Chair: Tracy Christofero | **GC#6: Course Addition**

Request for Graduate Course Addition

1. Prepare one paper copy with all signatures and supporting material and forward to the Graduate Council Chair.
2. E-mail one identical PDF copy to the Graduate Council Chair. If attachments included, please merge into a single file.
3. ***The Graduate Council cannot process this application until it has received both the PDF copy and the signed hard copy.***

College: CITE | Dept/Division: Engineering | Alpha Designator/Number: ME 520 | (•) Graded ( ) CR/NC

Contact Person: SARDER E. SADIQUE, Ph.D., P.E. (CA) | Phone: 3046965621

NEW COURSE DATA:

New Course Title: Introduction to Computational Fluid Dynamics

Alpha Designator/Number: M E 5 2 0

Title Abbreviation: I n t r o C o m p F l u i d D y n a m i c s

(Limit of 25 characters and spaces)

Course Catalog Description: (Limit of 30 words)

This course covers governing equations, ordinary differential equations (ODEs), numerical integration; finite difference and finite volume methods for parabolic, elliptic, hyperbolic partial differential equations (PDEs), numerical linear algebra; turbulence modeling.

Co-requisite(s):

First Term to be Offered: Fall 2015

Prerequisite(s): Graduate Status

Credit Hours: 3

Course(s) being deleted in place of this addition (*must submit course deletion form*):

Signatures: if disapproved at any level, do not sign. Return to previous signer with recommendation attached.

Dept. Chair/Division Head _____	Date _____
Registrar _____	Date _____
College Curriculum Chair _____	Date _____
Graduate Council Chair _____	Date _____

Request for Graduate Course Addition - Page 2

College: CITE | Department/Division: Engineering | Alpha Designator/Number: ME 520

Provide complete information regarding the new course addition for each topic listed below. Before routing this form, a complete syllabus also must be attached addressing the items listed on the first page of this form.

1. FACULTY: Identify by name the faculty in your department/division who may teach this course.

SARDER E. SADIQUE, Ph.D., P.E. (CA), Assistant Professor of Mechanical Engineering

2. DUPLICATION: If a question of possible duplication occurs, attach a copy of the correspondence sent to the appropriate department(s) describing the proposal. Enter "***Not Applicable***" if not applicable.

Not Applicable

3. REQUIRED COURSE: If this course will be required by another deparment(s), identify it/them by name. Enter "***Not Applicable***" if not applicable.

Not Applicable

4. AGREEMENTS: If there are any agreements required to provide clinical experiences, attach the details and the signed agreement. Enter "***Not Applicable***" if not applicable.

Not Applicable

5. ADDITIONAL RESOURCE REQUIREMENTS: If your department requires additional faculty, equipment, or specialized materials to teach this course, attach an estimate of the time and money required to secure these items. (Note: Approval of this form does not imply approval for additional resources.) Enter "***Not Applicable***" if not applicable.

Not Applicable

6. COURSE OBJECTIVES: (May be submitted as a separate document)

Submitted as a separate document in the Course Syllabus

7. COURSE OUTLINE (May be submitted as a separate document)

Submitted as a separate document in the Course Syllabus

8. SAMPLE TEXT(S) WITH AUTHOR(S) AND PUBLICATION DATES (May be submitted as a separate document)

Submitted as a separate document in the Course Syllabus

9. EXAMPLE OF INSTRUCTIONAL METHODS (Lecture, lab, internship)

Lecture/Lab

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10. EXAMPLE EVALUATION METHODS (CHAPTER, MIDTERM, FINAL, PROJECTS, ETC.)

MIDTERM, FINAL, PROJECTS, LAB

11. ADDITIONAL GRADUATE REQUIREMENTS IF LISTED AS AN UNDERGRADUATE/GRADUATE COURSE

N/A

12. PROVIDE COMPLETE BIBLIOGRAPHY (May be submitted as a separate document)

Submitted as a separate document in the Course Syllabus

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Please insert in the text box below your course summary information for the Graduate Council agenda. Please enter the information exactly in this way (including headings):

Department:
Course Number and Title:
Catalog Description:
Prerequisites:
First Term Offered:
Credit Hours:

Department: Engineering

Course Number and Title: ME 520 Introduction to Computational Fluid Dynamics

Catalog Description:
This course covers governing equations, ordinary differential equations (ODEs), numerical integration; finite difference and finite volume methods for parabolic, elliptic, hyperbolic partial differential equations (PDEs), numerical linear algebra; turbulence modeling.

Prerequisites: None

First Term Offered: Fall 2015

Credit Hours: 3

Course Title/ Number	**Introduction to Computational Fluid Dynamics - ME 520**
Semester/Year	
Days/Time	
Location	
Instructor	Sarder E. Sadique, Ph.D., P.E.(CA)
Office	Weisberg Engineering Lab Room 109 (previously lab general office) Division of Engineering College of Information Technology and Engineering Marshall University Huntington, WV 25755
Phone	304-696-5621
E-Mail	sadique@marshall.edu
Office/Hours	
University Policies	By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy be going to www.marshall.edu/academic-affairs and clicking on "Marshall University Policies." Or, you can access the policies directly by going to http://www.marshall.edu/academic-affairs/?page_ id=802 Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment

Catalog Course Description:

This course covers governing equations, ordinary differential equations (ODEs), numerical integration; finite difference and finite volume methods for parabolic, elliptic, hyperbolic partial differential equations (PDEs), numerical linear algebra; turbulence modeling.

Course Prerequisites:

None

Course Objectives:

Develop an understanding of introductory concepts in computational fluid mechanics with emphasis on the numerical solution of ordinary and partial differential equations; solution of ODEs by numerical integration; finite difference and finite volume methods for parabolic, elliptic, and hyperbolic PDEs (techniques for single and multi-dimensional problems); numerical linear algebra. Ability to implement and utilize various numerical methods and basic mathematical analysis for canonical problems in fluid mechanics. Develop advanced skills in MATLABand programming languages such as C/C++ & Fortran.

Required Texts, Additional Reading, and Other Materials

- Anderson, J. D. Computational Fluid Dynamics|The Basics with Applications. McGraw-Hill.
- Ferziger, J.H. and Peri_c, M. Computational Methods for Fluid Dynamics. Springer.
- Tannehill, J.C., Anderson, D.A., and Pletcher, R.H. Computational Fluid Mechanics and Heat Transfer. Second edition. Taylor & Francis.

Class/Laboratory Schedule

- Class: 3 hrs

Grade Policy:

The grading for the class will be determined using the following weights:

Lab Reports	30%
Homework	10%
Quizzes	5%
Midterm Exam	15%
Research Project	15%
Final Exam	25%

Letter Grade Scale*:

90 - 100 --------- A
80 - 89 ---------- B
70 - 79 ---------- C
60 - 69 ---------- D
0 - 59 ---------- F

* *The instructor does reserve the right to slightly curve or scale the grades based on class groupings/performance.*

Tests/Exams:

Makeup exams will be given only due to **extraordinary circumstances**, and only if the instructor is notified **prior** to the exam and the instructor judges it to be an acceptable excuse. Academic dishonesty (cheating) on any exam will result in a grade of zero for that exam. A second infraction will result in a course grade of F and possible University sanctions.

Grading Policy of Tests/Exams:

Three tests and a final exam will be given during the course of the semester. Exams will be closed book and closed notes. No makeup exams will be given with the exception of unusual circumstances (institutional excuse, severe injuries, family emergencies, group activities etc.).

Course Requirements / Due Dates

Exam/Test/Quiz/Project	Due Dates
Quiz 1	
Test 1	
Quiz 2	
Test 2	
Project	
Final Exam	

Grading

You **may be** allowed to reschedule an exam **only if**: you inform me and arrangements are made, at least **one week** before the exam date. Every effort will be made to fairly grade the exams, lab reports, and

homework. If you feel an error has been made in grading the exam it must be turned-in at the end of the class period it was distributed. Any error in grading of a lab report or homework assignment must be submitted within two days for re-grading.

Schedule of Topics* (tentative – subject to change)

Lecture	Topics	Chapter
1	Introduction to CFD	
2	The governing equations and their behavior	
3	Numerical solution of ODEs	
4	Methods for parabolic equations	
5	Methods for elliptic equations	
6	Methods for hyperbolic equations	
7	Numerical methods	
8	Finite difference methods	
9	Finite volume methods	
10	Turbulence modeling	
11	Systems of equations	
12	Numerical solution of diffusion-type equations	
13	Numerical solution of fluid flow equations	
14	Advanced/emerging topics	

* *The above schedule, policies, and assignments in this course are subject to change in the event of extenuating circumstances or by mutual agreement between the instructor and the students i.e. Schedule may be revised if necessary. Students will be notified if this is the case.*

Learning Outcomes:

Course Outcome – student will:	**Implementation Method**	**Evaluation Method**
Identify, formulate, and solve engineering problems by approximating complex physical systems in fluid flow by simplified canonical models	• Lectures • In-class assignment • Solve exercise problems	• Homework • Assignments • Exam, Quiz etc.
Integrate various numerical techniques in formulating a numerical solution method	• Lectures • In-class assignment • Solve exercise problems	• Homework • Assignments • Exam, Quiz etc.
Apply knowledge of math and science to engineering by describing a continuous fluid-flow phenomena in a discrete numerical sense.	• Lectures • In-class assignment • Laboratory	• Homework • Lab reports • Exam Quiz etc.
Demonstrate the techniques, skills, & engineering tools necessary for engineering practice by applying numerical methods to a "real-world" fluid-flow problem	• Lectures • In-class assignment • Laboratory	• Homework • Lab reports • Exam, Quiz etc.
Analyze and interpret data obtained from the numerical solution of fluid flow problems	• Lectures • In-class assignment • Laboratory	• Homework • Lab reports • Exam, Quiz etc.

PROGRAM LEARNING OUTCOMES (ABET)

Item No.	Outcome
a-2	Complete an engineering assignment that involves the use of calculus and scientific principles (e.g., chemistry or physics)
c-2	Complete a design with clearly defined objectives, engineering standards, and realistic constraints. Present a design in a professional manner
e-1	Formulate and solve an engineering problem with given data and constraints using applicable standards for a problem already identified. Present the results in a professional manner
k-3	Ability to use the techniques, skills and modern engineering tools necessary for engineering practice: Use of a modern engineering too for a design

Additional Academic Policies:

Marshall University policies pertaining to Academic Dishonesty, Excused Absences, University Computing Services Acceptable Use, Inclement Weather, Dead Week, Students with Disabilities, Academic Dismissal, Academic Forgiveness, Academic Probation and Suspension, Academic Rights and Responsibilities of Students, Affirmative Action, and Sexual Harassment can be found at: http://www.marshall.edu/academic-affairs/?page_id =802.

Attendance Policy:

The attendance policy will follow University's excused absence policy. You are expected to attend all classes. However, the instructor accepts your absence for one session provided that an advance notice will be given, unless this is an excused absence such as institutional excuse, severe injuries, family emergencies, group activities etc.