BIOL 502

California State University San Marcos • COURSE CHANGE(S) • FORM C-2

ORIGINATOR'S SECTION:		
1. College: ☐ CHABSS ☐ CoBA ☐ CoEHHS ☒ CSM	Desired Term and Year of Implementation (e.g., Fall 2008): Spring 2018	
2. Current Course abbreviation and Number: BIOL 502		

TYPE OF CHANGE(S). Check √ all that apply.

Course Number Change	☐	Delete Prerequisite	☐	Other Prerequisite Change	☐
Course Title Change	☐	Add Corequisite	☐	Grading Method Change	☐
Unit Value Change	☒	Delete Corequisite	☐	Mode of Instruction Change (C/S Number)	☒
Description Change	☒	Add Consent for Enrollment	☐	Consider for G.E. If yes, also fill out appropriate GE form.	☐
Add Prerequisite	☐	Delete Consent for Enrollment	☐	Cross-list	☐

Information in this section– both current and new – is required only for items checked (√) above.

CURRENT INFORMATION:	NEW INFORMATION:
	Course abbreviation and Number: BIOL 502
3. Title: **Population Genetics**	Title: *(Titles using jargon, slang, copyrighted names, trade names, or any non-essential punctuation may not be used.)* **Population Genetics**
4. Abbreviated Title for Banner *(no more than 25 characters):* **Population Genetics**	Abbreviated Title for PeopleSoft: *(no more than 25 characters, including spaces)* **Population Genetics**
5. Number of Units: **3**	Number of Units: **4**
6. Catalog Description: Patterns of the distribution of genes in populations with emphasis on quantitative genetics, gene frequency, selection and the effects of mutation on populations. Genetic mechanisms in evolution are considered. *Prerequisite: BIOL 352, or enrollment in the Biological Sciences graduate program.*	Catalog Description: ***(Not to exceed 80 words; language should conform to catalog copy. Please consult the catalog for models of style and format; include all necessary information regarding consent for enrollment, pre- and/or corequisites, repeated enrollment, crosslisting, as detailed below. Such information does not count toward the 80-word limit.)*** Study of how populations evolve in response to demography and natural selection, and understanding and interpreting genetic diversity and variation. Key concepts discussed include mutation, drift, neutral theory, migration, selection, structure and inbreeding. Lectures are complemented by an end-to-end laboratory, where students will work on a small-scale population genetics project, involving local flora and fauna. Techniques covered in lab include DNA extraction, quality control, PCR, genotyping, sequencing, bioinformatics using R to address questions about evolutionary history and genomic diversity. *Prerequisite: BIOL 352 with grade of C (2.0) or better, or enrollment in Master of Science in Biology program.*

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7. Mode of Instruction* (*See pages 17-23 at http://www.calstate.edu/cim/data-elem-dic/APDB-Transaction-DED-SectionV.pdf for definitions of the Course Classification Numbers*)

Type of Instruction	Number of Credit Units	Instructional Mode (Course Classification Number)
Lecture	3	C2
Activity		
Lab		

Type of Instruction	Number of Credit Units	Instructional Mode (Course Classification Number)
Lecture	3	C2
Activity		
Lab	1	C16

8. Grading Method:*	Grading Method:*
☒ Normal (N) *(Allows Letter Grade +/-, and Credit/No Credit)*	☒ Normal (N) *(Allows Letter Grade +/-, and Credit/No Credit)*

*If Originator is uncertain of this entry, please consult with Program Director/Chair.

CURRENT INFORMATION:	NEW INFORMATION:
☐ Normal Plus Report-in-Progress (NP) *(Allows Letter Grade +/-, Credit/No Credit, and Report-in-Progress)* ☐ Credit/No Credit Only (C) ☐ Credit/No Credit or Report-in-Progress Only (CP))	☐ Normal Plus Report-in-Progress (NP) *(Allows Letter Grade +/-, Credit/No Credit, and Report-in-Progress)* ☐ Credit/No Credit Only (C) ☐ Credit/No Credit or Report-in-Progress Only (CP))
9. If the NP or CP grading system was selected, please explain the need for this grade option.	
10. Course Requires Consent for Enrollment? ☐ Yes ☒ No ☐ Faculty ☐ Credential Analyst ☐ Dean ☐ Program/Department/Director/Chair	**Course Requires Consent for Enrollment?** ☐ Yes ☒ No ☐ Faculty ☐ Credential Analyst ☐ Dean ☐ Program/Department/Director/Chair
11. Course Can be Taken for Credit More than Once? ☐Yes ☒ No If yes, how many times (including first offering)	**Course Can be Taken for Credit More than Once?** ☐Yes ☒ No If yes, how many times (including first offering)
12. Is Course Cross Listed: ☐ Yes ☒ No If yes, indicate which course	**Is Course Cross-listed?** ☐ Yes ☒ No If yes, indicate which course and check "yes" in item #17 below.
13. Prerequisite(s): BIOL 352, or enrollment in the Biological Sciences Masters program	**Prerequisite(s):** BIOL 352, or enrollment in the Biological Sciences Masters program
14. Corequisite(s):	**Corequisite(s):**
15. Documentation attached: ☒ Syllabus ☐ Detailed Course Outline	

PROGRAM DIRECTOR/CHAIR - COLLEGE CURRICULUM COMMITTEE SECTION:
(Mandatory information – all items in this section must be completed.)

16. Does this course fulfill a requirement for any major (i.e. core course or elective for a major, majors in other departments, minors in other departments? ☒ **Yes** ☐ **No**
If yes, please specify:
Required for Biological Sciences major.

17. Does this course change impact other discipline(s)? ***(If there is any uncertainty as to whether a particular discipline is affected, check "yes" and obtain signature.)*** Check "yes" if the course is cross-listed. ☐ **Yes** ☒ **No**
If yes, obtain signature(s). Any objections should be stated in writing and attached to this form.

____ Discipline _____ Signature _____ Date _____Support _____Oppose

____ Discipline _____ Signature _____ Date _____Support _____Oppose

18. Reason(s) for changing this course:
Addition of this 1 credit lab complements the lecture course which is already offered, and help students understand concepts in population genetics better by working on a small-scale project with real data, generated by the class. Additionally, this lab will allow more hands-on time in learning bioinformatics and computer programming in R, which are vital to performing population genetic data analyses.

SIGNATURES : (COLLEGE LEVEL) :

Arun Sethuramam
1. Originator (Please Print) Date
10/5/17
2. Program Director/Chair Date
10/9/17
3. College Curriculum Committee Date
10/10/17
4. College Dean (or Designee) Date

(UNIVERSITY LEVEL)

5. UCC Committee Chair Date
6. Vice President for Academic Affairs (or Designee) Date
7. President (or Designee) Date

Tentative Syllabus
BIOL 502
Population Genetics
Spring 2018
California State University San Marcos
TR 4:00 PM – 5:15 PM
Markstein 305

Instructor: Dr. Arun Sethuraman
Pronounced: (*Uh-Roon Say-thu-Raa-mun*)

Office: SCI 2 125
Office phone: 750-8271
Office Hours: Monday 2 PM-4 PM, **or by appointment**
E-Mail: asethuraman@csusm.edu

Required Textbook: Principles of Population Genetics, 4th Edition by Daniel L. Hartl and Andrew G. Clark (Sinauer)
Additional lecture notes, readings will be posted on a regular basis on Cougar Courses.

Course Description:
BIOL 502 (4) Population Genetics
Detailed study of concepts, statistical theory, and applications of population genetics/genomics. Population genetics is the study of how populations evolve in response to demography and natural selection, and understanding and interpreting genetic diversity and variation. Key concepts that will be studied include measures of genetic variation, drift and the neutral theory, migration, selection, population structure and inbreeding. This lecture will be accompanied by a three hour/week end-to-end laboratory offering, where students will work on a small-scale population genetics project, involving local flora and fauna. Students will learn how to sample, extract DNA, control for quality, PCR-based microsatellite/SNP genotyping, genetic sequencing, and bioinformatics/population genetic data analyses using R and other commonly used software to address questions about evolutionary history and genomic diversity.
Three hours of lecture, three hours of lab per week. Prerequisite: BIOL 352 with grade of C (2.0) or better, or enrollment in Master of Science in Biology program.

Course Learning Outcomes (Lecture and Lab):
By the end of this laboratory course, every student should be able to:

1. Map out and perform a sequence end-to-end genetic data analyses to contextually address a biological question about a local species of flora/fauna.

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2. Understand the fundamental math/statistics behind population genetic data analyses.
3. Use corresponding population genetics software to analyze, interpret, and visualize population genetic data
4. Connect concepts learned across previous courses in ecology, genetics, statistics, and evolution with population genetics.

Assessments (Lecture and Lab):
Outcomes 1, 3: Incrementally prepared white-paper, addressing a biological question of the group's choice
Outcome 2: In-class problems, take-home assignments, midterm exams, final exam (all part of lecture course)
Outcome 4: In-class discussions, debates, class participation

Activities (Lecture and Lab):
Outcome 1: Students are expected (and required) to be team players – learn how to work in a group, teach each other concepts and theorems, work out problems and assignments, and effectively divide work assignments for each section of the white-paper.
Outcome 2: Practice problems at the back of the text, work out theorems/derivations, work in groups.
Outcome 3: Come to class, work on learning methods during dry-lab lab periods.
Outcome 4: Read assigned outside readings, do some out-of-textbook readings on applications of population genetics as required/assigned.

Course Grading:
There will be two midterm exams, and one final exam, each worth 100 points. The final exam will be comprehensive. All exams will be essay format, and will test your ability to (1) understand and assimilate theorems and mathematical derivations of population genetic problems, (2) apply these to real-life problems. 200 lab points will go towards a semester-wide white-paper writing effort (which if you put in sufficient effort, could be worked into a real publication). This paper will be an incremental effort, with weekly additions to analyses of assigned datasets. In week 1 of lab, students will be given a choice of local flora/fauna that they wish to study (besides being introduced to lab safety techniques, and introduction to DNA techniques). Students will then independently sample these plants/insects from around campus, or the local Southern California region. Starting Week 2, they will process their specimens (DNA extraction, quality control, PCR-based microsatellite or SNP genotyping reactions), which will then be sent off to the UC Riverside sequencing core facility for genotyping. Around week 4 of the course, students will form groups (~5 groups in the class) to identify a biological question they wish to address through genetic data analyses of their collated data – e.x. genomic diversity, evolutionary history, effective population sizes, migration rates, population structure, inbreeding rates, phylogeography, etc. The rest of the semester will be spent in incrementally collating results from concepts learned in each week, until the end of the semester, when the students will put together a

white-paper that describes their question, the dataset(s), data analyses, results, and discussion of their results. 50 points will be allocated (out of the 200) to a final presentation. Appropriate rubrics for grading the paper, presentation will be posted regularly. Students will be given feedback on their lab notebooks on a weekly/biweekly basis. These 200 points will be added to your lecture (BIOL 502 grade). Your overall grade will be guaranteed as:

A- with 90% of the points
B- with 80% of the points
C- with 70% of the points
D- with 60% of the points

There will be NO MAKEUP tests or labs given, without prior approval from me.

Lecture Schedule (Tentative):

		Chapters
Week 1 – 1/23-1/27	Introduction + Hardy-Weinberg Principle	1, 2
Week 2 – 1/30-2/3	Extensions of HWP + Linkage Disequilibrium	2
Week 3 – 2/6-2/10	Drift + Coalescence	3
Week 4 – 2/12-2/18	Mutation + Neutral Theory	4
Week 5 – 2/20-2/24	Review + Midterm 1	
Week 6 – 2/27-3/3	Selection	5
Week 7 – 3/6-3/10	Selection	5
Week 8 – 3/13-3/17	Inbreeding	6
Week 9 – 3/20-3/25	SPRING BREAK	
Week 10 – 3/27-3/31	Bring a question from fam/friends day + Lab day	
Week 11 – 4/3-4/7	Population Structure + Migration	6
Week 12 – 4/10-4/14	Review + Midterm 2	
Week 13 – 4/17-4/21	Molecular Population Genetics	7
Week 14 – 4/23-4/28	Population Genomics	9
Week 15 – 5/1-5/5	Human Population Genetics	10
Week 16 – 5/8-5/12	Review + Presentations	
Week 17 – 5/15-5/19	Final Exam	

Lab Schedule (Tentative):

Week 1 – 1/23-1/27 Lab safety, Introduction to DNA techniques
Week 2 – 1/30-2/3 Sample prep, tagging, DNA extraction
Week 3 – 2/6-2/10 Quality control, Gel Electrophoresis, Into to R 1
Week 4 – 2/12-2/18 PCR1 – 3 loci, Intro to R 2
Week 5 – 2/20-2/24 Gel electrophoresis, PCR2 – 3 loci, HWE/LD analyses in R
Week 6 – 2/27-3/3 Gel electrophoresis, Genotyping prep, Ne estimation in R
Week 7 – 3/6-3/10 Phylogeny in R/MEGA
Week 8 – 3/13-3/17 Inbreeding estimation in R
Week 9 – 3/20-3/25 SPRING BREAK
Week 10 – 3/27-3/31 R data analyses – Part 1

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Week 11 – 4/3-4/7 R data analyses – Part 2
Week 12 – 4/10-4/14 Selection analyses in R
Week 13 – 4/17-4/21 Data visualization in R
Week 14 – 4/23-4/28 Population genomics analyses in R
Week 15 – 5/1-5/5 Population genomics analyses in R – contd.
Week 16 – 5/8-5/12 Final presentations

Credit Hour Policy Statement:
For the lecture part of the class, each unit of credit corresponds to an "hour" of class-time and two hours of student learning outside of class. Therefore, just for the lecture portion of the class you should expect to spend 3 hours a week in class and 6 additional hours outside of class.

ADA Statement:
Student with disabilities who require reasonable accommodations must be approved for services by providing appropriate and recent documentation to the Office of Disabled Student Services (DSS). This office is located in Craven Hall 4300, and can be contacted by phone at (760) 750-4905 or by email sent to dss@csusm.edu. Students authorized by DSS to receive reasonable accommodations should meet with me during my office hours in order to ensure confidentiality.

All-University Writing Requirement:
Will be satisfied through the white-paper that will be due at the end of the semester.

Academic Honesty Statement:
Students will be expected to adhere to standards of academic honesty and integrity, as outlined in the Student Academic Honesty Policy. All assignments must be original work, clear and error-free. All ideas/material that are borrowed from other sources must have appropriate references to the original sources. Any quoted material should give credit to the source and be punctuated accordingly.

Academic Honesty and Integrity: Students are responsible for honest completion and representation of their work. Your course catalog details the ethical standards and penalties for infractions. There will be zero tolerance for infractions. If you believe there has been an infraction by someone in the class, please bring it to the instructor's attention. The instructor reserves the right to discipline any student for academic dishonesty, in accordance with the general rules and regulations of the university. Disciplinary action may include the lowering of grades and/or the assignment of a failing grade for an exam, assignment, or the class as a whole.

It is recommended that students be referred to the full Academic Honesty Policy at

http://www.csusm.edu/policies/active/documents/Academic_Honesty_Policy.html

The syllabus is tentative and is subject to change depending on how far we get each day. The problems will be due after we have discussed that topic. I will give you updates each week as to what problems will be due.

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