San José State University
Computer Science Department
CS/BIOL 123B Bioinformatics II, Sec 01, Spring 2026

Course and Contact Information

Instructor: Leonard Wesley

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Office Hours: Tuesdays 7:00AM – 9:00AM,
Zoom Link For Office Hours For Spring 2026
https://sjsu.zoom.us/j/82442818722?pwd=nwmaLCQzpwLaVqHDD6ay9t72tVPjbV.1
PASSCODE: 016303

Class Days/Time: Mondays and Wednesdays 7:30 AM – 8:45 AM

Classroom: MH 422

Modality: In Person

Prerequisites: Prerequisite: CS 123A.

Official SJSU Catalogue Course Description

Advanced Bioinformatics algorithms, tools, databases. Biological background; protein structure/function; sequencing technology; sequence identification; transcriptomics; metagenomics; CRISPR. Possible additional topics: functional genomics; protein networks; drug discovery; pathway analysis; immunoinformatics; analysis pipelines; machine learning applications. Project applying advanced approaches to real-world problems.

Expanded Course Description

The course investigates the main algorithms for solving computational problems in bioinformatics related to proteins, DNA and RNA. Methods will include HMMs, sequence and structure alignment, and comparative structure analysis to identify and classify protein folds. Students will be given programming and/or web-portal projects that provide practice with using bioinformatics related tools and algorithms.

Learning Outcomes

Upon successful completion of this course, students will:

1. SLO-1 PROTEINS: Have a basic understanding of structural and molecular basis of proteins. Become familiar with protein motifs, domains, DBs and how they can be used to solve bioinformatics problems.
2. SLO-2 COMPUTATIONAL ALGORITHMS: Know how to design, build, and implement sequence identification, sequencing, and HMMs work, and how they along with various web-based portals can be used to help carry out gene finding and protein fold analysis.
3. SLO-3 FUNCTIONAL GENOMICS: Become familiar with the methods of how to go forward from genes to phenotype, and from phenotype to gene within the context of disease identification and potential cures.
4. SLO-4 NGS & Single Cell Sequencing: Understand the principles and techniques of de novo and reference genome assembly to build a representation of the sequence or genome from which sequence reads were produced. learn how to perform SCS using SCAMPY and 10x datasets, and how to perform clustering, trajectory, and speed analysis diagnose diseases using SCS tools and techniques.

Each SLO above corresponds to a learning module that is described in the course calendar below. That is, there are four (4) learning modules that corresponds to each of the SLOs described above.

Required Texts/Readings

Jonathan Pevsner (2015) Bioinformatics and Functional Genomics, Third Edition, Wiley Blackwell ISBN: 978-1-118-58178-0

Other Optional Reading Material

Developing Bioinformatics Computer Skills, Cynthia Gibas and Per Jambeck, O'Reilly & associates. (A good book for beginners)

Introduction to Computational Biology: Maps, Sequences and Genomes, Michael S. Waterman, CRC Press. (A statistical oriented view of bioinformatics)

Bioinfromatics: A Practical Guide to the Analysis of Genes and Proteins, Andreas D. Baxecvanis and B.F. Francis Ouellette, John Wiley & Sons 2nd Ed. (Includes contributions from several authors providing a wide perspective)

Course Requirements and Assignments

Course Logistics

Students should expect to spend approximately nine (9) hours per week (on average) outside of the classroom preparing for and completing the assigned course work. This includes reading papers, viewing videos as appropriate, completing homework and programming exercises, and so forth. The amount of time that a student actually spends studying and completing course work will depend on individual skills and the time that the student actually allocates to the course. The nine (9) hours per week estimate is based on previous experiences of the instructor and students. So please plan and schedule accordingly.

Previously, some students have asked for special exceptions to policies and procedures for this course. An example includes asking the instructor for extra assignments or work to help improve a grade. Even if such a request is reasonable in the opinion of the instructor, no exception will be given to a student unless the same opportunity can be made available to the entire class, and does not constitute significant extra work on the part of students, instructors, graders and so forth. Students should have no concern that other students will receive special exceptions that will not be made available to the entire class.

NOTE: University policy (F69-24) states that "Students should attend all meetings of their classes, not only because they are responsible for material discussed therein, but because active participation is frequently essential to insure maximum benefit for all members of the class. Attendance per se shall not be used as a criterion for grading." However, attendance will be required in order to complete and submit many in-class exercises, quizzes, and exams. Should students miss or leave early from one or more classes, students are responsible for knowing and understanding any and all course subject matter, assignments, exercises, instructions and so forth that are presented or discussed during official scheduled class time.

Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/studying, or course related activities, including but not limited to internships, labs, and clinical practice. Other course structures will have equivalent workload expectations as described in the Syllabus.

Quizzes and Exams

There will be three quizzes, one midterm and a set of "topic final" projects, all of which will count toward a student's final grade as specified in the "Grades" section below. During quizzes and exams, communication with other individuals via any means is strictly prohibited without the express permission of the instructor. Violations will be met with the full impact of SJSU's academic integrity policy and procedures.

Projects

Topic final project topics will be described near the start of each topic in the course. Projects will involve applying the skills and knowledge learned in the course to the project. Projects in this course will be individual (not team) projects. Project scores will count toward the final grade as specified in the "Grades" section below.

In-Class Exercises

There will be four in-class exercises where groups of two to four will be formed to work on an assigned exercise. In-class participation is mandatory, and an attendance sign-up sheet will be passed around to verify participation. The assigned exercises are intended to reinforce learning and understanding of previous lecture, homework, and programming assignment subject matter by providing hands-on experience with completing the provided assignment. A supplement document named "In-Class Exercise Procedure.pdf" is available on Canvas in the "Course Procedures & Requirements" section on the course main Canvas landing page. The "In-Class Exercise Procedure.pdf" document describes the general organization of all in-class exercise assignments as well as the procedure for completing and submitting all in-class exercises. The "In-Class Exercise Procedure.pdf" document should be treated as part of the official Syllabus for this course.

Reading, Homework, Programming, Participation Assignments

Graded reading, homework, programming, class participation and brief course feedback assignments will be assigned frequently. For homework assignments, only one or two questions might be graded depending on the grading workload of the instructor. For non-programmer types (e.g., Biology. Biochemistry, Chemistry, … majors), comparable non-programming tasks will be assigned for "programming assignments." All graded assignments will count toward a student's final course grade. Programmer types (e.g., CS, Bioinformatics, Software Engineering, Data Science, … majors) must submit programming assignments as per specifications that are described in the "Programming Assignment Guidelines.pdf" document on Canvas.

Computational Resources

Students are required to make sure that they have access to sufficient UNIX, Windows, or Mac based computational resources (e.g., computers and software) to carryout assignments in the course. An attempt to offer the course in a classroom with sufficient

computation resources will be made by the department to support classroom instruction and demonstrations. However, students should be prepared to bring their portable laptops to class.

Questions and Regrade Requests

All questions about grading and re-grade requests must be presented to the instructor within two weeks from the date that graded assignments, exercises, and exams are returned to the class or by the last day of instruction for the semester (whichever is sooner). Assignments, quizzes, and exams will typically be returned (i.e., posted) to Canvas, or manually handed back in class. General questions about the topics covered in assignments, exams, exercises, programming assignments, and the course are permissible at any time.

Tentative course calendar of assignment due dates & exam dates:

(Please note that course calendar below, and its content is "subject to change with fair notice")

Week and Class Mtg #	**Tue**	**Thur**	**Module # & Name**	**TOPIC**	**Assignment** **See Canvas For Module & Weekly Assignment Details and Due Dates**
Week 1	1/26	1/28	#1 Proteins	**1/26:** Intro To Course: -Topics, learning objectives, course logistics, Instructor background - Syllabus **1/28:** - Protein context - Protein structure, motifs & domains	Learning Module #1

Week 2	2/2	2/4	#1 Proteins	**2/2:** - Protein structure, motifs & domains **2/4:** - Protein folding, domains, motifs	Learning Module #1
Week 3	2/9	2/11	#1 Proteins	**2/9:** - Protein folding, domains, motifs **2/11:** - Protein Analysis and DBs	Learning Module #1
Week 4	2/16	2/18	#1 Proteins	**2/16:** - Protein Analysis and DBs - Project Description **2/18:** Module #1 - **In-Class Exercise 1 Topics Covered Week 1 to Week 4**	Learning Module #1
Week 5	2/23	2/25	#2 Comp Algorithms	**2/23:** - Comp Alg Context - Comp Alg Proj Description - Genetic Algorithms **2/25:** - Sequencing	Learning Module #2 The deadline for students to Add or Drop classes via MySJSU with no petition is February 17 (per University Policy S22-6)
Week 6	2/24	2/26	#2 Comp Algorithms	**2/24:** - HMMs **2/26:** - **Quiz 1 (~35 mins): Covers Topics Week 1 thru Week 5** -	Learning Module #2

Week 7	3/2	3/4	#2 Comp Algorithms	**3/2:** - HMMs (cont.) **3/4:** - HMMs (cont.)	Learning Module #2
Week 8	3/9	3/11	#2 Comp Algorithms	**3/19:** - HMMs **3/11:** **In-Class Exercise 2** - **Topics Covered week 4 to week 6**	Learning Module #2
Week 9	3/16	3/18	#3 Functional Genomics	**3/16:** - Functional Genomics (FG) **3/18:** - **Midterm (Full period): Covers Topics Week 1 thru Week 8**	Learning Module #3
Week 10	3/23	3/25	#3 Functional Genomics	**3/23:** - FG: Forward & Backward **3/25:** - FG: Chip-Seq, Quality Assessment of Chip-Seq read datasets.	Learning Module #3
	3/30	**4/3**		**SPRING BREAK**	
Week 11	4/6	4/8	#3 Functional Genomics	**4/6:** - **In-Class Exercise 3 Covers Topics In Class Exercise 1 thru Week 6** **4/8:** - FG: Chip-Seq, Quality Assessment of Chip-Seq read datasets. Cont.	Learning Module #3

Week 12	4/13	4/15	#4 NGS & Single Cell Sequencing	**4/13:** - Team work on projects - Finish Functional Genomics & Protein Networks. (Recorded Lecture to be viewed offline) **4/15:** **Quiz 2 (~45 mins): Covers Topics Week 5 thru Week 11**	Learning Module #3
Week 13	4/20	4/22	#4 NGS & Single Cell Sequencing	**4/20:** - NGS technology landscape + overview. - NGS 1st gen to 4th gen. **4/22:** - NGS 1st gen to 4th gen. cont.	Learning Module #4
Week 14	4/27	4/29	#4 NGS & Single Cell Sequencing	**4/27:** - NGS 1st gen to 4th gen. - DeNovo Assembly **4/29:** - Single Cell Sequencing Technology	Learning Module #4
Week 15	5/4	5/6	#4 NGS & Single Cell Sequencing	**5/5:** - Single Cell Sequencing Technology **5/7:** **- In-Class Exercise 4 (Work on Projects, Q&A)**	Learning Module #4
Week 16	5/11	N/A	#4 NGS & Single Cell Sequencing	**5/11:** **Quiz 3 (~45 mins): Covers From Quiz 2 thru End Of Semester**	Learning Module #4
			Final Project Report and Code Due To Canvas Wednesday May 13, 2026 By 11:59PM No Final Exam. The Project Takes The Place Of The Final Exam		

SCHEDULE FOOTNOTES:
NONE AS OF SPRING 2026

Grades *

WRITTEN HOMEWORK (4 at 25 points each)	100 pts
QUIZZES (3 at 50pts each)	150 pts
MIDTERM	100 pts
IN-CLASS EXERCISES (4 at 50pts each)	200 pts
WEEKLY COURSE FEEDBACK (15 at 3.33pts each)	50 pts
TOPIC PROJECTS & CODE (4 at 50pts each)	200 pts
Total Course Points =	800 pts Total

* The total points for each category might change depending on the number of project teams and assignments. The instructor reserves the right to adjust, with sufficient advanced notice, the above point distributionby± 5 pts. Such adjustments might be based on the difficulty or simplicity of assignments or quizzes or exams.

Grading Percentage Breakdown		
Percent of Total Points	**Points**	**Letter Grade**
96.66%	≥ 773	A+
93.33%	≥ 747	A
90.00%	≥ 720	A-
86.66%	≥ 693	B+
83.33%	≥ 667	B
80.00%	≥ 640	B-
76.66%	≥ 613	C+
73.33%	≥ 587	C
70.00%	≥ 560	C-
66.66%	≥ 533	D+
63.33%	≥ 507	D
60.00%	≥ 480	D-
59.99%	< 773	F

(NOTE: Ranges might change if point totals change)

How To Calculate/Estimate Your Grade

If students would like to calculate their numeric grade percentage, the formula is as follows:

Numeric Grade Percentage =

$$\frac{Total\ points\ from\ assignments}{Total\ course\ points}\ x\ 100\%$$

There is no guarantee that grades will be curved. If so, it will typically be done at the end of the semester. The instructor is already aware that graduate students need to maintain an overall GPA of B or better. Just because a student NEEDS a particular grade doesn't mean that the instructor will automatically GIVE the student that grade. Students must EARN a passing grade based on submitted and evaluated course work.

Classroom Protocol:

When Off-Campus (e.g., via Zoom):

Students must make sure that their microphone is muted at all times unless instructed otherwise, e.g., to ask a question. Most of the time, interactions will be via Chat or responding to Polls.

During quizzes and exams, computer cameras MUST BE ON and the student visible at all times during the quiz or exam. Failure to have a working camera during exams will result in a minimum 50% reduction of the quiz or exam score.

When On Campus:

<THE OFFICIAL ASSIGNED CLASSROOM> is a dual-purpose room. It can be a regular lecture room or a computer laboratory. Please note that "or" in the last sentence is exclusive. In other words, SCI 311is never a lecture room AND a computer lab at the same time.

Lecture Mode: This is when *<THE OFFICIAL ASSIGNED CLASSROOM>* is used as a regular lecture room. Students are expected to listen and follow the Lecture. *<THE OFFICIAL ASSIGNED CLASSROOM>* can be a noisy room because of the large number of laptops/workstations and the server. Be considerate to your classmates and follow the Lecture. Do not use the computer (workstation) during lectures, and do not talk to your classmates during lectures. Do not open your laptops, or check email, web-chat, tweet, web-surf on the internet, and so forth. If you cannot follow these simple rules, please do not enroll in this class.

Lab Mode: This is when <BUILDING AND ROOM NUMBER>is used as a computer lab for in-class exercises, Canvas exams, and related assignments that involve the use of computers. Use the computers and share your ideas and solutions with your classmates except during exams or when otherwise instructed. For in-class exercises, the results of your work for that class session will need to be uploaded to an appropriate

Canvas assignment for review and possible grading. We shall alternate between the two modes. A typical class will begin with a short lecture (Lecture Mode) to describe the in-class exercise that will reinforce the assignment. This will be followed by a hands-on (Lab Mode). There will be a number of in-class exercises or hands-on-exercises. The purpose of the in-class exercises and hands-on exercises is to develop your understanding of the course lectures, homework assignments, videos, and e-materials.

Extra credit options, if available:

There are no pre-planned extra credit assignments in this course. However, homework assignments and exams might, on occasion, contain extra credit options/questions. At times, the instructor might announce and give extra credit exercises or assignments in class or as work to be completed outside of classroom instruction. There is no guarantee that such extra credit exercises or assignments will be offered to the class. If, in the opinion of the instructor, offering such extra credit options will be significantly advantageous to the learning process, they might be offered.

Late Assignment Submission

Late assignments will receive a 25% point deduction of a graded assignment for each 24hr period the submission is late. For example, if an assignment is worth 10 points, and the grade for the assignment is 8/10, and the assignment is submitted one day late, then the point deduction equals 2.5, and the final grade for the assignment is MAX(0, 8 – 2.5) = MAX(0, 5.5) = 5.5 .

Missed Assignments, In-Class Exercises, Quizzes, and Exams

A. QUIZZES:
   a. The grade for one missed quiz will be replaced with the average of the remaining two quizzes. The average is calculated as the sum of current quiz grades / the number of quizzes for the semester. For example, if quiz 1 = 85, quiz 2 = 95, and quiz 3 is missed, the quiz 3 grade will be replaced by (85+95)/3 = 60.
   b. More than one missed quiz will result in a course grade of incomplete provided the total missed points for the semester is less than 20% of the total course points.
   c. Or, provide acceptable documentation of the reason for missing the quiz and a makeup quiz will be provided.

B. MIDTERM:

a. The grade for a missed midterm exam will be 75% of the average score for quizzes, programming assignments, and homework assignments provided the total missed points for the semester is less than 20% of the total course points. Or, provide acceptable documentation of the reason for missing the midterm and a makeup exam will be provided.

C. HOMEWORK ASSIGNMENTS:
   a. The grade for one missed homework assignment will be replaced with the average of the remaining three homework assignments. The average is calculated as the sum of current homework grades / the number of homework assignments for the semester.
   b. The grade for the second missed homework assignments will be replaced with 75% of the average of the remaining homework assignments.
   c. More than two missed homework assignments will result in a grade of incomplete provided the total missed points for the semester is less than 20% of the total course points. An alternative is to accept zeros for the missed homework assignments, or if acceptable documentation of the reason for missing the homework assignments is provided, makeup assignments will be provided.

D. PROGRAMMING ASSIGNMENTS:
   a. The grade for one missed programming assignment will be replaced with 50% of the remaining programming assignment.
   b. Two missed programming assignments will result in a grade of incomplete provided the total missed points for the semester is less than 20% of the total course points. An alternative is to accept zeros for all missed programming assignments, or if acceptable documentation is provided, makeup assignments can be provided

E. IN-CLASS EXERCISES:
   a. The grade for one missed In-Class Exercise will be replaced with the average of the remaining three In-Class Exercises. The average is calculated as the sum of current in-class exercise grades / the number of in-class exercises for the semester.
   b. The grade for two missed In-Class Exercises will be replaced with 75% of the average of the remaining two In-Class Exercises.
   c. More than two missed In-Class Exercises will result in a grade of incomplete provided the total missed points for the semester is less than 20% of the total course points. An alternative is to accept zeros for all missed in-class exercises, or if acceptable documentation of the reason for missing the In-Class Exercises is provided, a makeup assignment can be provided.

F. WEEKLY FEEDBACK:
   a. All missed weekly feedback assignments will receive zero points.

G. FINAL PROJECT REPORT & CODE:
   a. The grade for a missed final project report and code will be 75% of the average of all other course assignments, exams, and quizzes provided the total missed points for all other assignments is less than 5% of the total course points.
   b. If the total missed points for all other assignments is more than 5% but less than 20% of the total course points, a grade of incomplete will be given.

H. TOTAL MISSED POINTS MORE THAN 20% BUT LESS THAN 30% OF TOTAL COURSE POINTS AND TOTAL MISSED POINTS MORE THAN 30%.
   a. **Missed between 20% and 30% of total course points:** A course grade that equal to (100% - <missed points %>) * Average of remaining assignments, quizzes, exams, and programming assignments.
   b. **Missed more than 30% of total course points:** If the percentage of total missed points is greater than 30%, a course grade that is the result of assigning a zero grade for all missed assignments will be assigned. An alternative grade or options can be discussed with the instructor.

Receiving An Incomplete (I) Grade

Receiving a grade of Incomplete (I) is not automatic. Students must complete at least 80% of course assignments by the end of the semester to be eligible to receive a grade of incomplete. Students must also provide documentation to support the reason for the request to receive an Incomplete grade. The instructor has the final decision to give an Incomplete grade. If the instructor agrees to give a student an Incomplete grade, the instructor will enter the remaining work to be completed as part of the PeopleSoft grade submission process.

Grade Change Policy

It is a university policy (S09-7) that "A change of grade request must be submitted by the department office directly to the Office of the Registrar in a timely fashion. Normally, such requests must be received by the drop deadline of the following Spring or Spring semester … Requests for exceptions to this policy must be accompanied with a documented and compelling reason. …"

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/. Make sure to review these policies and resources.