Course Approval Form

For instructions see:
http://registrar.gmu.edu/facultystaff/catalog-revisions/course/

Action Requested:

[x] Create new course [ ] Inactivate existing course
[ ] Modify existing course (check all that apply)
[ ] Title [ ] Credits [ ] Repeat Status [ ] Grade Type
[ ] Prereq/coreq [ ] Schedule Type [ ] Restrictions
[ ] Other:

Course Level:

[ ] Undergraduate
[x] Graduate

College/School: College of Sciences
Department: Physics and Astronomy
Submitted by: Cing-Dao Kan
Ext: 3-5898 **Email:** cdkan@gmu.edu

Subject Code: PHYS **Number:** 694
(Do not list multiple codes or numbers. Each course proposal must have a separate form.)

Effective Term: [ ] Fall [x] Spring [ ] Summer *Year* 2017

Title:
Current: N/A
Banner (30 characters max w/ spaces):
New: Applied Mechanics of Solids

Fulfills Mason Core Req? (undergrad only)
[ ] Currently fulfills requirement
[ ] Submission in progress

Credits: (check one) [3] Fixed [ ] Variable — or — to

Repeat Status: (check one)
[x] Not Repeatable (NR)
[ ] Repeatable within degree (RD)
[ ] Repeatable within term (RT)
Maximum credits allowed: 3

Grade Mode: (check one)
[x] Regular (A, B, C, etc.)
[ ] Satisfactory/No Credit
[ ] Special (A, B C, etc. +IP)

Schedule Type: (check one) LEC can include LAB or RCT
[x] Lecture (LEC)
[ ] Lab (LAB)
[ ] Recitation (RCT)
[ ] Internship (INT)
[ ] Independent Study (IND)
[ ] Seminar (SEM)
[ ] Studio (STU)

Prerequisite(s):
PHYS 620 or permission of instructor

Corequisite(s):

Instructional Mode:
[x] 100% face-to-face
[ ] Hybrid: ≤ 50% electronically delivered
[ ] 100% electronically delivered

Restrictions Enforced by System: Major, College, Degree, Program, etc. (include code)

Equivalencies: (check only as applicable)
[ ] YES, course is 100% equivalent to: _____
[ ] YES, course is being renumbered to/will replace the following: _____

Catalog Copy for NEW Courses Only (Consult University Catalog for models)

Description (No more than 60 words, use verb phrases and present tense)	**Notes** (List additional information for the course)
Applied mechanics of solids deals with the physical laws, mathematical methods, and computer algorithms that are used to predict material and structural response subjected to mechanical or thermal loading. Topics covered includes mathematical description of solids, equations of motion and equilibrium, constitutive equations, principle of virtual work and fracture mechanics. Analytical technique and numerical method are also introduced.	

Indicate number of contact hours: Hours of Lecture or Seminar per week: 3 Hours of Lab or Studio:
When Offered: (check all that apply) [x] Fall [ ] Summer [ ] Spring

Approval Signatures

Department Approval Date
College/School Approval Date

If this course includes subject matter currently dealt with by any other units, the originating department must circulate this proposal for review by those units and obtain the necessary signatures prior to submission. Failure to do so will delay action on this proposal.

Unit Name	Unit Approval Name	Unit Approver's Signature	Date

For Graduate Courses Only

Graduate Council Member
Provost Office
Graduate Council Approval Date

For Registrar Office's Use Only: Banner_____Catalog_____

revised 6/22/15

Course Proposal Submitted to the College of Science Curriculum Committee (COSCC)

The form above is processed by the Office of the University Registrar. This second page is for the COSCC's reference. Please complete the applicable portions of this page to clearly communicate what the form above is requesting.

Course Number and Title:
PHYS 694, Applied Mechanics of Solids

Date of Departmental Approval:
TBD

Course Prerequisites:
PHYS 620 (Continuum Mechanics) or permission of instructor

Catalog Description:
Introduction to the physical laws, mathematical formulations, and computer algorithms that are used to predict material and structural response subjected to mechanical or thermal loading. Topics covered includes mathematical description of solids, equations of motion and equilibrium, constitutive equations, principle of virtual work, and fracture mechanics. Analytical technique and numerical method are also covered.

Reason for the New Course:
This new course will be one of the require electives for the new Engineering Physics concentration in our Physics Ph.D. Program. A corresponding Program Modification Proposal in expanding the scope of the current Physics Ph.D. Program by adding a new concentration in Engineering Physics is submitted together with this Course Approval Form. The main aim of this new course is to offer students interested in engineering physics fundamental knowledge in applied mechanics of solids and relationships essential for physicists and engineers working in this field.

Prerequisite(s): PHYS 620 or permission of instructor

Hours of Lecture or Seminar per week: 3

Relationship to Existing Programs:
A proposal for modifying the current Physics Ph.D. Program by adding a new concentration in Engineering Physics is submitted together with this course proposal. The proposed Applied Mechanics of Solids course (PHYS 694) will be one of the required electives for the new concentration. PHYS 694 can also serve as an elective course for the graduate students in Bioengineering, Civil, Environmental, and Infrastructure Engineering, as well as Mechanical Engineering.

Relationship to Existing Courses:
There is no existing course in Applied Mechanics of Solids. A direct reading course on Applied Mechanics of Solids is being offered this semester to suit the needs of the program.

Semester of Initial Offering:
Fall 2017.

Proposed Instructors:
Cing-Dao Kan, Dhafer Marzougui and Chi Yang

Tentative Syllabus for PHYS 694

Applied Mechanics of Solids

Contact Information

- Day(s) and Time:
- Location:
- Instructor:
- Email:
- Phone:
- Office Hour:
- Office:

Course Description

Introduction to the physical laws, mathematical methods, and computer algorithms that are used to predict material and structural response subjected to mechanical or thermal loading. Topics covered includes mathematical description of solids, equations of motion and equilibrium, constitutive questions, principle of virtual work, and fracture mechanics. Analytical technique and numerical method are also covered.

Course Prerequisites

PHYS 620 (Continuum Mechanics) or permission of instructor

Course Objectives

- To familiarize students with the mathematical framework of basic concepts used in engineering when dealing with deformable solids;
- To understand concepts of governing equations, principle of virtual work, constitutive equations, and fracture mechanics;
- To set up properly posed boundary and initial-value problems associated with mechanics of solids and solve them analytically;
- To become familiar with numerical algorithm using finite element method to solve physics and engineering problems.

Course Schedule

- Week 1: Introduction, and Fundamental Concepts
- Week 2: Mathematical Foundations: Governing Equations
- Week 3: Equations of Motion and Equilibrium for Deformable Solids
- Week 4: Governing Equation using Work and Principle of Virtual Work
- Week 5: Constitutive Relationships between Stress and Strain
- Week 6: Solutions to Simple Boundary and Initial Value Problems
- Week 7: Analytical Techniques and Solutions for Linear Elastic Solids
- Week 8: Mid-Term Exam
- Week 9: Analytical Methods and Solutions for Plastic Solids
- Week 10: Bounding Theorems in Plasticity and Their Applications
- Week 11: Theory and Implementation of Finite Element Methods

- Week 12: Material Failure Modeling using Linear Elastic Fracture Mechanics
- Week 13: Material Failure Modeling using Plastic Fracture Mechanics
- Week 14: Review and Discussion
- Week 15: Final Exam

Textbooks

- Allan F. Bower "Applied Mechanics of Solids," First Edition, CRC Press, 2009, ISBN-13: 978-1439802472.

References

- Pin Tong and Yuen-Chen Fung "Classical and Computational Solid Mechanics," World Scientific Publishing Company, 2001, ISBN-13: 978-9810241247.
- Peter Howell, Gregory Kozyreff, and John Ockendon "Applied Solid Mechanics," First Edition, Cambridge Texts in Applied Mathematics, 2009, ISBN-13: 978-0521540117.

Grading

- Exams: 80% - One midterm (30%) and one final (50%). You will be given review problems to prepare for the exams.
- Homework: 20% - Usually one assignment per week.
- Course grade will be a letter grade. The following graduate grading is available at university catalog.

Grade	Quality Points	Graduate Courses
A+	4.00	Satisfactory/Passing
A	4.00	Satisfactory/Passing
A-	3.67	Satisfactory/Passing
B+	3.33	Satisfactory/Passing
B	3.00	Satisfactory/Passing
B-	2.67	Satisfactory/Passing
C	2.00	Unsatisfactory/Passing
F	0.00	Unsatisfactory/Failing

Academic Integrity

All students will be expected to abide by the Honor Code: Student members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work. GMU honor code is available at http://oai.gmu.edu/the-mason-honor-code-2/.

University Policy

The University Catalog, http://catalog.gmu.edu, is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at http://universitypolicy.gmu.edu/.

Disability Accommodations

If you have a learning disability or other condition that may affect academic performance, please:
a) Make sure documentation is on file with Office of Disability Services (SUB I, Rm. 4205; 993-2474; http://ods.gmu.edu) to determine the accommodations you need; and
b) Talk with the instructor to discuss your accommodation needs.