Course Information

Date Submitted: 9/2/2015

Current Prefix and Number: ME - Mechanical Engineering , ME 556 INTRODUCTION TO COMPOSITE MATERIALS

Other Course:

Proposed Prefix and Number: ME 556

What type of change is being proposed?

  Major – Add Distance Learning

Should this course be a UK Core Course? No

1. General Information

a. Submitted by the College of: ENGINEERING

b. Department/Division: Mechanical Engineering

c. Is there a change in 'ownership' of the course? No

  If YES, what college/department will offer the course instead: Select...

e. Contact Person

  Name: Y. Charles Lu

  Email: ycharles.lu@uky.edu

  Phone: 2705343113

  Responsible Faculty ID (if different from Contact)

  Name:

  Email:

  Phone:

f. Requested Effective Date

  Semester Following Approval: No OR Effective Semester: 2016 spring

2. Designation and Description of Proposed Course

a. Current Distance Learning (DL) Status: Please Add

b. Full Title: INTRODUCTION TO COMPOSITE MATERIALS

  Proposed Title: INTRODUCTION TO COMPOSITE MATERIALS

c. Current Transcript Title: INTRODUCTION TO COMPOSITE MATERIALS

  Proposed Transcript Title: INTRODUCTION TO COMPOSITE MATERIALS

d. Current Cross-listing: MSE 556/CME 556

Proposed – ADD Cross-listing : MFS556

Proposed – REMOVE Cross-listing:

e. Current Meeting Patterns

LECTURE: 3

Proposed Meeting Patterns

LECTURE: 3

f. Current Grading System: ABC Letter Grade Scale

Proposed Grading System: *Letter (A, B, C, etc.)*

g. Current number of credit hours: 3

Proposed number of credit hours: 3

h. Currently, is this course repeatable for additional credit? No

Proposed to be repeatable for additional credit? No

If Yes: Maximum number of credit hours:

If Yes: Will this course allow multiple registrations during the same semester? No

2i. Current Course Description for Bulletin: Applications, materials selection and design of materials. Relation between properties of constituent materials and those of composite. Processing methods for materials and for some structures. Lab focuses on preparation and testing of composite materials and their constituents.

Proposed Course Description for Bulletin: Modern composite materials and their applications. Basic concepts and definitions. Fundamental properties of fibers and polymer resins. Manufacturing methods. Analysis and design of laminated and chopped fiber reinforced composites. Micro- and macro-mechanical analysis of elastic constants. Failure theory of composite materials. Computational design of composites.

2j. Current Prerequisites, if any: Prereq: MSE 201, 301, CHE 236, and Engineering Standing, or consent of instructor.

Proposed Prerequisites, if any: Engineering Standing, and EM302 or with Instructor permission.

2k. Current Supplementary Teaching Component:

Proposed Supplementary Teaching Component:

3. Currently, is this course taught off campus? No

Proposed to be taught off campus? No

If YES, enter the off campus address:

4. Are significant changes in content/student learning outcomes of the course being proposed? No

If YES, explain and offer brief rational:

5a. Are there other depts. and/or pgms that could be affected by the proposed change? No

If YES, identify the depts. and/or pgms:

5b. Will modifying this course result in a new requirement of ANY program?   No

   If YES, list the program(s) here:

6. Check box if changed to 400G or 500: No

Distance Learning Form

Instructor Name: Y. Charles Lu

Instructor Email: ycharles.lu@uky.edu

Internet/Web-based: Yes

Interactive Video: No

Hybrid: No

1.How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to University Senate Syllabus Guidelines, specifically the Distance Learning Considerations? ·The course syllabus confirms to University Senate Syllabus Guidelines, specifically the Distance Learning Considerations. The use of Blackboard, email, and web-conferencing provides timely and appropriate interactions between the students and the instructor.

2.How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goals, assessment of student learning outcomes, etc.   Students learning outcomes are accessed for all sections of the course through homework, projects, ad exams. The assessments from DL students will be compared with those from a classroom-based students.

3.How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; academic offense policy; etc.   Standard university policy will be followed in al academic aspects, and exams will be proctored on-site.

4.Will offering this course via DL result in at least 25% or at least 50% (based on total credit hours required for completion) of a degree program being offered via any form of DL, as defined above?   Yes.

If yes, which percentage, and which program(s)?   100; Manufacturing System Engineering MS program. The Manufacturing Systems Engineering Program is being transitioned into an online degree, with a number of courses offered fully online starting 2015. Offering this course as an elective in the MFS program will increase the number of courses available to online students. Students in the ME program will be also eligible to take the online version of ME 556. The online course will be identical to the on-campus version as learning outcomes and course content will remain same.

5.How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom setting?   Access to student services will be the same as for other web-based courses in the university.

6.How do course requirements ensure that students make appropriate use of learning resources?   Students will be required to access resources on-line using venues such as Blackboard.

7.Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program. This course does not require the access to laboratory or equipment. It requires the use of computer software (Abaqus) for design and analysis of composite materials and structures. The student-version Abaqus is available for free download.

8.How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/or receipt of the course, such as the Information Technology Customer Service Center (http://www.uky.edu/UKIT/)? Syllabus provides this access information.

9.Will the course be delivered via services available through the Distance Learning Program (DLP) and the Academic Technology Group (ATL)? YES

If no, explain how student enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said technology. N/A

10.Does the syllabus contain all the required components? YES

11.I, the instructor of record, have read and understood all of the university-level statements regarding DL.

Instructor Name: Y. Charles Lu

SIGNATURE|STEPHEN|L S Stephens|ME 556 CHANGE Dept Review|20150223

SIGNATURE|BJSTOK0|Barbara J Brandenburg|ME 556 CHANGE College Review|20150406

SIGNATURE|JMETT2|Joanie Ett-Mims|ME 556 CHANGE Undergrad Council Review|20150722

SIGNATURE|TIMWU|Tingwen Wu|ME 556 ZCOURSE_CHANGE Approval Returned to Dept|20150724

SIGNATURE|JMETT2|Joanie Ett-Mims|ME 556 CHANGE Undergrad Council Review|20151014

SIGNATURE|ZNNIKO0|Roshan Nikou|ME 556 CHANGE Graduate Council Review|20151210

Course Change Form

https://myuk.uky.edu/sap/bc/soap/rfc?services=

Open in full window to print or save

Attachments:

Browse...   Upload File

	ID	Attachment
Delete	4561	Composites_Support_Letter.pdf
Delete	5293	MFS556 Introduction to Composite Materials Syllabu
Delete	5506	DL explanation.pdf

First | 1 | Last

NOTE: Start form entry by choosing the Current Prefix and Number
(*denotes required fields)

	Current Prefix and Number:	ME - Mechanical Engineering ▼ ME 556 INTRODUCTION TO COMPOSITE MATERIALS ▼	Proposed Prefix & Number: (example: PHY 401G) ☐ Check if **same** as current	ME 556
*	What type of change is being proposed?		☐ Major Change ☑ Major – Add Distance Learning ☐ Minor - change in number within the same hundred series, exception the same "hundred series" ☐ Minor - editorial change in course title or description which does not in in content or emphasis ☐ Minor - a change in prerequisite(s) which does not imply a change in content or emphasis, or which is made necessary by the elimination or si alteration of the prerequisite(s) ☐ Minor - a cross listing of a course as described above	

	Should this course be a UK Core Course? ○ Yes ◉ No	
	If YES, check the areas that apply:	
	☐ Inquiry - Arts & Creativity	☐ Composition & Communications - II
	☐ Inquiry - Humanities	☐ Quantitative Foundations
	☐ Inquiry - Nat/Math/Phys Sci	☐ Statistical Inferential Reasoning
	☐ Inquiry - Social Sciences	☐ U.S. Citizenship, Community, Diversity
	☐ Composition & Communications - I ☐ Global Dynamics	

1.	General Information	
a.	Submitted by the College of: ENGINEERING	Submission Date: 9/2/2015
b.	Department/Division:	Mechanical Engineering
c.*	Is there a change in "ownership" of the course?	
	○ Yes ◉ No If YES, what college/department will offer the course instead? Select... ▼	
e.*	* Contact Person Name: Y. Charles Lu Email: ycharles.lu@uky.edu Phone: 2705343113	
	* Responsible Faculty ID (if different from Contact) Email: Phone:	
f.*	Requested Effective Date:	☐ Semester Following Approval	OR	Specific Term: 2 2016 spring
2.	Designation and Description of Proposed Course.	

a.	Current Distance Learning(DL) Status:	○ N/A ○ Already approved for DL* ◉ Please Add ○ Please Drop
	*If already approved for DL, the Distance Learning Form must also be submitted <u>unless</u> the department affirms (by checking this box) tha proposed changes do not affect DL delivery.	
b.	Full Title:	INTRODUCTION TO COMPOSITE MATERIALS	Proposed Title: *	INTRODUCTION TO COMPOSITE MATERIALS
c.	Current Transcript Title (if full title is more than 40 characters):	INTRODUCTION TO COMPOSITE MATERIALS
c.	Proposed Transcript Title (if full title is more than 40 characters):	INTRODUCTION TO COMPOSITE MATERIALS

d.	Current Cross-listing:	☐ N/A	OR	Currently[3] Cross-listed with (Prefix & Number):	MSE 556/CI

	Proposed – ADD[3] Cross-listing (Prefix & Number):	MFS556

	Proposed – REMOVE [2,4] Cross-listing (Prefix & Number):	

e. Courses must be described by **at least one** of the meeting patterns below. Include number of actual contact hours [5] for each meeting pattern type.

Current:	Lecture 3	Laboratory[5]	Recitation	Discussion	Indep. Study
	Clinical	Colloquium	Practicum	Research	Residency
	Seminar	Studio	Other	Please explain:	

Proposed: *	Lecture 3	Laboratory[5]	Recitation	Discussion	Indep. Study
	Clinical	Colloquium	Practicum	Research	Residency
	Seminar	Studio	Other	Please explain:	

f.	Current Grading System:	ABC Letter Grade Scale
	Proposed Grading System:*	⦿ Letter (A, B, C, etc.) ◯ Pass/Fail ◯ Medicine Numeric Grade (Non-medical students will receive a letter grade) ◯ Graduate School Grade Scale

g.	Current number of credit hours:	3	Proposed number of credit hours:*	3

h.*	Currently, is this course repeatable for additional credit?	◯ Yes ⦿ No
*	Proposed to be repeatable for additional credit?	◯ Yes ⦿ No
If YES:	Maximum number of credit hours:	
If YES:	Will this course allow multiple registrations during the same semester?	◯ Yes ⦿ No

i. Current Course Description for Bulletin:

Applications, materials selection and design of materials. Relation between properties of constituent materials and those of composite. Processing methods for materials and for some structures. Lab focuses on preparation and testing of composite materials and their constituents.

* Proposed Course Description for Bulletin:

Modern composite materials and their applications. Basic concepts and definitions. Fundamental properties of fibers and polymer resins. Manufacturing methods. Analysis and design of laminated and chopped fiber reinforced composites. Micro- and macro-mechanical analysis of elastic constants. Failure theory of composite materials. Computational design of composites.

j. Current Prerequisites, if any:

Prereq: MSE 201, 301, CHE 236, and Engineering Standing, or consent of instructor.

* Proposed Prerequisites, if any:

Engineering Standing, and EM302 or with Instructor permission.

k.	Current Supplementary Teaching Component, if any:	,	◯ Community-Based Experience ◯ Service Learning

		○ Both

	Proposed Supplementary Teaching Component:	○ Community-Based Experience ○ Service Learning ○ Both ○ No Change
3.	Currently, is this course taught off campus?	○ Yes ◉ No
*	Proposed to be taught off campus?	○ Yes ◉ No
	If YES, enter the off campus address:	
4.*	Are significant changes in content/student learning outcomes of the course being proposed?	○ Yes ◉ No
	If YES, explain and offer brief rationale:	
5.	Course Relationship to Program(s).	
a.*	Are there other depts and/or pgms that could be affected by the proposed change?	○ Yes ◉ No
	If YES, identify the depts. and/or pgms:	
b.*	Will modifying this course result in a new requirement[Z] for ANY program?	○ Yes ◉ No
	If YES[Z], list the program(s) here:	
6.	Information to be Placed on Syllabus.	
a.	☐ Check box if changed to 400G or 500.	If changed to 400G- or 500-level course you must send in a syllabus and you must include the differentiatior undergraduate and graduate students by: (i) requiring additional assignments by the graduate students; anc establishing different grading criteria in the course for graduate students. (See SR 3.1.4.)

Distance Learning Form

This form must accompany every submission of a new/change course form that requests distance learning delivery. This form may be required when changing a course already approved for I **fields are required!**

Introduction/Definition: For the purposes of the Commission on Colleges Southern Association of Colleges and Schools accreditation review, **distance learning** is defined as educational process in which the majority of the instruction (interaction between students and instructors and among students) in a course occurs when students and instruct the same place. Instruction may be synchronous or asynchronous. A distance learning (DL) course may employ correspondence study, or audio, video, or computer technolor

A number of specific requirements are listed for DL courses. **The department proposing the change in delivery method is responsible for ensuring that the require below are satisfied at the individual course level.** It is the responsibility of the instructor to have read and understood the university-level assurances regarding an equi experience for students utilizing DL (available at http://www.uky.edu/USC/New/forms.htm).

Course Number and Prefix:	MFS556	Date:	2/19/2015
Instructor Name:	Y. Charles Lu	Instructor Email:	ycharles.lu@uky.edu

Check the method below that best reflects how the majority of the course content will be delivered.

Internet/Web-based ☑   Interactive Video ☐   Hybrid ☐

Curriculum and Instruction

1. How does this course provide for timely and appropriate interaction between students and faculty and among students? Does the course syllabus conform to Univers Syllabus Guidelines, specifically the Distance Learning Considerations?

   The course syllabus confirms to University Senate Syllabus Guidelines, specifically the Distance Learning Considerations. The use of Blackboard, email, and web-conferencing provides timely and appropriate interactions

2. How do you ensure that the experience for a DL student is comparable to that of a classroom-based student's experience? Aspects to explore: textbooks, course goa assessment of student learning outcomes, etc.

Students learning outcomes are accessed for all sections of the course through homework, projects, ad exams. The assessments from DL students will be compared with those from a classroom-based students.

3. How is the integrity of student work ensured? Please speak to aspects such as password-protected course portals, proctors for exams at interactive video sites; acac offense policy; etc.

Standard university policy will be followed in al academic aspects, and exams will be proctored on-site.

4. Will offering this course via DL result in at least 25% or at least 50%* (based on total credit hours required for completion) of a degree program being offered via a DL, as defined above?

Yes.

Which percentage, and which program(s)?

100; Manufacturing System Engineering MS program.

*As a general rule, if approval of a course for DL delivery results in 50% or more of a program being delivered through DL, the effective date of the course's DL deli six months from the date of approval.

5. How are students taking the course via DL assured of equivalent access to student services, similar to that of a student taking the class in a traditional classroom se

Access to student services will be the same as for other web-based courses in the university.

Library and Learning Resources

6. How do course requirements ensure that students make appropriate use of learning resources?

Students will be required to access resources on-line using venues such as Blackboard.

7. Please explain specifically how access is provided to laboratories, facilities, and equipment appropriate to the course or program.

This course does not require the access to laboratory or equipment. It requires the use of computer software (Abaqus) for design and analysis of composite materials and structures. The student-version Abaqus is available

Student Services

8. How are students informed of procedures for resolving technical complaints? Does the syllabus list the entities available to offer technical help with the delivery and/ of the course, such as the Information Technology Customer Service Center (http://www.uky.edu/UKIT/)?

Syllabus provides this access information.

9. Will the course be delivered via services available through the Distance Learning Program (DLP) and the Academic Technology Group (ATL)?

◉ Yes
○ No

If no, explain how students enrolled in DL courses are able to use the technology employed, as well as how students will be provided with assistance in using said technology.

N/A

10. Does the syllabus contain all the required components, below? ☑ Yes

- Instructor's *virtual* office hours, if any.
- The technological requirements for the course.
- Contact information for Distance Learning programs (http://www.uky.edu/DistanceLearning) and Information Technology Customer Service Center (http://www.uky.edu/UKIT/Help/; 859-218-HELP).
- Procedure for resolving technical complaints.
- Preferred method for reaching instructor, e.g. email, phone, text message.
- Maximum timeframe for responding to student communications.
- Language pertaining academic accommodations:
  - "If you have a documented disability that requires academic accommodations in this course, please make your request to the University Disability Res Center. The Center will require current disability documentation. When accommodations are approved, the Center will provide me with a Letter of Accommodation which details the recommended accommodations. Contact the Disability Resource Center, Jake Karnes, Director at 859-257-2754 or jkarnes@email.uky.edu."
- Specific dates of face-to-face or synchronous class meetings, if any.
- Information on Distance Learning Library Services (http://www.uky.edu/Libraries/DLLS)
  - Carla Cantagallo, DL Librarian
  - Local phone number: 859 257-0500, ext. 2171; long-distance phone number: (800) 828-0439 (option #6)
  - Email: dllservice@email.uky.edu
  - DL Interlibrary Loan Service: http://www.uky.edu/Libraries/libpage.php?lweb_id=253&llib_id=16

11. I, the instructor of record, have read and understood all of the university-level statements regarding DL.

Instructor Name:
Y. Charles Lu

Abbreviations: DLP = Distance Learning Programs ATG = Academic Technology Group Customer Service Center = 859-218-HELP (http://www.uky.edu/UKIT/Help)

Revised 8/09

[1]See comment description regarding minor course change. *Minor changes are sent directly from dean's office to Senate Council Chair.* If Chair deems the change as "n form will be sent to appropriate academic Council for normal processing and contact person is informed.

[2]Courses are typically made effective for the semester following approval. No course will be made effective until all approvals are received.

[3] Signature of the chair of the cross-listing department is required on the Signature Routing Log.

[4] Removing a cross-listing does not drop the other course – it merely unlinks the two courses.

[5] Generally, undergrad courses are developed such that one semester hr of credit represents 1 hr of classroom meeting per wk for a semester, exclusive of any lab me meeting generally represents at least two hrs per wk for a semester for 1 credit hour. (See *SR 5.2.1.*)

[6] You must *also* submit the Distance Learning Form in order for the course to be considered for DL delivery.

[7]In order to change a program, a program change form must also be submitted.

UNIVERSITY OF KENTUCKY
DEPARTMENT OF MECHANICAL ENGINEERING

ME556/CME556/MSE556/MFS556: Introduction to Composite Materials

Spring Semester 2015
Course Information, Assessment and Policy Statement

INSTRUCTOR:

Dr. Y. Charles Lu, PE.
Office: Crounse 210
Phone: 270-534-3115 (office), Email: ycharles.lu@uky.edu
Virtual Office: https://connect.uky.edu/MFS556
Office hours: Weekly, on Mondays and Wednesdays from 2:00 – 4:00 PM
(online through Adobe Connect)

'CLASS SCHEDULE: Lectures – M W, 2:30-3:45 pm,   CLC220

TEXTBOOKS:

Required: Isaac M. Daniel and Ori Ishai, Engineering Mechanics of Composite Materials, 2nd Ed., Oxford Univ. Press, New York, NY, 2006.

Reference: Bhagwan D. Agarwal, Lawrence J. Broutman and K. Chandrashekhara, Analysis and Performance of Fiber Composites, 3rd Ed., Wiley, Hoboken, NJ, 2006.

PREREQUISITES: Engineering Standing and EM302 or with Instructor permission.

REQUIRED MATERIAL:
All students must have a webcam and microphone to participate in the virtual meetings. Access to a scanner may be required. The minimum technical requirements to be successful in an on-line course are available at: http://www.uky.edu/DistanceLearning/current/technology/techReqs.html (to be changed to specific requirements link on course website later)

CATALOG COURSE DESCRIPTION:
Modern composite materials and their applications. Basic concepts and definitions. Fundamental properties of fibers and polymer resins. Manufacturing methods. Analysis and design of laminated and chopped fiber reinforced composites. Micro- and macro-mechanical analysis of elastic constants. Failure theory of composite materials. Computational design of composites. (3 credit hour)

LEARNING OUTCOMES:
This is an introductory course in the rapidly expanding field of composite and hybrid materials. This class introduces the students the background for stress and strength analysis in the design of composite materials and structures. After successfully completing this course, the student should be able to

- Understand the properties and performances of various reinforcement fibers and polymer matrices used in composites
- Familiar with the manufacturing processes of various composite materials
- Calculate the elastic properties of both long and short fiber composites based on various techniques (mechanics of materials, semi-empirical Halpin-Tsai, etc.)
- Compute the rotate stress, strain and stiffness tensors using ideas from matrix algebra
- Analyze the composite structures under various loading conditions, including finding laminate properties from lamina properties
- Understand the failure theories of laminated composites
- Familiar with recent developments in advanced composites, including multifunctional composites and nanocomposites
- Use the computational technique to design and analyze composite materials and structures

TOPICS COVERED:
- Basic Concepts and Definitions
- Materials
    - Reinforcement fibers
    - Polymer matrices
- Manufacturing Processes
    - Compression molding
    - Autoclave molding
    - Filament winding
    - Transfer molding
- Micromechanics-Elastic Properties
    - Longitudinal properties
    - Transverse properties
    - Shear properties
- Elastic Behavior of Unidirectional Lamina
    - Anisotropic constitutive relations
    - Mathematical and engineering constants
    - Transformation relations
    - Micro mechanics predictions of lamina properties
- Strength of Unidirectional Lamina-Micromechanics
    - Longitudinal tension (shear lag analysis, statistical aspects)
    - Longitudinal compression
    - Transverse tension
    - In-plane shear

- Strength of Unidirectional Lamina-Macromechanics
    - Macromechanical failure theories
    - Maximum stress
    - Maximum strain
    - Interaction theories

- Elastic Analysis of Multidirectional Laminates
- Advanced Topics in Composites
    - Multifunctional composites
    - Nanocomposites
- Computational Design of Composites

The finite element solver ABAQUS will be used for design and analysis of composite materials and structures. The student version ABAQUS is available for free download via: http://academy.3ds.com/software/simulia/abaqus-student-edition/

TESTS: Tests have been tentatively scheduled as follows:

Midterm Exam	Monday Mar 9, 2015
Final Exam	Wednesday May 6, 2015

COURSE GRADING: Grades for the course will be determined as follows:

Homework Assignments*	-	20%
Design Projects*	-	15%
Attendance for Discussions	-	5%
Midterm Exam*	-	30%
Final Exam*	-	30%

Additional questions/assignments will be given for students taking this course for graduate credit.

GRADE SCALE:
Grades will be assigned as follows:

Undergraduate Students: A = 90%-100%; B = 80%-89%; C=70%-79%; D= 60%-69%;E= Below 60%
Graduate Students: A = 90%-100%; B = 80%-89%; C=70%-79%; E= Below 70%

Graduate Students: For those students taking the course for graduate credit, a differential in grade assignment compared to that for undergraduates is expected. The level of difficulty in the course project is also expected to be higher for graduate students. Also, graduate students must obtain a grade of 'C' or better to pass the course.

HOMEWORK ASSIGNMENTS:
Homework will be assigned weekly and are due one week from the date assigned unless otherwise indicated. Homework must be submitted electronically through Canvas by 11:59 PM on the date it is due. All grades for the homework assignments will be posted on Canvas. All homework submitted on Canvas must be completed on white paper (lined notebook paper or white printer paper), scanned and submitted in pdf format. You can also use MS Word, MS PowerPoint, MS Excel, etc., to provide answers to the homework. If so, all the documents must be converted into pdf format before being submitted through Canvas. See below for late homework policy.

DESIGN PROJECT:
This course includes a final Design Project, which involves in the design of an actual product made of composite materials. Computational method will be used for the project. Students are required to submit a formal report, electronically through Canvas by 11:59 PM on the date it is due.

ONLINE DISCUSSION SESSIONS:
Online Discussion Sessions: A discussion session will be scheduled for a number of selected weeks/modules to discuss the week's content and answer any questions related to homework. These will be held through Adobe Connect. See below for how to connect to the Adobe Connect meetings. The weeks in which discussion sessions are scheduled will be notified at the beginning of the course.

The discussion sessions are synchronous and 30 minutes long. Attendance will be taken at the discussion sessions. You are required to attend at least 5 of these discussion sessions (5% of the grade). Students are encouraged to review the lecture video and homework assignment prior to the discussion session and be prepared with questions. The online discussion sessions will be the preferred platform to answer homework related questions.

Alternate times will be setup for the discussion session through a Doodle poll (a link is posted on Canvas). You are required to select and attend one of the discussion sessions each week consistently. If you are not able to attend the discussion at the chosen time in a certain week due to a conflict, you can attend at an alternate time. Please inform the instructor ahead of time.

MIDTERM GRADE: An estimate of the midterm grade will be made available prior to the withdrawal deadline.

STUDENT INTERACTION:
Communication: Communication between instructor and student will be via email or virtual office meetings (**https://connect.uky.edu/MFS556**). The most suitable time for regular meetings via Adobe Connect will be established at the beginning of the semester.

E-mail: UK email addresses will be used. Students must activate e-mail forwarding if they prefer another primary e-mail address.

Canvas Access: Canvas will be used to communicate course content, announcements, exam grades, etc. To access UK's Canvas go to www.uky.edu and click on LINK BLUE then CANVAS.

Technical Support: Students experiencing difficulty with delivery of the course material should contact the instructor or the UK help desk. Links to UK help are available on the Canvas login page. For difficulties with Canvas or logins, contact the Teaching and Academic Support Center http://www.uky.edu/ukit/atg/tasc, or the Information Technology Customer Support Center at https://www.uky.edu/ukit/help, and inform the instructor.

Audio-conferencing:

There are several options for the audio connection – use the one indicated by the instructor
   a. Direct phone line (recommended if only person-to-person conversation)
   b. Web-audio within Adobe connect. After logging in, push "TALK" when you wish to speak.

EXCUSED ABSENCES:
Students need to notify the professor of absences prior to class when possible. S.R. 5.2.4.2 defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit "reasonable cause for nonattendance" by the professor.

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class. Information regarding dates of major religious holidays may be obtained through the religious liaison, Mr. Jake Karnes (859-257-2754).

Students are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed (excused or unexcused) per university policy.

VERIFICATION OF ABSENCES:
Students may be asked to verify their absences in order for them to be considered excused. Senate Rule 5.2.4.2 states that faculty have the right to request "appropriate verification" when students claim an excused absence because of illness or death in the family. Appropriate notification of absences due to university-related trips is required prior to the absence.

LATE SUBMISSION POLICY:
Students who wish to submit a homework assignment/report later than the due date should obtain permission in advance from the instructor; otherwise, it will be treated as failure to submit the assignment as required. The number of additional days provided to submit the assignment/report will be decided by the instructor based on the reasoning for the delay. Points will be deducted for every late submitted assignment/report if delayed further than the extended deadline. Five percent of the grade will be taken off for each day the submission is delayed from the newly stipulated deadline.

MAKE-UP POLICY FOR MISSED WORK WITH AN EXCUSED ABSENCE:
Those students who have an excused absence will have one week to contact instructor regarding missed graded work.

ACADEMIC INTEGRITY:
Per university policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the university may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the following website: http://www.uky.edu/Ombud. A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited.

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Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone. When a student's assignment involves research in outside sources of information, the student must carefully acknowledge exactly what, where and how he/she employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas which are so generally and freely circulated as to be a part of the public domain (Section 6.3.1).

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Tentative Course Outline

MFS 556 Introduction to Composite Materials - On-line Course Schedule

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1	Introduction to the Course Introduction to Composite Materials	Problem Set #1	HW due on following Wednesday
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	Mid-term Examination		
8	Macromechanics of Lamina I: stiffness and compliance matrices	Problem Set #8	HW due on following Wednesday
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17	*Review* *Final Examination*		

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UK

UNIVERSITY OF KENTUCKY

Department of Chemical and Materials Engineering

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Lexington, KY 40506-0046
(859) 257-5507
kalika@engr.uky.edu

Memorandum

To: College of Engineering

From: Doug Kalika, Professor and Chair
Department of Chemical and Materials Engineering

Date: March 4, 2015

Subject: Proposed On-Line Offering of CME/MSE 556

On behalf of the faculty of the Department of Chemical and Materials Engineering, I am pleased to support the offering of ME/CME/MSE/MFS556 (*Introduction to Composite Materials*) in an on-line version, as proposed by Prof. Charles Lu.

This is an important elective course for materials and chemical engineering students at both the undergraduate and graduate levels. By offering this class on-line, we will be able to provide access to the course for a wider population of students.

ME556/CME556/MSE556/MFS556: Introduction to Composite Materials

Spring Semester 2015
Course Information, Assessment and Policy Statement

INSTRUCTOR:
> Dr. Y. Charles Lu, PE.
> Office: Crounse 210
> Phone: 270-534-3115 (office), Email: ycharles.lu@uky.edu
> Virtual Office: https://connect.uky.edu/MFS556
> Office hours: Weekly, on Mondays and Wednesdays from 2:00 – 4:00 PM
> (online through Adobe Connect)

CLASS SCHEDULE: Lectures – M W, 2:30-3:45 pm,   CLC220

TEXTBOOKS:

> **Required:** Isaac M. Daniel and Ori Ishai, Engineering Mechanics of Composite Materials, 2nd Ed., Oxford Univ. Press, New York, NY, 2006.

> **Reference:** Bhagwan D. Agarwal, Lawrence J. Broutman and K. Chandrashekhara, Analysis and Performance of Fiber Composites, 3rd Ed., Wiley, Hoboken, NJ, 2006.

PREREQUISITES: Engineering Standing and EM302 or with Instructor permission.

REQUIRED MATERIAL:
All students must have a webcam and microphone to participate in the virtual meetings. Access to a scanner may be required. The minimum technical requirements to be successful in an on-line course are available at: http://www.uky.edu/DistanceLearning/current/technology/techReqs.html (to be changed to specific requirements link on course website later)

CATALOG COURSE DESCRIPTION:
Modern composite materials and their applications. Basic concepts and definitions. Fundamental properties of fibers and polymer resins. Manufacturing methods. Analysis and design of laminated and chopped fiber reinforced composites. Micro- and macro-mechanical analysis of elastic constants. Failure theory of composite materials. Computational design of composites. (3 credit hour)

LEARNING OUTCOMES:
This is an introductory course in the rapidly expanding field of composite and hybrid materials. This class introduces the students the background for stress and strength analysis in the design of composite materials and structures. After successfully completing this course, the student should be able to

- Understand the properties and performances of various reinforcement fibers and polymer matrices used in composites
- Familiar with the manufacturing processes of various composite materials
- Calculate the elastic properties of both long and short fiber composites based on various techniques (mechanics of materials, semi-empirical Halpin-Tsai, etc.)
- Compute the rotate stress, strain and stiffness tensors using ideas from matrix algebra
- Analyze the composite structures under various loading conditions, including finding laminate properties from lamina properties
- Understand the failure theories of laminated composites
- Familiar with recent developments in advanced composites, including multifunctional composites and nanocomposites
- Use the computational technique to design and analyze composite materials and structures

TOPICS COVERED:
- Basic Concepts and Definitions
- Materials
  - Reinforcement fibers
  - Polymer matrices
- Manufacturing Processes
  - Compression molding
  - Autoclave molding
  - Filament winding
  - Transfer molding
- Micromechanics-Elastic Properties
  - Longitudinal properties
  - Transverse properties
  - Shear properties
- Elastic Behavior of Unidirectional Lamina
  - Anisotropic constitutive relations
  - Mathematical and engineering constants
  - Transformation relations
  - Micro mechanics predictions of lamina properties
- Strength of Unidirectional Lamina-Micromechanics
  - Longitudinal tension (shear lag analysis, statistical aspects)
  - Longitudinal compression
  - Transverse tension
  - In-plane shear

- Strength of Unidirectional Lamina-Macromechanics
  - Macromechanical failure theories
  - Maximum stress
  - Maximum strain
  - Interaction theories

- Elastic Analysis of Multidirectional Laminates
- Advanced Topics in Composites
    - Multifunctional composites
    - Nanocomposites
- Computational Design of Composites

The finite element solver ABAQUS will be used for design and analysis of composite materials and structures. The student version ABAQUS is available for free download via: http://academy.3ds.com/software/simulia/abaqus-student-edition/

TESTS: Tests have been tentatively scheduled as follows:

Midterm Exam	Monday Mar 9, 2015
Final Exam	Wednesday May 6, 2015

COURSE GRADING: Grades for the course will be determined as follows:

Homework Assignments*	-	20%
Design Projects*	-	15%
Attendance for Discussions	-	5%
Midterm Exam*	-	30%
Final Exam*	-	30%

Additional questions/assignments will be given for students taking this course for graduate credit.

GRADE SCALE:
Grades will be assigned as follows:

Undergraduate Students: A = 90%-100%; B = 80%-89%; C=70%-79%; D= 60%-69%;E= Below 60%
Graduate Students: A = 90%-100%; B = 80%-89%; C=70%-79%; E= Below 70%

Graduate Students: For those students taking the course for graduate credit, a differential in grade assignment compared to that for undergraduates is expected. The level of difficulty in the course project is also expected to be higher for graduate students. Also, graduate students must obtain a grade of 'C' or better to pass the course.

HOMEWORK ASSIGNMENTS:
Homework will be assigned weekly and are due one week from the date assigned unless otherwise indicated. Homework must be submitted electronically through Canvas by 11:59 PM on the date it is due. All grades for the homework assignments will be posted on Canvas. All homework submitted on Canvas must be completed on white paper (lined notebook paper or white printer paper), scanned and submitted in pdf format. You can also use MS Word, MS PowerPoint, MS Excel, etc., to provide answers to the homework. If so, all the documents must be converted into pdf format before being submitted through Canvas. See below for late homework policy.

DESIGN PROJECT:
This course includes a final Design Project, which involves in the design of an actual product made of composite materials. Computational method will be used for the project. Students are required to submit a formal report, electronically through Canvas by 11:59 PM on the date it is due.

ONLINE DISCUSSION SESSIONS:
Online Discussion Sessions: A discussion session will be scheduled for a number of selected weeks/modules to discuss the week's content and answer any questions related to homework. These will be held through Adobe Connect. See below for how to connect to the Adobe Connect meetings. The weeks in which discussion sessions are scheduled will be notified at the beginning of the course.

The discussion sessions are synchronous and 30 minutes long. Attendance will be taken at the discussion sessions. You are required to attend at least 5 of these discussion sessions (5% of the grade). Students are encouraged to review the lecture video and homework assignment prior to the discussion session and be prepared with questions. The online discussion sessions will be the preferred platform to answer homework related questions.

Alternate times will be setup for the discussion session through a Doodle poll (a link is posted on Canvas). You are required to select and attend one of the discussion sessions each week consistently. If you are not able to attend the discussion at the chosen time in a certain week due to a conflict, you can attend at an alternate time. Please inform the instructor ahead of time.

MIDTERM GRADE: An estimate of the midterm grade will be made available prior to the withdrawal deadline.

STUDENT INTERACTION:
Communication: Communication between instructor and student will be via email or virtual office meetings (**https://connect.uky.edu/MFS556**). The most suitable time for regular meetings via Adobe Connect will be established at the beginning of the semester.

E-mail: UK email addresses will be used. Students must activate e-mail forwarding if they prefer another primary e-mail address.

Canvas Access: Canvas will be used to communicate course content, announcements, exam grades, etc. To access UK's Canvas go to www.uky.edu and click on LINK BLUE then CANVAS.

Technical Support: Students experiencing difficulty with delivery of the course material should contact the instructor or the UK help desk. Links to UK help are available on the Canvas login page. For difficulties with Canvas or logins, contact the Teaching and Academic Support Center http://www.uky.edu/ukit/atg/tasc, or the Information Technology Customer Support Center at https://www.uky.edu/ukit/help, and inform the instructor.

Audio-conferencing:

There are several options for the audio connection – use the one indicated by the instructor
    a. Direct phone line (recommended if only person-to-person conversation)
    b. Web-audio within Adobe connect. After logging in, push "TALK" when you wish to speak.

EXCUSED ABSENCES:

Students need to notify the professor of absences prior to class when possible. S.R. 5.2.4.2 defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit "reasonable cause for nonattendance" by the professor.

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class. Information regarding dates of major religious holidays may be obtained through the religious liaison, Mr. Jake Karnes (859-257-2754).

Students are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed (excused or unexcused) per university policy.

VERIFICATION OF ABSENCES:

Students may be asked to verify their absences in order for them to be considered excused. Senate Rule 5.2.4.2 states that faculty have the right to request "appropriate verification" when students claim an excused absence because of illness or death in the family. Appropriate notification of absences due to university-related trips is required prior to the absence.

LATE SUBMISSION POLICY:

Students who wish to submit a homework assignment/report later than the due date should obtain permission in advance from the instructor; otherwise, it will be treated as failure to submit the assignment as required. The number of additional days provided to submit the assignment/report will be decided by the instructor based on the reasoning for the delay. Points will be deducted for every late submitted assignment/report if delayed further than the extended deadline. Five percent of the grade will be taken off for each day the submission is delayed from the newly stipulated deadline.

MAKE-UP POLICY FOR MISSED WORK WITH AN EXCUSED ABSENCE:

Those students who have an excused absence will have one week to contact instructor regarding missed graded work.

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