in the field and will understand the technical jargon that is used.
3. Introduction (**15 pts**) and Objectives
   a. Describe the purpose and objectives of the experiment. What is unknown? Why is it important? What physical concepts are used in making the measurement? Include equations or diagrams that explain the physics.
   b. List assumptions, equations, physical concepts. Feel free to use diagrams as needed. Include governing principles that driving your analysis (e.g. Bernoulli's equation, ideal gas law, etc.) Are there assumptions entailed within your analysis (or for equations used)? Did you use any references (Do not reference websites only papers and books.)
4. Experimental Setup and Procedure (**15 pts**)
   a. Draw a diagram of the setup(s). Describe what was done, what variables are varied, what was measured, how and why.
   b. The purpose of the experimental setup and procedure is to clearly describe how the work was performed. This should be written in detail such that others can repeat your work. Feel free to use schematics, images, or diagrams. Include labels of on your figures and carefully describe the parts of the system. Describe equipment used (for example Type-T thermocouple or u-tube monometer). Include the resolution and accuracy of the instrument used.
   c. This section can also include the process you have used to reduce your data. Did you develop a calibration equation? Did you use some constants from a book? Describe any manipulation of your raw data including those performed by the labview program. Theoretical equations go in the introduction (e.g. Bernoulli's eqn, idea gas law, definition of Reynolds number) while practical equations (e.g. fit of a calibration curve) go in the experimental setup).
5. Results and Discussion (**30 pt**)
   a. Present and describe your results. Include plots of your results with clearly marked axis labels and units. It is important that the font type and size matches the main text. Present tabular and graphical results. All results should be computer generated. You should plot a symbol for each data point in a figure. Data points are connected by a straight line. A "French curve" is explicitly forbidden (i.e. splines). Error bars and uncertainties should be shown. If you use certain plotting software, such as Excel, they have features that incorporate splines into the representation of the data. This is by no means acceptable. Do not smooth your experimental data or use spline fitting. If you fit your data use a least squares fitting algorithm. The fit equation should be based on theory and the both the fitting parameters as well as the R-squared value should be reported.
   b. S.I. is to be used in the presentation of data.
   c. In your own words, refer to the figures and describe the trends, physical phenomena, possible error, and anything else which has relevance to the results. Discuss the measured results relative to expectation and understanding of the physics.
   d. At some point during the class you will also be asked to include some discussion about the uncertainty of your experimental results.

e. Q&A ---If assigned, you answer any questions given in the lab handout. This is not a normal part of a academic or industrial report.

6. Summary **(10 pt)**
   a. Report a summary of your work. Include any deviation from the expected results and describe how the physics related to your measurements. If you are to compare results to expectations the real question that arises is, "What do you expect? And why?" Include any discussion on how the lab can be improved. Offer critical comments regarding the technique and propose alternative techniques and solutions.
7. References
   a. List references by number here. You should list them by order usage. In the main text you should use a number in superscript [1] or in brackets [1]. If you use the brackets, this comes before the punctuation. If you use superscript this should come after the superscript.
   b. Do not reference websites only papers and books

Comment [v1]: C2, C3

8. Appendix
   a. Original Data, listing of computer codes, sample calculations. Only include information which could be useful to reader in better understanding what you are presenting.

Other important considerations for report:

**Details (7 pts)**

a. Page #'s
b. 1" margins
c. Numbered equations
d. Numbered figures with figure captions
e. References

**Grammar (15 pts)**

Since this course has a writing designation, you will also be graded on your writing style and grammar. This section is somewhat subjective. We will have lectures relating to technical writing and you see that there are some variations in style that are acceptable. Spelling errors and obvious poor grammar will be marked down. Style changes may be suggested but not marked down. If you feel that a mistake with the grading of grammar has been made, please bring it to the TAs attention. If your conversations with the TA do not resolve the issue, contact the instructor.

**Arizona State University Criteria Checklist for**

# LITERACY AND CRITICAL INQUIRY - [L]

## Rationale and Objectives

**Literacy** is here defined broadly as communicative competence in written and oral discourse. **Critical inquiry** involves the gathering, interpretation, and evaluation of evidence. Any field of university study may require unique critical skills which have little to do with language in the usual sense (words), but the analysis of spoken and written evidence pervades university study and everyday life. Thus, the General Studies requirements assume that all undergraduates should develop the ability to reason critically and communicate using the medium of language.

The requirement in Literacy and Critical Inquiry presumes, first, that training in literacy and critical inquiry must be sustained beyond traditional First Year English in order to create a habitual skill in every student; and, second, that the skills become more expert, as well as more secure, as the student learns challenging subject matter. Thus, the Literacy and Critical Inquiry requirement stipulates two courses beyond First Year English.

Most lower-level [L] courses are devoted primarily to the further development of critical skills in reading, writing, listening, speaking, or analysis of discourse. Upper-division [L] courses generally are courses in a particular discipline into which writing and critical thinking have been fully integrated as means of learning the content and, in most cases, demonstrating that it has been learned.

Students must complete six credit hours from courses designated as [L], at least three credit hours of which must be chosen from approved upper-division courses, preferably in their major. Students must have completed ENG 101, 107, or 105 to take an [L] course.

Notes:

1. ENG 101, 107 or ENG 105 must be prerequisites
2. Honors theses, XXX 493 meet [L] requirements
3. The list of criteria that must be satisfied for designation as a Literacy and Critical Inquiry [L] course is presented on the following page. This list will help you determine whether the current version of your course meets all of these requirements. If you decide to apply, please attach a current syllabus, or handouts, or other documentation that will provide sufficient information for the General Studies Council to make an informed decision regarding the status of your proposal.

**Proposer: Please complete the following section and attach appropriate documentation.**

## ASU - [L] CRITERIA

TO QUALIFY FOR **[L]** DESIGNATION, THE COURSE DESIGN MUST PLACE A MAJOR EMPHASIS ON COMPLETING CRITICAL DISCOURSE--**AS EVIDENCED BY THE FOLLOWING CRITERIA:**

| YES | NO | | Identify Documentation Submitted |
|---|---|---|---|
| ☑ | ☐ | **CRITERION 1:** At least 50 percent of the grade in the course should depend upon writing, including prepared essays, speeches, or in-class essay examinations. *Group projects are acceptable only if each student gathers, interprets, and evaluates evidence, and prepares a summary report* | Course Syllabus |

1. Please describe the assignments that are considered in the computation of course grades--and indicate the proportion of the final grade that is determined by each assignment.

2. **Also:**

Please **circle, underline, or otherwise mark** the information presented in the most recent course syllabus (or other material you have submitted) that verifies **this description** of the grading process--and label this information **"C-1".**

**C-1**

| YES | NO | | Identify Documentation Submitted |
|---|---|---|---|
| ☑ | ☐ | **CRITERION 2:** The composition tasks involve the gathering, interpretation, and evaluation of evidence | Course Syllabus, Lab Report Guidelines |

1. Please describe the way(s) in which this criterion is addressed in the course design

2. **Also:**

Please **circle, underline,** or **otherwise mark** the information presented in the most recent course syllabus (or other material you have submitted) that verifies **this description** of the grading process--and label this information **"C-2".**

**C-2**

| YES | NO | | Identify Documentation Submitted |
|---|---|---|---|
| ☑ | ☐ | **CRITERION 3:** The syllabus should include a minimum of two substantial writing or speaking tasks, other than or in addition to in-class essay exams | Course Syllabus |

1. Please provide relatively detailed descriptions of two or more substantial writing or speaking tasks that are included in the course requirements

2. **Also:**

Please **circle, underline,** or **otherwise mark** the information presented in the most recent course syllabus (or other material you have submitted) that verifies **this description** of the grading process--and label this information **"C-3".**

**C-3**

| ASU - [L] CRITERIA | | | |
|---|---|---|---|
| ☑ | ☐ | **CRITERION 4:** These substantial writing or speaking assignments should be arranged so that the students will get timely feedback from the instructor on each assignment in time to help them do better on subsequent assignments. *Intervention at earlier stages in the writing process is especially welcomed* | Course Syllabus |

1. Please describe the sequence of course assignments--and the nature of the feedback the current (or most recent) course instructor provides to help students do better on subsequent assignments

2. **Also:**

Please **circle, underline,** or **otherwise mark** the information presented in the most recent course syllabus (or other material you have submitted) that verifies **this description** of the grading process--and label this information **"C-4".**

**C-4**