Office of the Registrar
FORM 40G REV. 1/07

EFD 39.06

PURDUE UNIVERSITY
REQUEST FOR ADDITION, EXPIRATION, OR REVISION OF A GRADUATE COURSE
(500-600 LEVEL) Graduate Council Document No. 08-9a

DEPARTMENT: Civil Engineering
EFFECTIVE SESSION: ~~Spring 2008~~ Fall 2008

INSTRUCTIONS: Please check the items below which describe the purpose of this request.

- [x] 1. New course with supporting documents (complete proposal form)
- [ ] 2. Add existing course offered at another campus
- [ ] 3. Expiration of a course
- [ ] 4. Change in course number
- [ ] 5. Change in course title
- [ ] 6. Change in course credit/type
- [ ] 7. Change in course attributes
- [ ] 8. Change in instructional hours
- [ ] 9. Change in course description
- [ ] 10. Change in course requisites
- [ ] 11. Change in semesters offered
- [ ] 12. Transfer from one department to another

PROPOSED:		EXISTING:	
Subject Abbreviation	CE	Subject Abbreviation	
Course Number	68901 ~~689~~	Course Number	
Long Title	Plasticity Theory		
Short Title	Plasticity Theory (Abbreviated title will be entered by the Office of the Registrar if omitted. (22 CHARACTERS ONLY))		

TERMS OFFERED (Check All That Apply): [ ] Summer [x] Fall [ ] Spring

CAMPUS(ES) INVOLVED: [ ] Calumet [ ] N. Central [ ] Cont Ed [ ] Tech Statewide [ ] Ft. Wayne [x] W. Lafayette [ ] Indianapolis

CREDIT TYPE
1. Fixed Credit: Cr. Hrs. 3
2. Variable Credit Range: Minimum Cr. Hrs ____ (Check One) To [ ] Or [ ] Maximum Cr. Hrs ____
3. Equivalent Credit: Yes [ ] No [x]
4. Thesis Credit: Yes [ ] No [x]

COURSE ATTRIBUTES: Check All That Apply
1. Pass/Not Pass Only [ ]
2. Satisfactory/Unsatisfactory Only [ ]
3. Repeatable [ ] Maximum Repeatable Credit: [ ]
4. Credit by Examination [ ]
5. Designator Required [ ]
6. Special Fees [ ]
7. Registration Approval Type: Department [ ] Instructor [ ]
8. Variable Title [ ]
9. Remedial [ ]
10. Honors [ ]
11. Full Time Privilege [ ]
12. Off Campus Experience [ ]

Instructional Type	Minutes Per Mtg	Meetings Per Week	Weeks Offered	% of Credit Allocated	Delivery Method (Asyn. Or Syn.)	Delivery Medium (Audio, Internet, Live, Text-Based, Video)
Lecture	75	2	16	100	Syn	Live
Recitation						
Presentation						
Laboratory						
Lab Prep						
Studio						
Distance						
Clinic						
Experiential						
Research						
Ind. Study						
Pract/Observ						

Cross-Listed Courses

COURSE DESCRIPTION (INCLUDE REQUISITES):
Sem. 1, ~~Class 0,~~ Cr 3.
Prerequisites: AAE553 or ME612 ~~or equivalent, or consent of instructor.~~
The course covers stress analysis, strains analysis, elastic and inelastic constitutive relations, with emphasis on plasticity, and the solution of plastic boundary-value problems for a wide range of materials, including metals, soils and alloys of various types. Specific topics covered by the course include: tensors, stress analysis, strain analysis, laws of thermodynamics, basic concepts from elasticity, viscoplasticity as an extension of viscoelastic concepts, classical plasticity, principle of maximum plastic dissipation, Drucker's inequality, yield function and yield surface, flow rule, hardening rule, classical models (Tresca, Von Mises, Mohr-Coulomb, Drucker-Prager), bounding-surface plasticity, thermodynamics and constitutive models, causes of plasticity at the microstructural level, non-coaxial plasticity, limit analysis, method of characteristics (slipline method) and cavity expansion analysis. Professor Salgado.

	Date		Date		Date
Calumet Department Head		Calumet School Dean		Calumet Undergrad Curriculm Committee	
Fort Wayne Department Head		Fort Wayne School Dean		Fort Wayne Chancellor	
Indianapolis Department Head		Indianapolis School Dean		Undergrad Curriculm Committee	
North Central Department Head		North Central Chancellor		Date Approved by Graduate Council	APPROVED 3/20/08
West Lafayette Department Head	01/30/08	West Lafayette College/School Dean	1-31-08	Graduate Council Secretary	5/23/08
Graduate Area Committee Convener	3/20/08	Graduate Dean		West Lafayette Registrar	8/22/08

OFFICE OF THE REGISTRAR

8/22/08

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COURSE ATTRIBUTES: Check All That Apply
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5. Designator Required [ ]
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7. Registration Approval Type
   Department [ ] Instructor [ ]
8. Variable Title [ ]
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Presentation						
Laboratory						
Lab Prep						
Studio						
Distance						
Clinic						
Experiential						
Research						
Ind. Study						
Pract/Observ						

Cross-Listed Courses

COURSE DESCRIPTION (INCLUDE REQUISITES):
Sem. 1, Class 3, Cr 3.
Prerequisites: AAE553 or ME612 or equivalent, or consent of instructor.
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Calumet Department Head	Date	Calumet School Dean	Date	Calumet Undergrad Curriculm Committee	Date
Fort Wayne Department Head	Date	Fort Wayne School Dean	Date	Fort Wayne Chancellor	Date
Indianapolis Department Head	Date	Indianapolis School Dean	Date	Michael Johnson 3/26/08 Undergrad Curriculm Committee	Date
North Central Department Head	Date	North Central Chancellor	Date	Date Approved by Graduate Council	
MK Bah 01/30/08 West Lafayette Department Head	Date	Leiled Choate 1-31-08 West Lafayette College/School Dean	Date	Graduate Council Secretary	Date
Graduate Area Committee Convener	Date	Graduate Dean	Date	West Lafayette Registrar	Date

OFFICE OF THE REGISTRAR

TO: Purdue University Graduate Council

From: Faculty Member: Rodrigo Salgado

From: Department: Civil Engineering

Campus: West Lafayette

Date: 1/29/2008

For Reviewer's comments only	
Select One	
Reviewer:	
Comments:	

Subject: Proposal for New Graduate Course –Documents Supporting Registrar's Form 40

Contact information if questions arise

Name: Becky Hull
Phone Number: 62379
E-mail: bhull@purdue.edu
Campus Address: 550 Stadium Mall Drive (CIVL)

Course Number: CE 689

Course Title: Plasticity Theory

A. Justification for the Course

Explain how this course relates to other courses offered in the department or other departments and how this course fulfills a recognized need.

Plasticity theory is needed to model realistically the mechanical response of a wide range of materials, including metals, soils and alloys of various types. Both students interested in developing constitutive models for new or existing materials and students interested in solving boundary-value problems in which plastic deformations develop will benefit from the course.

This course is intended primarily for students — Choose One — from within this department

B. Level of the course:

Justify request for graduate course level by indicating anticipated enrollments of undergraduate and graduate students.

Anticipated Undergraduate Student Enrollment: Choose One: None

Anticipated Graduate Student Enrollment: Choose One: 100%

C. Prerequisites: (If none, please explain reasons for absence)

Prerequisites: AAE553 or ME612 or equivalent, or consent of instructor.

D. Course Instructor:

Instructor's Name: Rodrigo Salgado

E1. Course Outline:

(An outline of topics to be covered and an indication of the relative emphasis or time devoted to each topic is necessary. If laboratory or field experience is involved, the nature of this component should be explained as well).

See attached

E2. Method of Evaluation or Assessment:

Mid-term and Final Exam

F. Reading List:

A reading list or bibliography should be limited to material the students will be required to read in order to successfully complete the course. It should not be a compilation of general reference material.

Lubliner, J., Plasticity Theory, Macmillan; Class notes by the instructor; Technical papers.

Engineering Faculty Document No. 39-06
October 2007

MEMORANDUM

TO: The Faculty of the College of Engineering

FROM: The Faculty of the School of Civil Engineering

RE: New Graduate Level Course CE 689

The Faculty of the School of Civil Engineering has approved the following new course. This action is now submitted to the Engineering Faculty for a recommendation for approval.

CE 689 Plasticity Theory

Sem.1, Class 3, Cr 3

Prerequisites: CE 297 and MA 261 or consent of instructor.

The course covers stress analysis, strains analysis, elastic and inelastic constitutive relations, with emphasis on plasticity, and the solution of plastic boundary-value problems. Specific topics covered by the course include: tensors, stress analysis, strain analysis, laws of thermodynamics, basic concepts from elasticity, viscoplasticity as an extension of viscoelastic concepts, classical plasticity, principle of maximum plastic dissipation, Drucker's inequality, yield function and yield surface, flow rule, hardening rule, classical models (Tresca, Von Mises, Mohr-Coulomb, Drucker Prager), bounding surface plasticity, thermodynamics and constitutive models, causes of plasticity at the microstructural level, non-coaxial plasticity, limit analysis, method of characteristics (slipline method) and cavity expansion analysis.

Reason: To provide students with knowledge of the theory of plasticity and the modeling of the mechanics of materials. Coverage includes behavior at the element level and the solution of boundary-value problems. The times the course was offered the enrollment was 16 students in fall 2003 and 21 students in spring 2006.

M. Katherine Banks, Head
School of Civil Engineering

APPROVED FOR THE FACULTY
OF THE SCHOOLS OF ENGINEERING
BY THE ENGINEERING
CURRICULUM COMMITTEE
ECC Minutes #9
Date 11/26/07
Chairman ECC Michael J. Trevisani

Supporting Documentation

1. **Justification:** Plasticity theory is needed to model realistically the mechanical response of a wide range of materials, including metals, soils and alloys of various types. Both students interested in developing constitutive models for new or existing materials and students interested in solving boundary-value problems in which plastic deformations develop will benefit from the course.

2. **Level:** Graduate Level

3. **Prerequisites:** CE 297 and MA 261 or consent of instructor

4. **Instructor**: Rodrigo Salgado

5. **Course Objectives:** Students who complete the course should be able to:

    - Calculate stresses and strains at a point.
    - Relate stresses to strains using elasticity.
    - Identify conditions in which rate of loading may be important.
    - Use the basic viscoelastic models.
    - Use the classical plasticity models to predict mechanical response.
    - Identify the different components of and different ways of building an advanced constitutive model, including models with viscoplastic and hypoplastic components.
    - Relate observations at the macro level and microstructural processes.
    - Perform calculations of the stability of bodies and structures using limit analysis.
    - Perform calculations of the stability of bodies and structures using the slipline method.
    - Perform cavity expansion analysis.

6. **Course Outline:**

Week	Topic
1	Indicial notation. Tensors and related mathematics.
2	Review of strain analysis.
3	Review of stress analysis.
4	Thermodynamic laws.
5	Elasticity.
6	Viscoelasticity
7	Viscoelasticity and Classical Plasticity
8	Classical Plasticity -- **Midterm Exam**
9	Classical plasticity
10	Bounding surface plasticity
11	Viscoplasticity
12	Limit analysis
13	Limit analysis/Method of characteristics
14	Method of characteristics
15	Cavity expansion analysis
16	Final Exam

7. **Textbook and class notes**

Lubliner, J. Plasticity Theory. MacMillan.
Class notes by the instructor.
Technical papers.