CALIFORNIA STATE POLYTECHNIC UNIVERSITY, POMONA

ACADEMIC SENATE

GENERAL EDUCATION COMMITTEE

REPORT TO

THE ACADEMIC SENATE

GE-007-189

AMM 3650 - Color Science-Principles and Applications Laboratory (GE Synthesis B5)

General Education Committee	Date: 02/14/2019
Executive Committee Received and Forwarded	Date: 04/10/2019
Academic Senate	Date: 04/24/2019 First Reading

TITLE OF REFERRAL: AMM 3650: COLOR OF SCIENCE-PRINCIPLES AND APPLICATIONS LABORATORY

BACKGROUND:

This is a new general education course for GE Area B5-Upper Division Synthesis.

RESOURCES CONSULTED:
Office of Academic Programs
Sara Meyer, Alyssa Lang, Melissa Flicker

DISCUSSION:
The GE Committee evaluated the ECO of this course, its objectives, how it meets the relevant GE student learning outcomes, the methods of assessment and other relevant details and found it to meet the requirements of GE Area B5. The GE Committee also consulted members of the ART Department in the ENV for any impact or duplication and there seems to be none. This is a corequisite 1-unit lab to a 2-unit lecture course.

RECOMMENDATION:

The GE Committee recommends approval of GE-007-189, AMM 3650: Color Science-Principles and Applications Laboratory

Curriculog printout provided for reference only. For most recent changes please refer to Curriculog database (https://cpp.curriculog.com/).

AMM - 3650L - Color Science - Principles & Applications Laboratory

C. Course - New/Modify General Education

General Catalog Information

Department* College of Agriculture | Apparel Merchandising and Management

Proposal Type* (•) New GE Course ( ) Modify GE Course

Modification Summary

Establish or Modify Articulation Agreement* Yes No

Subject Area* AMM

Catalog Number* 3650L

Formal Course Title* Color Science - Principles & Applications Laboratory

Abbreviated Course Title* Color Sci - Prncpls & Apps Lab

Unit(s)* (1)

C/S Classification* C-15 (Laboratory/Activity Hybrid)

To view C/S Classification Long Description click: http://www.cpp.edu/~academic-programs/scheduling/Documents/Curriculum%20Guide/Appendix_C_CS_Classification.pdf

Component* Laboratory

Contact Hour(s) 3 hours laboratory.

Instruction Mode(s)*	Face-to-Face
Grading Basis*	Graded Only
Repeat for Credit*	May be taken only once
Repeat for Credit Limit	
If course may be repeated for credit, total units applicable to degree and max units per semester.	
When Offered	
Cross Listed Course Subject Area and Catalog Nbr	
Dual Listed Course Subject Area and Catalog Nbr	
Course Category (select all that apply)*	☐ Major Course ☐ Service Course (used in other programs) ☑ GE Course ☐ None of the above
GE Area/Subarea*	B5

To view the General Education SubArea definitions, click http://www.cpp.edu/~academic-programs/scheduling/Documents/Ch.3-GeneralEducationProposals.pdf.

I. Catalog Description

Catalog Description*	Exploration of the physical, chemical, physiological and psychophysical aspects of light, color and colorimetry with demonstrations and lab activities. Color perception, color specification, and color communication practices. Color measurement, color matching, and color quality control lab tests. Colorants and coloration processes. Theories and principles of color systems using data. Lab projects addressing industrial color applications.

II. Required Coursework and Background (i.e. Enrollment Requirements)

Prerequisite(s) (leave blank if none)	GE Areas A1, A2, A3, B1, B2, B3 and B4.
Corequisite(s) (leave blank if none)	AMM 3650.
Pre or Corequisite(s) (leave blank if none)	
Concurrent (leave blank if none)	

III. Course Note(s) (OPTIONAL)

Note(s)	

IV. Expected Outcomes

List the knowledge, skills, or abilities which students should possess upon completing the course.*

Color plays a critical role in our world, influencing our perceptions, moods and actions. Consequently, color is a key element of global commerce from agriculture, food, interior decor, apparel, and essentially all consumer and industrial goods. Information technology and globalization has significantly impacted color science, creating and requiring new methods for imparting, measuring, evaluating and communicating color. This course will provide a key element of science not currently addressed in the curriculum that will be of value to all majors. Students will apply knowledge gained from chemistry, physics and mathematics in this course.

By successfully completing the course students will be able to meet the following educational objectives:

1. Explain the color perception process.
2. Apply the principles of color theory and color application.
3. Utilize appropriate color specification methods for communication and quality control.
4. Demonstrate color measurement, shade matching, and color quality analysis through the use of specialized software.
5. Demonstrate selection and application of appropriate coloration techniques based on colorants, materials, and end-uses.
6. Utilize systems to manage color digitally in an industrial context.

If this is a course for the major, describe how	

these outcomes relate to the mission, goals and objectives of the major program.

Explain how the course meets the description of the GE SubArea(s). Please select appropriate outcomes according to the GE Area/SLO mapping. *

One of the most salient aspects of our experience of the world around us is that entities we view have color properties. Color is perhaps the most important source of information about our world. It plays a vital role in our lives, influencing our perceptions, moods and actions. Beyond the natural world, color plays a vital role in commerce, including agriculture, food, architecture, interior décor, apparel, defense, and essentially all consumer and industrial goods. Information technology and globalization have significantly impacted color science, creating and requiring new methods for imparting, measuring, evaluating and communicating color.

This course will investigate a key element of science not currently addressed in the curriculum that will be of value to all majors. Color science is essentially an interdisciplinary subject, encompassing physics, chemistry, physiology, math, computer science, and psychology. This course is designed for students from any discipline and focuses on color science in the context of global industry and commerce. In this lab course students will apply knowledge gained from the natural sciences and mathematics.

Additional guidelines

- Include readings from original primary/historical sources, as opposed to only secondary sources.
    - Students will review the history of color science and use industry and professional resources (Munsell Color Laboratory, CIE, AATCC etc) to understand colorimetry as an applied science.
- Promote original and critical thinking in writing and/or discussion.
    - Student will evaluate problems in color science and coloration by conducting tests and experiments, and present their findings.
- Focus attention on understanding the interrelationships among the disciplines and their applications.
    - Color science embraces chemistry, physics and math. Students will conduct experiments and tests that require them to synthesise knowledge from these disciplines, and apply it in the design,

execution and interpretation of their results.

- Examine ideas and issues covered in this area in deeper and/or broader more integrative ways.
    - By conducting tests and experiments students will understand how color science explains important perceptual phenomena, underpins all creative design activities, and how its application resolves critical commercial problems in a globally-integrated world.
- Encourage synthetic-creative thinking in order to identify problems, understand broader implications and construct original ideas.
    - The weekly lab assignments will challenge students to apply their developing knowledge of color science to understand concepts and solve color problems.
- Identify and evaluate assumptions and limitations of ideas and models.
    - This element will be incorporated in lab assignments and class discussions.
- Develop written and oral communication skills appropriate for an upper division course.
    - Each week students will be required to make written and oral presentations. Profesisonal standards are expected and will be supported by appropriate rubrics.
- Provide student work for assessment of the student's understanding of the required educational objectives in this subarea or in this course.
    - See section IX
- The relationship between science, technology, and civilization.
    - The understanding of color provided in this course embraces its role in our world, the application of science and technology to measure, evaluate, apply and communicate it.
- The effect science and technology have on culture and human values.
    - The importance role of color science in society and

in commerce will be a theme of the course.

- The application and generalization of basic scientific or quantitative knowledge from the foundational courses to real world or practical problems.
    - The applications of color science is virtually unbounded. Examples will be provided and built into the course assignments.

Describe how these outcomes relate to the associated GE Learning Outcomes listed below.*

1a. Write effectively for various audiences.

Students will write professional test reports and a paper reflecting what they gained through the course.

1b. Speak effectively for various audiences.

Students will engage in classroom discussions and give presentations on their testing and experiments.

1c. Find, evaluate, use and share information effectively and ethically.

Through lab assignments, students will work individually and in groups to find, evaluate, apply, and share information to solve problems related to color science.

1d, Construct arguments based on sound evidence and reasoning to support an opinion or conclusion.

Weekly lab reports and in-class presentations will require students to develop and support arguments based on color theory and scientific method.

1e. Apply and communicate quantitative arguments using equations and graphical representations of data.

Color science involves a large volume of data and extensive use of calculations. Students will use scientific instruments to measure phenomena, and then utlize appropriate equations and make graphical representations of data to explain information.

2a. Apply scientific methods and models to draw quantitative and qualitative conclusions about the physical and natural world.

Through lab assignments students will demonstrate how color can be identified, explained, and presented in a scientific way. Both quantitative and qualitative methods will be employed.

2d. Integrate concepts, examples, and theories from more than one discipline to identify problems, construct original ideas, and draw conclusions.

Lab assignments will embrace multiple disciplines, such as chemistry, physics, psychology, physiology, engineering, mathematics, social sciences, among others. The synthesis, integration and application of knowledge is a critical element of this class.

General Education Outcomes*

- Ia. Write effectively for various audiences
- Ib. Speak effectively to various audiences.
- Ic. Find, evaluate, use, and share information effectively and ethically.
- Id. Construct arguments based on sound evidence and reasoning to support an opinion or conclusion.
- Ie. Apply and communicate quantitative arguments using equations and graphical representations of data.
- IIa. Apply scientific methods and models to draw quantitative and qualitative conclusions about the physical and natural world.
- IId. Integrate concepts, examples, and theories from more than one discipline to identify problems, construct original ideas, and draw conclusions.

To view the mapping, click https://www.cpp.edu/~academic-programs/Documents/GE%20SLO%20Mapping.pdf

V. Instructional Materials

Provide bibliography that includes texts that may be used as the primary source for instruction, and other appropriate reference materials to be used in instruction. The reference list should be current, arranged alphabetically by author and the materials should be listed in accepted bibliographic form.

Instructional Materials*

1. Roy S. Berns, Principles of Color Technology. New York: Wiley,

2000.
2. Rolf G. Kuehni, Color Vision and Technology, AATCC Publication, 2013.
3. American Association of Textile Chemists and Colorists (AATCC) Technical Manual.
4. American Society for Testing and Materials (ASTM) Book of Textile Standards
5. The New Munsell Student Color Set 3rd Edition, New York: Fairchild Publications, 2014.

Other Readings and Other Resources:

Academic Journals:

Color Research and Application:https://onlinelibrary.wiley.com/journal/15206378

Coloration Technology: https://onlinelibrary.wiley.com/journal/14784408

AATCC Journal of Research: https://www.aatcc.org/pub/aatcc-journal/

Professional Organizations:

CIE (International Commission on Illumination): http://www.cie.co.at/

ISCC (Inter-Society Color Council – the principal professional society in the field of color in the United States) https://www.iscc.org/

AIC (International Color Association) https://www.aic-color.org/

The Color Association of United States: http://www.colorassociation.com/

Faculty are encouraged to make all materials accessible. Indicate with an asterisk those items that have had accessibility (ATI/Section 508) reviewed. For more information, http://www.cpp.edu/~accessibility

VI. Minimum Student Materials

List any materials, supplies, equipment, etc., which students must provide, such as notebooks, computers, internet access, special clothing or uniforms, safety equipment, lockers, sports equipment, etc. Note that materials that require the assessment of a fee may not be included unless the fee has been approved according to University procedures.

Minimum Student Materials*

1. Textbook
2. Materials for lab projects
3. Flash drive

VII. Minimum College Facilities

List the university facilities/equipment that will be required in order to offer this class, such as gymnastic equipment, special classroom, technological equipment, laboratories, etc.

Minimum College Facilities*

Smart classroom, white boards, Blackboard.

Lab equipped with color software, testing and coloration equipment.

VIII. Course Outline

Describe specifically what will be included in the course content. This should not be a repetition of the course description but an expansion that provides information on specific material to be included in the class, e.g. lecture topics, skills to be taught, etc. This should not be a week-by-week guide unless all instructors are expected to follow that schedule.

Course Outline*

Theme/Topic – Lab Activity
• Light, Light Sources and Illuminants • Light and Vision
• Absorption and Scattering of Light • Color Stimuli • Dyes and Pigments • Fibers and Polymers •
Measurement of Reflected or Scattered Light • Standard Measuring Geometries of Reflectance Data • SCI and SCE • Measuring Spectral Information • Instrument Calibration • Sample Presentation •
Defining Color • Observer, Light, and Object • Color Vision: Rods and Cones •

- The Color by Number
- The Fabric Store Experiment
- Color Space and Color Solid
- Color Perception Phenomena

- The CIE Colorimetric System
- Calculation Tristimulus Values and Chromaticity Coordinates
- Color Measurement
- 1964 CIE 10^0 Standard Observer
- Object Color Solid above the Chromaticity Diagram

- Defining Color Ordering Systems
- Geometric Distance Representative of Perceptual Color Properties
- Geometric Distance Representative of Stimulus Units
- General Issues with Color Order Systems and Their Atlases

- The Law of Color Mixing
- Mixture of Lights: Additive Color Mixture
- Mixture of Colorants: Subtractive Color Mixture

- Color and Appearance

- Color Reproduction
- Levels of Reproductive Accuracy
- Color Reproduction on Textiles, Pigment, Plastic, and Ink

- Coloring Strength
- Relative Strength and Shade from Coloration
- Interrelation of Strength and Color Difference

- Color Constancy and Metamerism
- Applications

- Describing Perceived Color Differences
- CIELAB Color Space, and CIELAB, CMC(2:1), CIE2000 Color Difference Formulas
- Color Difference in Color Quality Control
- Objective Assessment of color fastness of testing

- Kubelka-Munk Theory
- Color Matching Basic for Textile, Pigment, Plastic, and Ink

- Color Communication
- Physical color vs. Digital Color
- Global Color Supply Chain

- Lab Report and Presentation

IX. Instructional Methods

Describe the type(s) of method(s) that are required or recommended for the instruction of this course (lectures, demonstrations, etc.). Include any method that is essential to the course, such as the use of particular tools or software.

Instructional Methods*

The Lab class will involve using the lab facilities for testing and experiments. Lab demonstrations, iundividual and small group activities, experiential learning, instructional videos, interactive simulations.

X. Evaluation of Outcomes

Describe the methods to be used toevaluate students' learning, i.e. written exams, term papers, projects, participation, quizzes, attendance, etc.*

- Labs Assignments, Class Presentations & Reports 70%
- Presentation and Final Lab NoteBook 25%
- Reflective Writing 5%

Laboratory exercises provide the learner with the opportunity to apply theory with practice. Students will be exposed to scientific color equipment and practices to reinforce material learned.

Describe the required meaningful writing assignments tobe included. *

Weekly Lab Reports, a Lab Note book, and Lab presentations will be used to evaluate student learning outcomes. Laboratory tests and experiments provide the learner with the opportunity to apply theory with practice. For example, students will measure reflectance data of several paired colored samples first, and then calculate the overall color difference based on the CIELAB equations. The calculated color difference data will be used to compare against the visual color difference of those paired color samples. This is a way to let students understand the relationship between visual color difference and instrumental color difference.

Students Lab reports will demonstrate their learning relating to lecture material and hands on experience. Students are expected to use the lecture material to describe what they carryout in the lab. Students will be exposed to color equipment and practices to reinforce material learned. Each student will prepare and submit a final lab report and give a 5-10 minute oral presentation based on their final report. Students will also write a reflective paper on their learning experiences in the class.

Discuss how these methods may be used to address the course and

Course Learning Outcomes /	Explain the color perception	Apply the principles of color	Utilize appropriate color	Demonstrate color measurement,	Demonstrate selection and	Utilize system to

program outcomes, as appropriate. Include or attach a matrix to align the evaluation methods to the outcomes.*

GE Outcomes	process.	theory and color application.	specification methods for communication and quality control.	shade matching, and color quality analysis through the use of specialized software.	application of appropriate coloration techniques based on colorants, materials, and end-uses	manag colo digital in an industr contex
1a – Write effectively				X		
1b - Speak effectively to various audiences	X	X				X
1c - Find, evaluate, use, and share information effectively and ethically			X			
1d - Construct arguments based on sound evidence and reasoning to support an opinion or conclusion			X		X	
1e Apply and communicate quantitative arguments using equations and graphical representations of data.		X		X		
2a - Apply scientific methods and models to draw quantitative and qualitative conclusions		X		X	X	

about the physical and natural world.						
2d - Integrate concepts, examples, and theories from more than one discipline to identify problems, construct original ideas, and draw conclusions				X		X

If this is a general education course, discuss how these methods may be used to address the associated GE Learning Outcomes listed below. Include or attach a matrix to align the evaluation methods to the outcomes.*

OUTCOMES	**1. Laboratory Assignments & Reports**	**2. Final Report &**
I. Acquire foundational skills and capacities.		
a. Write and speak effectively to various audiences.	X	X
b. Locate, evaluate, and responsibly use and share data employing information and communication technologies.	X	X
c. Construct arguments based on sound evidence and reasoning to support an opinion or conclusion.	X	X
d. Apply and communicate quantitative arguments using tables, graphs, and equations.	X	X
1e. Apply and communicate quantitative arguments using equations and graphical representations of data.	X	X
II. Develop an understanding of various branches of knowledge and their interrel		
a. Apply scientific methods and models to draw quantitative and qualitative conclusions about the physical and natural world.		X
d. Integrate concepts, examples, and theories from more than one discipline to identify problems, construct original ideas, and draw conclusions.	X	X

XI. Course/Department/College Specific Requirements (OPTIONAL)

Department/ College Required ECO Information (Optional)	

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AY Proposal Submitted	2018-2019
AY Proposal Implemented	
PS Academic Group	10-CAG
PS Academic Organization	460-AMM
Course Type	Apparel Merchandising and Management
Impact Report (for modified courses only)	☐ Attached

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Senate Referral Number	GE-007-189
Senate Report Number	