Course Approval Form

For approval of new courses and deletions or modifications to an existing course.

registrar.gmu.edu/facultystaff/curriculum

Action Requested:

[X] Create new course [ ] Delete existing course

[ ] Modify existing course (check all that apply)

[ ] Title [ ] Credits [ ] Repeat Status [ ] Grade Type

[ ] Prereq/coreq [ ] Schedule Type [ ] Restrictions

[ ] Other: _____

Course Level:

[X] Undergraduate

[ ] Graduate

College/School: COS **Department:** SPACS

Submitted by: Krishnamurthy V. Vemuru **Ext:** 35121 **Email:** kvemuru@gmu.edu

Subject Code: PHYS **Number:** 332

(Do not list multiple codes or numbers. Each course proposal must have a separate form.)

Effective Term: [x] Fall [ ] Spring [ ] Summer Year 2014

Title: Current _____

Banner (30 characters max including spaces) _____

New Solar Cells

Credits: (check one) [x] Fixed [ ] Variable 3 to _____

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

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

Schedule Type Code(s): (check all that apply) [x] Lecture (LEC) [ ] Lab (LAB) [ ] Recitation (RCT) [ ] Internship (INT) [ ] Independent Study (IND) [ ] Seminar (SEM) [ ] Studio (STU)

Prerequisite(s):

PHYS262 and PHYS263 or
PHYS245 and PHYS246

Corequisite(s):

Instructional Mode:

[x] 100% face-to-face

[ ] Hybrid: ≤ 50% electronically delivered

[ ] 100% electronically delivered

Special Instructions: (list restrictions for major, college, or degree;hard-coding; etc.)

Satisfies the materials science course requirement for the renewable energy minor program

Are there equivalent course(s)? [ ] Yes [x] No

If yes, please list _____

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)
Covers the physics of solar cells, basics of semiconductors, *pn* junctions, basic structure of solar cells, the latest advances in solar cell materials, and concepts for improving the efficiency of solar cells. Solar cell design based on silicon, copper indium gallium selenide, gallium arsenide, organic solar cells, dye-sensitized solar cells, quantum dots, and nanowires will also be reviewed.	

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 [x] 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 2/2/10*

Course Proposal Submitted to the Curriculum Committee of the College of Science

1. <u>COURSE NUMBER AND TITLE</u>:
PHYS 332: Solar Cells

<u>Course Prerequisites</u>: PHYS 262 and 263, or PHYS 245 and 246

<u>Catalog Description</u>:
Covers the physics of solar cells, basics of semiconductors, pn junctions, basic structure of solar cells, the latest advances in solar cell materials, and concepts for improving the efficiency of solar cells. Solar cell design based on silicon, copper indium gallium selenide, gallium arsenide, organic solar cells, dye-sensitized solar cells, quantum dots, and nanowires will also be reviewed.

2. <u>COURSE JUSTIFICATION</u>: Upper division course that satisfies renewable energy minor materials science requirement

<u>Course Objectives</u>:
The physics of solar cells
Materials and methods used in the manufacturing of the four generations of solar cells
Compare the energy conversion efficiencies of different types of solar cells
Compare cost effectiveness of different types of solar cells
Solar cell manufacturing companies and career outlook

<u>Course Necessity</u>:
Only the second course that satisfies renewable energy minor materials science requirement

<u>Course Relationship to Existing Programs</u>:

Satisfies renewable energy minor materials science requirement

<u>Course Relationship to Existing Courses</u>:
None; course taught as PHYS 390 special topics in Fall 2013

3. <u>APPROVAL HISTORY</u>:

4. <u>SCHEDULING AND PROPOSED INSTRUCTORS</u>:

<u>Semester of Initial Offering</u>: Fall 2014

<u>Proposed Instructors</u>: Krishnamurthy V. Vemuru

5. <u>TENTATIVE SYLLABUS</u>: See attached.

Solar Cells

PHYS390

Fall 2013 Syllabus

Description

Solar cells are used to generate electricity from the Sun. The goal of this course is to cover the physics of the solar cells such as the importance of renewable energy sources in future economy, the principle of operation of solar cells, the basics of semiconductors, *pn* junctions, *pin* junctions, conversion of thermal radiation into chemical energy, conversion of chemical energy into electrical energy, basic structure of solar cells, the latest advances in solar cell materials and technologies, and concepts for improving the efficiency of solar cells. The four generations of solar cells covering silicon, cadmium telluride, copper indium gallium selenide, gallium arsenide, organic solar cells, dye-sensitized solar cells, quantum dots, and nanowires will also be reviewed. Some recent research on solar cell physics from selected journal articles will also be reviewed.

Learning Goals

- The physics of solar cells
- Materials and methods used in the manufacturing of the four generations of solar cells
- Compare the energy conversion efficiencies of different types of solar cells
- Compare cost effectiveness of different types of solar cells
- Solar cell manufacturing companies and career outlook

Textbook: Solar Cells, Materials, Manufacture, and Operations, Second Edition, Augustin McEvoy, L. Castner, Tom Markvart, (Elsevier, 2013).

Additional Reference: The Physics of Solar Cells, Jenny Nelson (Imperial College Press, 2003).

Prerequisites: PHYS262 and PHYS263 or PHYS245, PHYS246, and the permission of the instructor.

Lectures: Class meets on Tuesdays and Thursdays: 9 to 10:15 AM in 207, Innovation Hall.

Instructor: Krishnamurthy V. Vemuru

Office: 201 B Planetary Hall, Office Hours: WF 1:30 to 2:30 pm or by Appointment

Phone: 703-993-5121, Email: kvemuru@gmu.edu

Grading: 15 assignments x 5 points = 75 points

Final Exam (5 problems, which may also include conceptual or descriptive questions) x 5 points = 25 points

Final Exam: December 12, 8:45 to 10:15 AM

Letter grades: A+: 95-100%, A: 90 – 94%, A-: 85-89%, B+: 80 to 84%, B: 75 to 79%, C+: 70 to 74%, C: 65 to 69%, D: 60 to 64%, and F: 0-59%