

**San José State University**  
**College of Social Sciences/Department of Economics**  
**ECON 138, Business and Economic Forecasting, Section 1, Fall, 2022**

**Course and Contact Information**

Instructor(s): Rui Liu

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Office Hours: W 5-6 pm at DMH 143; Th 12-1 pm via Zoom (click [here](#) to make an appointment)

Class Days/Time: Wednesday 6-8:45 pm

Classroom: DMH 161

Prerequisites: ECON 1A, ECON 1B and a semester of statistics.

**Course Description (Required - Delete the word “Required” in final draft)**

*The purpose of this course is to introduce an array of methods and practices for analyzing time-series data and generating statistical forecasts. This will be accomplished through a mix of theoretical discussions and software-based applications to real-world problems.*

**Course Format**

**Technology Intensive, Hybrid, and Online Courses (Required if applicable)**

*Each class session will include a brief lecture followed by hands-on laboratory work. During lectures, the instructor will cover forecasting concepts and provide demonstrations to facilitate understanding of these concepts. Students will then participate in laboratory exercises to gain hands-on experience of concepts covered in lecture. As such, regular attendance and active participation in lab activities is essential for learning and succeeding in the course. Students should bring a laptop to class for use in laboratory exercises, but owning a laptop is not a requirement for taking this course – please see below for loan/rental options. Students will be assessed via homework problems, quizzes, and a final project.*

*Given that the format and content of this course is quite different than that of typical economics courses, it is especially important that you stay on top of your homework and regularly practice your new skills. Unlike many of your other courses, this is not a course in which you can cram at the last minute! Should you miss a class, it is extremely important to find out what you missed—preferably by contacting one of your fellow students—and to practice lab activities on your own. Being proactive about seeking help is similarly important in achieving a successful outcome. Please ask questions when you don't understand information in lecture, laboratory activities, or readings -- asking questions and offering ideas is welcomed and encouraged!*

**Course Learning Outcomes (CLO)**

Upon successful completion of this course, students will be able to:

1. *explain a variety of statistical model and filtering tools for time series and identify correct methods to analyze these models.*
2. *analyze any time series data using various statistical approaches (e.g, exponential smoothing, ARIMA, and linear regression).*
3. *generate reasonable forecast values in R.*
4. *interpret the results and create a reproducible report using RStudio and R Markdown.*

## **Required Texts/Readings (Required - Delete the word “Required” in final draft)**

### **Textbook**

*Hyndman, R.J., & Athanasopoulos, G. (2021) Forecasting: principles and practice, 3rd edition, OTexts: Melbourne, Australia. [OTexts.com/fpp3](https://otexts.com/fpp3).*

*Shmueli, G., & K. C. Lichtendahl, Jr. (2016) Practical Time Series Forecasting with R: A Hands-On Guide, 2nd edition, Axelrod Schnall. ISBN-10: 0997847913*

*Grolemund, G., & Wickham, H. (2017). R for Data Science. O’Reilly Media. <https://r4ds.had.co.nz/index.html>.*

### **Other technology requirements / equipment / material**

*As noted above, to participate in in-class lab activities, you will need to use a laptop. If you do not own a laptop, several options are available to you. First, for in-class lab activities, we will be doing pair programming, which refers to programming with a partner and regularly switching who is the “driver” and who is the “navigator”. As such, an excellent option for students without a laptop is to simply pair with a classmate who does own a laptop – something which can worked out during the first week of class. Second, if you prefer to work with your own laptop, you can rent one from library as detailed below. Finally, for completing homework assignments, studying for quizzes, and working on your final project, you may use SEEL Econ lab located at CCB 100, as detailed below.*

#### *Renting laptops*

*Laptops can be borrowed from the library for free for relatively short periods of time. Unfortunately, this option is rather tedious in that you would need to install R and other relevant software each time you borrowed a laptop. A better, long-term solution would be to rent a laptop through SJSU IT IMS Equipment Loaning Program, which allows for rentals by the week as well as by the semester. Please see the ITS website for more details at <https://sjsuequipment.getconnect2.com/>.*

#### *Computer labs*

*Most computer labs on campus will not have the necessary software installed that is required for this class. As such, please use the following computer lab in Central Classroom Building (across from Clark Hall) which is well-equipped for our needs: CCB 100.*

## **Course Requirements and Assignments**

During this course, you will be required to participate in class and to complete the following: homework, quizzes, and a final project (see details below in “Grading Information” and “Schedule”). Students will use the RStudio environment for programming activities, assignments, and projects.

“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 practica. Other course structures will have equivalent workload expectations as described in the syllabus.”

### Homework (30%)

Throughout the semester, you will be required to complete weekly homework assignments (13 total assignments) in R Markdown. No late homework assignments will be accepted, but I will allow each student to drop their three lowest homework scores, such that the remaining 10 assignments count 3% each. Homework assignments will be checked for plagiarism, and assignments that demonstrate plagiarism will receive a score of zero. See Canvas for further details on submitting homework assignments.

### Quizzes (50%)

Seven quizzes will test your conceptual knowledge from lecture and assigned readings, as well as your programming skills practiced via laboratory activities and homework assignments. Two of your lowest quiz scores will be dropped, such that the remaining five quizzes count 10% each. Please note that no makeup quizzes will be given except in emergency situations in which documentation is provided by an independent authority (e.g., a doctor’s note).

### Final project (20%)

The culminating assignment for this course is a final project of your choosing. You will work in groups of 1-2 students on a project that applies R to a forecasting question of your choice. This assignment will be discussed in greater detail later in the semester.

### Extra credit

You will have two opportunities to receive extra credit (0.5 point each) in this class. First, you will receive extra credit if schedule a 30-minute appointment with a career counselor by logging into Spartan Connect > Appointments, Drop-ins, and Workshops & Events. Second, you may book an appointment via [this link](#) with a Speech Coach peer tutor who offers free, non-judgmental, supportive public speaking tutoring to students.

## Grading Information

| <i>Grade</i>   | <i>Percentage</i> |
|----------------|-------------------|
| <i>A plus</i>  | <i>96 to 100%</i> |
| <i>A</i>       | <i>93 to 95%</i>  |
| <i>A minus</i> | <i>90 to 92%</i>  |
| <i>B plus</i>  | <i>86 to 89 %</i> |
| <i>B</i>       | <i>83 to 85%</i>  |
| <i>B minus</i> | <i>80 to 82%</i>  |

|                |                  |
|----------------|------------------|
| <i>C plus</i>  | <i>76 to 79%</i> |
| <i>C</i>       | <i>73 to 75%</i> |
| <i>C minus</i> | <i>70 to 72%</i> |
| <i>D plus</i>  | <i>66 to 69%</i> |
| <i>D</i>       | <i>63 to 65%</i> |
| <i>D minus</i> | <i>60 to 62%</i> |

### **University Policies**

Per [University Policy S16-9](#), relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on [Syllabus Information web page](#) (<https://www.sjsu.edu/curriculum/courses/syllabus-info.php>). Make sure to visit this page to review and be aware of these university policies and resources.

# Econ 138 / Business and Economic Forecasting, Fall 2022, Course Schedule

## Course Schedule

| Week | Date   | Topics   | Notes (Readings, Assignments, Deadlines)<br>(Delete if not applicable)   |
|------|--------|--|--|
| 1    | Aug 24 | Course Overview, Intro to R and RStudio, R Markdown, Loading Data, Data Wrangling, | Readings: <ul style="list-style-type: none"> <li>Syllabus and other course materials</li> <li>Grolemund &amp; Wickham – ch 1-8 &amp; 27</li> </ul> Assignments: <ul style="list-style-type: none"> <li>Install R and RStudio on your computer</li> <li>HW 1</li> </ul> |
| 2    | Aug 31 | Data Wrangling, Data Visualization, Pipes, Time Series Plots                       | Readings: <ul style="list-style-type: none"> <li>Grolemund &amp; Wickham – ch 1-8 &amp; 27</li> </ul> Assignments: <ul style="list-style-type: none"> <li>HW 2</li> </ul>  |
| 3    | Sep 7  | Getting Started with Forecasting, Time Series Graphics                             | Readings: <ul style="list-style-type: none"> <li>Hyndman &amp; Athanasopoulos – ch 1&amp;2</li> <li>Cowpertwait &amp; Metcalfe – ch 1</li> </ul> Assignments: <ul style="list-style-type: none"> <li>Quiz 1</li> <li>HW 3</li> </ul>                                   |
| 4    | Sep 14 | Time Series Decomposition  | Readings: <ul style="list-style-type: none"> <li>Hyndman &amp; Athanasopoulos – ch 3</li> <li>Cowpertwait &amp; Metcalfe – ch 3</li> </ul> Assignments: <ul style="list-style-type: none"> <li>HW 4</li> </ul>   |
| 5    | Sep 21 | Time Series Features   | Readings: <ul style="list-style-type: none"> <li>Hyndman &amp; Athanasopoulos – ch 4</li> <li>Cowpertwait &amp; Metcalfe – ch 4</li> </ul> Assignments: <ul style="list-style-type: none"> <li>Quiz 2</li> <li>HW 5</li> </ul>   |
| 6    | Sep 28 | The Forecaster's Toolbox   | Readings: <ul style="list-style-type: none"> <li>Hyndman &amp; Athanasopoulos – ch 5</li> <li>Cowpertwait &amp; Metcalfe – ch 4</li> </ul> Assignments: <ul style="list-style-type: none"> <li>HW 6</li> </ul>   |
| 7    | Oct 5  | Time Series Regression Models  | Readings: <ul style="list-style-type: none"> <li>Hyndman &amp; Athanasopoulos – ch 7</li> </ul>  |

|       |        |   |  |
|-------|--------|---|--|
|       |        |   | <ul style="list-style-type: none"> <li>• Cowpertwait &amp; Metcalfe – ch 5</li> </ul> Assignments: <ul style="list-style-type: none"> <li>• Quiz 3</li> <li>• HW 7</li> </ul>  |
| 8     | Oct 12 | Exponential Smoothing                               | Readings: <ul style="list-style-type: none"> <li>• Hyndman &amp; Athanasopoulos – ch 8</li> <li>• Cowpertwait &amp; Metcalfe – ch 3</li> </ul> Assignments: <ul style="list-style-type: none"> <li>• HW 8</li> </ul>                   |
| 9     | Oct 19 | ARIMA Models  | Readings: <ul style="list-style-type: none"> <li>• Hyndman &amp; Athanasopoulos – ch 9</li> <li>• Cowpertwait &amp; Metcalfe – ch 6</li> </ul> Assignments: <ul style="list-style-type: none"> <li>• Quiz 4</li> <li>• HW 9</li> </ul> |
| 10    | Oct 26 | Dynamic Regression Models                           | Readings: <ul style="list-style-type: none"> <li>• Hyndman &amp; Athanasopoulos – ch 10</li> <li>• Cowpertwait &amp; Metcalfe – ch 5</li> </ul> Assignments: <ul style="list-style-type: none"> <li>• HW 10</li> </ul>                 |
| 11    | Nov 2  | Case Studies, Intro to Advanced Forecasting Methods | Readings: <ul style="list-style-type: none"> <li>• Hyndman &amp; Athanasopoulos – ch 12</li> </ul> Assignments: <ul style="list-style-type: none"> <li>• Quiz 5</li> <li>• HW 11</li> </ul>  |
| 12    | Nov 9  | Prophet Model                                       | Readings: <ul style="list-style-type: none"> <li>• Hyndman &amp; Athanasopoulos – ch 12</li> </ul> Assignments: <ul style="list-style-type: none"> <li>• HW 12</li> </ul>  |
| 13    | Nov 16 | Neural Networks                                     | Readings: <ul style="list-style-type: none"> <li>• Hyndman &amp; Athanasopoulos – ch 12</li> </ul> Assignments: <ul style="list-style-type: none"> <li>• Quiz 6</li> <li>• HW 13</li> </ul>  |
| 14    | Nov 23 | No class  |  |
| 15    | Nov 30 | Case Studies  | Assignments: <ul style="list-style-type: none"> <li>• Quiz 7</li> <li>• HW 14</li> </ul>   |
| Final | Dec 14 | DMH 161 and 5:15-7:30                               | Assignments:   |

|      |  |    |  |
|------|--|----|--|
| Exam |  | PM | <ul style="list-style-type: none"><li>• Final project</li><li>• Presentation</li></ul> |
|------|--|----|--|