NEW COURSE PROPOSALS: Lecture/Lab or Lecture/Activity COMBINATION PROPOSAL

College: [Engineering and Computer Science] **Department: [Mechanical Engineering]**

Note: Use this form to request two courses that are co-requisites with each other such as Lecture/Lab or Lecture/Activity combinations. These are routinely published together in the printed Catalog and SOC as in BIOL 101/L (3/1). However, these are technically two entries in the Solar Catalog: BIOL 101 (3) and BIOL 101L (1). This form allows you to request both the lecture/lab and lecture/activity courses together.

1. **Course information for Catalog Entry**

Subject Abbreviation and Number: *(ie, BIOL 101/L General Biology and Lab (3/1)L)* **[ME 436]**
Course Title: *(BIOL 101 General Biology (3))* **[Mechanics and Design of Composite Materials]**

Lecture Units: **[2]** units
Course Prerequisites: **[ME 330, ME 386/L]** *(if any)*
Course Corequisites: **[ME 436L]** *(if any)*
Recommended Preparatory Courses: **[ ]** *(if any)*

Laboratory/Activity Title: *(General Biology Lab (1))* **[ME 436L]**
Laboratory/Activity Units: **[1]** units
Course Prerequisites: **[ME 330, ME 386/L]** *(if any)*
Course Corequisites: **[ME 436]** *(if any)*
Recommended Preparatory Courses: **[ ]** *(if any)*

2. **Course Description for Printed Catalog:** *Notes:* If grading is NC/CR only, please state in course description. If a course numbered less than 500 is available for graduate credit, please state "Available for graduate credit in the catalog description."

[Prerequisite: ME 330, ME 386/L. Introduction to composite materials. Analysis, design and applications of laminated fiber reinforced composites. Macro-mechanical analysis of engineering constants and failure. Design Project.]

3. **Date of Proposed Implementation: (Semester/Year): [Fall] / [2016]** *Comments*

4. **Course Level**

[X]Undergraduate Only **[]**Graduate Only **[]**Graduate/Undergraduate

5. **Course Abbreviation "Short title" (maximum of 17 characters and spaces)**

Lecture Short Title: **[COMPOSITES]**
Lab/Activity Short Title: **[COMPOSITES LAB]**

6. **Basis of Grading:**

[]Credit/No Credit Only **[X]Letter Grade Only** **[]CR/NC or Letter Grade**

7. **Number of times a courses may be taken:**

[X] May be taken for credit for a total of **[1]** times, or for a maximum of **[3]** units
[ ] Multiple enrollments are allowed within a semester

8. **C-Classification:** *(e.g., Lecture-discussion (C-4).)*
   Lecture **[2]** units @ **[C] [4]**
   Lab/Activity **[1]** units @ **[C] [16]**

9. **Replaces Current Experimental Course?**
   [ ] YES **[X]** NO
   Replaces Course Number/Suffix:**[ ]**
   Previously offered **[ ]** times.
10. **Proposed Courses Use:** *(Check all that apply)*
    [X]Own Program: **[X]**Major **[ ]**Minor **[ ]**Masters **[ ]**Credential **[ ]**Other
    [ ] Requirement or Elective in another Program
    [ ] General Elective
    [ ] General Education, Section **[ ]**
    [ ] Meets GE Information Competence (IC) Requirement
    [ ] Meets GE Writing Intensive (WI) Requirement
    [ ] Community Service Learning (CS)
    [ ] Cross-listed with: *(List courses)* **[ ]**

11. **Justification for Request**: *Course use in program, level, use in General Education, Credential, or other. Include information on overlap/duplication of courses within and outside of department or program. (Attach)*

12. **Estimate of Impact on Resources within the Department, for other Departments and the University.** *(Attach)*

13. **Course Outline and Syllabus** *(Attach) Include methods of evaluation, suggested texts, and selected bibliography*. Describe the difference in expectations of graduates and undergraduates for all 400 level courses that are offered to both.

14. **Indicate which of the PROGRAM'S measurable Student Learning Outcomes are addressed in this course.** *(Attach)*

15. **Assessment of COURSE objectives** *(Attach)*
    A. Identify each of the course objectives and describe how the student performance will be assessed
16. **If this is a General Education course combination, indicate how the General Education Measurable Student Learning Outcomes (from the appropriate section) are addressed in this course.** *(Attach)*

17. **Methods of Assessment for Measurable Student Learning Outcomes** *(Attach)*
    A. Assessment tools
    B. Describe the procedure dept/program will use to ensure the faculty teaching the course will be involved in the assessment process (refer to the university's policy on assessment.)

18. Record of Consultation: *(Normally all consultation should be with a department chair or program coordinator.) If more space is needed attach statement and supporting memoranda.*

Date:	Dept/College:	Department Chair/ Program Coordinator	Concur (Y/N)
[3/5/2015]	[CECM/ECS]	[N. Dermendjian]	[Y]
[3/5/2015]	[CS/ECS]	[R. Covington]	[Y]
[3/5/2015]	[ECE/ECS]	[A. Amini]	[Y]
[3/5/2015]	[ME/ECS]	[H. Johari]	[Y]
[3/5/2015]	[MSEM/ECS]	[K. Chang]	[Y]
[ ]	[ ]	[ ]	[ ]

Consultation with the Oviatt Library is needed to ensure the availability of appropriate resources to support proposed course curriculum.

Collection Development Coordinator — **Date**

Please send an email to: collection.development@csun.edu — [3/5/2015]

19. Approvals:

Department Chair/Program Coordinator:	Hamid Johari	Date:	[3/5/2015]
College (Dean or Associate Dean):	Robert Ryan	Date:	[3/25/2015]
Educational Policies Committee:		Date:	[ ]
Graduate Studies Committee:		Date:	[ ]
Provost:		Date:	[ ]

11. Justification for Request:

The proposed course is intended to introduce undergraduate students to the design and analysis of composite structures and components. The course will cover different manufacturing processes with emphasis on in-the-autoclave and out-of-the-autoclave processes. Currently, there is no course at the undergraduate level to cover composite materials, which is an important class of engineering materials in many applications.

12. Estimated Impact on Resources within the Department, for other Departments and the University:

Minimal impact is expected on departmental resources because a tenure track faculty member who is currently teaching another senior elective in the mechanics area will be assigned to teach this new senior elective course instead. The software that will be integrated in the course is free from Autodesk Inc. as an educational promotion package. Notably, this software is already installed on most of the computers in the Mechanical Engineering department. Lastly, due to the large increase in the department's enrollment, this additional senior elective will provide students with another course to supplement their engineering skills.

13. Course Outline and Syllabus:

ME 436/L Mechanics and Design of Composite Materials

Prerequisites: ME 330, ME 386/L. Introduction to composite materials manufacturing. Analysis, design and applications of laminated fiber reinforced composites. Macro-mechanical analysis of engineering constants and failure. Design Project.

Prerequisite: ME 330, ME 386/L

Textbook:
I.M. Daniel and O. Ishai. Engineering Mechanics of Composite Materials, 2nd Edition. Oxford University Press. ISBN: 978-0-19-515097-1

References:

- J. Shigley. Mechanical Engineering Design, McGraw-Hill.
- R. Gibson. Principles of Composite Material Mechanics. CRC Press.
- R. Jones. Mechanics of Composite Materials. Taylor & Francis.

Course Content:

A. Introduction to composite materials and applications (Time Allotted: 2 weeks)
   a. Composite Materials System
   b. Advantage of Composites
   c. Classification of Composites

B. Manufacturing processes (Time Allotted: 3 weeks)
   a. Spray Lay-up
   b. Wet/Hand Lay-up
   c. Vacuum Bagging
   d. Filament Winding
   e. Pultrusion
   f. Resin Transfer
   g. Autoclave
   h. Out-of-autoclave

C. Elastic Behavior of Unidirectional Lamina (Time Allotted: 2.5 weeks)
   a. Stress-Strain Relations
   b. Relation between mathematical and engineering constants
   c. Stress-strain Relations for thin lamina
   d. Transformation of elastic parameters
   e. Transformation of stress-strain relation in terms of engineering constants

D. Strength of Unidirectional Lamina (Time Allotted: 2.5 weeks)
   a. Macromechanical Strength Parameters
   b. Macromechanical failure theories
   c. Maximum Stress Theory

d. Maximum Strain Theory
e. Tsai-Hill Theory
f. Tsai-Wu Theory

E. Elastic Behavior of Multidirectional Laminates (Time Allotted: 2.5 weeks)
a. Strain-Displacement Relations
b. Stress-Strain relations of layer with a laminate
c. Force and Moments resultants
d. Laminate Stiffness
e. Laminate Compliances
f. Symmetric Laminates
g. Balanced Laminates
h. Special types of laminates

F. Computer-Aided Analysis (Time Allotted: 2.5 weeks)
a. Introduction to NEi Analysis software
b. Static Analysis
c. Modal Analysis
d. Analysis of sandwich structure

The laboratory exercises in the companion lab section include:

1- Introduction to safety procedures and tools (1 week)
2- Wet layup lab (1 week)
3- Vacuum Bagging lab (2 weeks)
4- Layup of complex shapes (2 weeks)
5- Pre-impregnated layup lab (2 weeks)
6- Oven lab (3 weeks)
7- Autoclave lab (3 weeks)

Course Objectives: The objectives of the course are to promote the development of: (1) an ability to identify the properties of fiber and matrix materials used in commercial composites and identify different composite manufacturing processes, (2) an ability to predict the elastic properties of unidirectional fiber lamina, (3) transformation of stress, strain and stiffness tensors and understand linear elasticity of composite (isotropic and anisotropic), (4) an ability to analyze a laminated plate in bending, including finding laminate properties from lamina properties and predict the failure, (5) an ability to use the ideas developed in the analysis of composites towards using composites in design.

Grading: The breakdown of the final grade is as follows:

Assignment	% of final grade
Homework	10%
Design Assignments	15%
Midterm	25%
Design Project	25%
Final	25%

Homework: Homework problems will be assigned once a week approximately and they are due in the class the following week. No late homework will be accepted.

Course Policies: Each student is required to attend every lecture. Students are responsible for arriving before class begins, and remaining for the duration of the course meeting. If a student misses a class, it is his or her responsibility to find out what was discussed in class, any homework assigned or exam scheduled.

14. Indicate which of the Program's Measurable Student Learning Outcomes are addressed in this course:

Demonstration of Program Outcomes in course
a. an ability to apply knowledge of mathematics, science, and engineering
c. an ability to design a system, component, or process to meet desired needs within realistic constraints
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

15. Assessment of COURSE objectives

The three course objectives listed in the course outline are assessed through the homework and examinations in addition to the project. The alignment of the course objectives and the student assessment tools is shown in the table below.

Course Objectives	Assessments of Student Performance
1. An ability to identify the properties of fiber and matrix materials used in commercial composites and identify different composite manufacturing processes.	Homework and Exams
2. An ability to predict the elastic properties of unidirectional fiber lamina.	Homework and Exams
3. Transformation of stress, strain and	Homework and Design

stiffness tensors and understand linear elasticity of composite (isotropic and anisotropic).	assignments
4. An ability to analyze a laminated plate in bending, including finding laminate properties from lamina properties and predict the failure.	Homework, Design assignments, and Exam
5. An ability to use the ideas developed in the analysis of composites towards using composites in design.	Homework, Design assignments, and Design Project

16. Not Applicable

17. Methods of Assessment for Measurable Student Learning Outcomes:

A. Assessment Tools

Homework, Design Assignments, Design Project, and Examinations.

COURSE ALIGNMENT MATRIX

Assess how well ____ME 436/L____ contributes to the program's student learning outcomes by rating each course objective for that course with an I, P or D.

I=introduced (basic level of proficiency is expected)
P=practiced (proficient/intermediate level of proficiency is expected)
D=demonstrated (highest level/most advanced level of proficiency is expected)

Course Objectives	Student Learning Outcome a	Student Learning Outcome c	Student Learning Outcome k
1. An ability to identify the properties of fiber and matrix materials used in commercial composites and identify different composite manufacturing processes.	D	P	D
2. An ability to predict the elastic properties of unidirectional fiber lamina.	D	P	D
3. Transformation of stress, strain and stiffness tensors and understand linear elasticity of composite (isotropic and anisotropic).	D	P	D
4. An ability to analyze a laminated plate in bending, including finding laminate properties from lamina properties and predict the failure.	D	P	D
5. An ability to use the ideas developed in the analysis of composites towards using composites in design.	D	P	P

B. Describe the procedure dept/program will use to ensure the faculty teaching the course will be involved in the assessment process

The ME Department has developed a Course Evaluation Form which is used by all full-time and part-time faculty members to evaluate program outcomes and course objectives. All mechanical engineering courses are evaluated according to a defined schedule. The form template is attached.

Mechanical Engineering - Course Evaluation Form

Course Number: **Instructor:** **Semester/year:**

The purpose of this is form is to document the achievement of course objectives and program outcomes in the courses that you instruct. Answers to the questions below should cite supporting evidence from your own observations, student performance on assignments and examinations, and other feedback.

☐ **First time course taught by this instructor** ☐ **Course taught previously**

Course prerequisite(s) _____ _____ _____

- **Were the students adequately prepared by prerequisite courses?** **Yes** ☐ **No** ☐

- ~~Were changes implemented since the last time this course was taught?~~ **Yes** ☐ **No** ☐

If Yes, what changes were made since the last time this course was taught? Did these changes improve the course?

Changes made since last time	*Effects of change*

- Are changes called for the next time this course is taught? **Yes** ☐ **No** ☐

If Yes, what changes should be made the next time this course is taught?

Changes recommended for next time	*Purpose of changes*

Most useful comments from students:

Achievement of Course Objectives/Demonstration of Program Outcomes

Did the students demonstrate achievement of the course objectives and program outcomes specific to this course? In the table below, rate achievement of objectives/outcomes using evidence from direct assessment of student work, student surveys, etc.

If sampling, please indicate the approximate percent of the class sampled:
Use assessment rubrics for determining program outcome assessment

Course Objectives/Program Outcomes *List Course Objectives first, followed by Program Outcomes*	*Means of Direct Assessment by Instructor—what evidence was used for your assessment?*	*Instructor's Direct Outcome Assessment* *4=Excellent to 0=Poor*	*Improved (yes/no/??) compared to last year*