**RES 210 Advanced STEM Research**

4 Credits

Instructor Contact Information Here



Permission of instructor required.

Prerequisite: Satisfactory completion of RES 110

Available for year-long course of study through the Dual Enrollment Program only.

**Course Catalog Description**: This is the third in a three-course scientific research sequence. The final course continues the work undertaken in RES 110 with an emphasis on the completion of experiments and the communication of results in consultation with mentors. All data collected must be entered in the scientific notebook. All experiments performed should be repeated at least once to ensure repeatability of your data. Upon the experiment's completion, students will perform qualitative and quantitative data analyses which must be analyzed for reliability. Application of appropriate statistical evaluation can be used to support reliability. Student research is expected to be presented at a minimum of two science fair competitions. A final research paper will be written in APA style and submitted for peer review (National High School Journal of Science). Students are expected to spend at least three hours per week outside of class. The final part of the course will be a reflective essay on the research experience.

**Course Objectives**: By the end of this course, students should be able to:

* Demonstrate **Quantitative Literacy** by drawing appropriate conclusions based on quantitative analysis of their experimental data, while also recognizing the limits of their analysis.
* Demonstrate **Critical Thinking** by formulating judgments and drawing conclusions based on verifiable data and their ability to synthesize ideas or arguments in a way that allows an issue to be evaluated.
* Apply C**ritical Thinking** while conducting experiments, and choosing and implementing statistical methods
* Demonstrate **Ethical Reasoning** by identifying how their research question could affect other individuals, the environment, and the world.
* Demonstrate **Communication** skills by presenting evaluations of research articles pertaining to their research, and by presenting research outcomes visually by creating a scientific poster and orally at a public symposium
* **Communicate** findings by writing a scientific research paper for peer review (National High School Journal of Science)

**High Impact Practices:**

\*Students will engage in undergraduate level research throughout the course, which is a high-impact practice.

**Alignment of assignments with learning outcomes**

|  |  |
| --- | --- |
| Learning Outcome | Assignments |
| Demonstrate **Quantitative Literacy** by drawing appropriate conclusions based on quantitative analysis of their experimental data, while also recognizing the limits of their analysis. | ***Scientific Notebook***  **Midterm (Data Collection and Analyses)**  Final - ***Research Paper and Presentation*** |
| Demonstrate **Critical Thinking** by formulating judgments and drawing conclusions based on verifiable data and their ability to synthesize ideas or arguments in a way that allows an issue to be evaluated. | ***Scientific Notebook***  **Reviews of Research Presentation**  **Midterm (Data Collection and Analyses)**  Final - ***Research Paper and Presentation*** |
| Apply C**ritical Thinking** while conducting experiments, and choosing and implementing statistical methods | ***Scientific Notebook***  **Midterm (Data Collection and Analyses)** |
| Demonstrate **Ethical Reasoning** by identifying how their research question could affect other individuals, the environment, and the world | ***Scientific Notebook***  Final - ***Research Paper and Presentation*** |
| Demonstrate **Communication** skills by presenting evaluations of research articles pertaining to their research, and by presenting research outcomes visually by creating a scientific poster and orally at a public symposium | **Reviews of Research Presentation**  Final - ***Research Paper and Presentation*** |
| **Communicate** findings by writing a scientific research paper for peer review (National High School Journal of Science) | Final - ***Research Paper and Presentation*** |

**Required Text and References**

* Dawson, C., 2019. Introduction to Research Methods. 5th edition
* Kumar, R. 2014. Research Methodology: a step-by-step guide for beginners. 4th edition. Sage.
* Publication Manual of the American Psychological Association, Seventh Edition (2020)

Methods of Assessment:

* ***Scientific Notebook***: Time logs chronicling approximately 8 hours of research every 2 weeks. Annotations of research must be in a scientific notebook.
* ***Biweekly assessments***: Conference with instructor every two weeks to discuss goals and review research progress (20 per year)
* ***Exams:*** 
  + Mid-term - **Data Collection and Analyses** paper that details analysis and statistics of results with discussions. **Midterm:** All data collected must be entered in the scientific notebook. All experiments performed should be repeated at least once to ensure repeatability of your data. Upon the experiment's completion, students will perform appropriate qualitative and/or quantitative data analyses which must be analyzed for reliability. Application of appropriate statistical evaluation can be used to support reliability.
  + Final - ***Research Paper and Presentation:*** A primary activity for this course is the completion of an APA style research paper for an independent research project. The paper includes all the major sections of an APA-style scientific article, copies of all instruments and links to all cited reference articles. This submission must include: 1) an electronic copy of your article (including Title page, Abstract, Introduction, Literature Review, Methodology, Analyses, Results, Discussion, Conclusion, and References), 2) all appendices (including your measures, informed consent form, debriefing form, etc.). The final research paper will be submitted for peer review (National High School Journal of Science).
* **Reflective Essay on Research Experience:**

***Attendance***: Attendance will be taken and is part of your Class Participation grade. Students need to document about 3 hours of work each week for class time. They will also submit reviews of presentations made during class.

***Class Participation*:** You can earn up to 50 points for participation.

* *40-50 points*: Attended almost every class. Student asked and answered questions, submitted all assignments on time, demonstrated knowledge of materials, participated actively in exercises, and attended office hours with regularity.
* *25-39 points*: Attended about two thirds of in-class and online meetings, student asked and answered some questions including chat, demonstrated some knowledge of materials, participated in exercises, and attended a few office hours.
* *0-24 points*: Student attended class intermittently, did not participate by asking and answering questions including chat, and/or did not participate in demonstrating knowledge of materials, did not participate actively in exercises, and did not attend office hours.

Therefore, there are a possible *1000 points* for the course:  Grades for this course will be determined as follows:

|  |  |
| --- | --- |
| **Assignments** | **Total Points** |
| Scientific Notebook | 150 |
| Homework | 200 |
| Biweekly assessment | 300 |
| Midterm (Data Analyses) | 150 |
| Final exam (Scientific paper) | 150 |
| Class Participation | 50 |

Grades for this course will be determined as follows:

* A = 93-100%
* A- = 90-92%
* B+ = 87-89%
* B = 83-86%
* B- = 80-82%
* C+ = 77-79%
* C = 73-76%
* C- = 70-72%
* D+ = 67-69%
* D = 60-66%
* F = Below 60%

**Course outline for SCI 210** (Analysis of data and writing research paper)

This course is divided into 6 parts.

Part 1: Plagiarism and bias

Part 2: Ethical code

Part 3: Processing and displaying data

Part 4: Entering Science Fairs and competitions

Part 5: Writing a Research Paper

Part 6: Reflection Paper

|  |  |
| --- | --- |
| Week # | Topic |
| 1 | Plagiarism and Bias review  Check Science Fair application deadlines |
| 2 | Ethics:  The misuse of information  Inappropriate use of information |
| 3-8 | Complete gathering experimental data |
| 9 | Review data collected  Check for consistency, accuracy and precision of scales |
| 10 | Submit applications to Science Fairs |
| 10-13 | Displaying your data  Frequency distributions (graphs)  Cross tabulations (relationship between dependent and independent variables) |
| 14 | Identify trends, outliers, or inaccuracies in data |
| 15 | Apply appropriate statistical analysis to validify your results |
| 16-20 | Discuss results with Mentor |
| 21-22 | Midterm project |
| 23-27 | Create PowerPoint of research  Create Scientific poster of research  Practice presentation of research |
| 28-30 | Competitions |
| 31-38 | Write a formal research paper and submit for peer review |
| 35-40 | Help organize school science symposium |
| 41 | Write reflective paper on your research experience |
| 42 | Present PowerPoint of research at Science Symposium |

**Assessment Rubrics**

**Science Research Biweekly Assessment**

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Scoring Key:

A = outstanding work B = adequate work C = less than adequate D = dismal F = not there

NA = not applicable to this assessment

During this evaluation, did the student:

1. Document an appropriate amount of research for articles/information/people supported by documentation?

A B C D F NA

1. Achieve appropriate advancement in reading journals that are clearly annotated and summarized?

A B C D F NA

1. Effectively use their time both in class and out of class as evidenced by their time log?

A B C D F NA

1. Demonstrate respect for others in the classroom, displaying an exemplary and helpful attitude towards the research classroom?

A B C D F NA

1. Meet all deadlines and goals set at the end of the last assessment?

A B C D F NA

1. Statistically give a PowerPoint or poster presentation or complete a required paper?

A B C D F NA

1. Demonstrate independence, self-motivation, enthusiasm and timeliness to forward their progress in their research efforts?

A B C D F NA

1. Communicate with teacher, mentor or other appropriate professional promptly with documentation?

A B C D F NA

**Missing an assessment is an automatic zero unless there is an unforeseen legal absence. It is the students responsible for rescheduling the assessment ASAP. If a student needs to reschedule an assessment due to unforeseen circumstances, notification must be at least 24 hours in advance. It is up to the evaluator to decide how or when to reschedule based on the circumstances. Failure to reschedule the assessment ASAP could result in a missed assessment.**

Overall grade for this assessment: \_\_\_\_\_\_\_\_\_\_

Date: \_\_\_\_\_\_\_\_\_\_\_

Student’s signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Teacher’s signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Rubric for completing SCIENCE RESEARCH PAPER**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | PASS | | FAIL | |
| Title | Clearly states what the research is focused on and captures attention of reader | States the focus of the research but may not capture readers attention | Focus of research is a bit ambiguous and fairs to attract readers attention | Title is too general and does not identify the focus of the research |
| Abstract | Clearly and concisely states the goals, results and main conclusion of the study | States the objectives of the study, the approach used and the outcomes | Ambiguous about what is being studied and what can be concluded from the study | Missing or too brief. |
| Introduction | Clearly states how this study fits into the progression of study citing relevant past research and what still needs to be studied. | Somewhat clear as to how this study fits in with past research (too much or too little information given); some idea as to why the new study is needed | Scattered ideas about what was studied in the past that leads to the new research; limited idea as to why the study is warranted | Missing, past studies don’t really relate to new study, no evidence why this study is needed. |
| Hypothesis | Very well thought out and logical based on introduction | Clear and based on information from the introduction | Confusing/poorly worded | Missing or badly worded |
| Methods | Detailed list of biological agents/chemical concentrations (along with sources), equipment used, experiment set-up along with diagrams, thorough description of all steps involved (and maybe why), all safety precautions involved, and how outcomes were measured and recorded | Good description of the methods used but missing a few elements | Materials and equipment used were not well listed or all there, the steps taken were not well described so could not be exactly reproduced, missing some elements. | Missing or very brief, confusing to follow, no clear idea on how to measure any of the outcomes. |
| Results | Clearly explains how the hypothesis is connected to the methods used and identifies the dependent and independent variables. Relevant information is summarized from figures /tables/graphs. Do the results support the hypothesis? Problems that arose? Critical analysis of own work. | Connects hypothesis to methods used and identifies all variables. Information in figures/tables/  graphs is summarized but lack details. No explanation of any problems or issues involved. Some critical analysis of work | Attempts to connect hypothesis and methods, and/or incorrectly identifies some variables. Fails to explain figures/ tables/ graphs, and ignored explanations of problems or issues. | Missing or very confusing, experiment steps cannot be replicated. |
| Discussion / Conclusion | Successfully links the experiments completed in the study with the hypothesis statement. Logical connections of trends that appear in the data are discussed and good statistical evidence on data reliability. Excellent discussion of the impact of experiments on current knowledge and what may need to be done in future studies. | Good attempt to link results with the hypothesis and to clarify connectiveness of study to past research. Some discussion on trends that appear in the data and statistical support on its reliability. Good discussion on how this research impacts the field and what must be done in the future. | Mostly repeating the experiment results. Contrived connection to hypothesis or how this experiment impacts current knowledge. No reliability of data discussed. No idea what should be done moving forward. | No attempt to link experiment to hypothesis or current knowledge. Nothing on data reliability. Ignored what needs to be done in the future. |
| References | Excellent variety and extensive, correct formatting, most research articles are within the past decade. | Good variety and breadth, correct formatting, most research articles are within the past decade. | Limited variety and breadth, some errors in formatting, many research articles are beyond the past decade. | Missing or very limited search was done, incorrect formatting, not many current research articles were used. |
| Writing skills | Concise, consistent, correct use of abbreviations, good grammar and no use of slang and free of spelling errors, well organized and good formatting, all citations are correctly done. | Mostly concise, correct use of abbreviations, few grammatical and spelling errors, good organization and formatting, most citations are correctly done. | Inconsistent, incorrect use of abbreviations, many spelling and/or grammatical errors, organization and formatting is problematic, citations are not always correct. | Writing is too lengthy, many spelling and/or grammatical errors, poorly organized and formatted, citations are either missing or incorrectly done. |
| Presentation skills | Excellent presentation and PowerPoint, appropriate dress, clear and well-articulated, no distracting movements, enthusiasm for work was evident, excellent at question-and-answer session. | Good presentation and PowerPoint, appropriate dress, mostly clear and well-articulated, some distracting movements, enthusiasm for work was evident, good at question-and-answer session. | Adequate presentation and PowerPoint, somewhat appropriate dress, inconsistent clarity and articulation, some distracting movements, enthusiasm for work was not always evident, question-and-answer session could be better. | Poor presentation and PowerPoint, inappropriate dress, poor volume, distracting movements or hesitating pauses, enthusiasm for work was not evident, poor question-and-answer session. |
| Reflection Paper | Excellent concise critical analysis of the whole research experience, thought provoking insight about the work completed and what was learned from the experience | Somewhat concise analysis of the research experience, with some insight into what was gained from the completed research project | Mostly descriptive with a little self-analysis of the research experience, some mention of what was gained personally from completing the research project | A summative description of what the research was about and little analysis about the research experience and its impact on self-development. |

**Accommodations for Students with Disabilities**

Eastern Connecticut State University is committed to following the requirements of the Americans with Disabilities Act (ADA) of 1990, the ADA Amendment Act of 2008, and Section 504 of the Rehabilitation Act of 1973, as amended in 1998. If you are a student with a disability (or think you might have a disability) and require accommodations or assistance evacuating a building in the case of an emergency, please contact the Office of AccessAbility Services (OAS) at 860-465-0189 to discuss your request further. Please note that accommodations are not retroactive and must be communicated through a Letter of Accommodation, which is drafted by the OAS. Please visit the Office of Accessibility Website at <https://www.easternct.edu/accessability/index.html> for more information on how to register with our office.

**Student Sexual Misconduct Policy**

Title IX of the Education Amendment of 1972, as well as the Board of Regents Policy on Sexual Misconduct Reporting, Support Services and Processes, prohibit acts of sexual misconduct – sexual harassment, sexual assault, sex-based discrimination, dating violence, domestic violence, stalking, and inappropriate relationships between employees and students.  If you or someone you know has been or experiences harassment or assault, resources are available within the Title IX Office and with the Sexual Assault & Interpersonal Violence Response Team (SAIV-RT).  Alleged violations should be reported to the Title IX Coordinator in the Office of Equity and Diversity at 860-465-5012.  Reports to law enforcement can be made to Eastern Connecticut State University Police Department at 860-465-5310.  To receive support and advocacy, please contact the Co-Chair of the Sexual Assault & Interpersonal Violence Response Team (SAIV-RT) at 860-465-4314. You may also visit the SAIV-RT website at [https://www.easternct.edu/sexual-assault-and-interpersonal-violence/index.html](https://nam04.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.easternct.edu%2Fsexual-assault-and-interpersonal-violence%2Findex.html&data=04%7C01%7Crodriguezlau%40easternct.edu%7C63e1e16837cb455b3df908d962847131%7C00bc4ae8576c45e3949d4f129d8b670a%7C1%7C0%7C637649143783810922%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=wrC0aDoD0PR59afvL5VL6UHOJZRq1pCpTgZT5xVstHA%3D&reserved=0) for more information including a list of confidential resources.

**Cheating, Plagiarism, and Personal Misconduct**

Students are responsible for familiarizing themselves with the University’s numerous policies and procedures contained in the University Catalog and Student Handbook.  The Code of Conduct policies and the Policy on Academic Misconduct are of special significance, since cheating, plagiarism, and personal misconduct are strictly prohibited and carry severe penalties.  Students should read and understand Eastern's Academic Misconduct Policy, which can be found in the student handbook. <https://easternct.makekb.com/entry/307/> All violations will be handled under the procedures established in this policy.

**Assistance at the Writing Center**

The Eastern Writing Center, located in the ASC and staffed by trained peer tutors, is available to help all students with their writing. The Writing Center supports the liberal-arts mission of Eastern by helping students with their writing from any class, at any stage, from brainstorming and drafting to revision to proofreading and editing. We help students do their own work, and do it more comfortably and confidently. Any student can and should use the Writing Center. The process of talking with readers about writing and getting feedback on student writing is something all writers do and can benefit from. Students can either drop into the Center or make an appointment by going to the “Useful Links” column on the Current Students webpage and selecting “GradesFirst” ([http://www.easternct.edu/index/current-students/](https://na01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.easternct.edu%2Findex%2Fcurrent-students%2F&data=02%7C01%7C%7C3160dad10a984ba6642708d60f463376%7C00bc4ae8576c45e3949d4f129d8b670a%7C0%7C0%7C636713191515391454&sdata=FnXdgewhsTrm6Jmyi0RI2br6DeTwTJJZm10LwM5n9gM%3D&reserved=0)). Students are asked to bring copies of any assignment sheets to the Writing Center, so tutors know what is expected of the assignment.

**Assistance with Academic Advising and Subject Tutoring at the Academic Service Center**

Students are encouraged to use the support offered by the Academic Services Center (ASC) located on the ground floor of the Library. Advising Services and tutoring in math, writing, and other subjects, including supplementary instruction, are available. The ASC also offers Peer Academic Coaching (PAC) assistance with study techniques, time management, “Eastern in 4” planning and understanding learning styles. For further information about our services, please call 465-4625 or check the ASC website at <http://www.easternct.edu/asc/>.

**Student Crisis Statement**

Any student who is facing challenges (i.e. mental health, securing food/housing) and believes this may affect their performance in the course is urged to contact the Dean of Students at 860-465-5244 for support. Students experiencing an immediate threat to their safety or wellbeing should contact 24-hour emergency services by dialing 911 or the Eastern’s University Police Department: 860-465-5310.

**Final Examination Statement**  
University policy states that, “No examination shall be given during the final week of scheduled classes of a full semester course.” Faculty must receive prior approval from the Vice-President of Academic Affairs in order to schedule an examination during the final week of classes. Faculty may, with approval from the Vice-President of Academic Affairs in consultation with the Academic Dean and Registrar, hold a single exam session for all sections of the same course. Students will be notified of the exam date, time, and place on the course syllabus.

**Misuse of Intellectual Property**

Students are advised that lectures, notes, and faculty-developed materials are the intellectual property of the instructor. Students who record lectures without express permission\*, re-distribute notes/recordings, or in any other way violate intellectual property laws may be subject to disciplinary action (e.g. failure of the course, and/or academic misconduct charges up to and including Academic Dismissal). Faculty members reserve the right to pursue separate civil litigation pertaining to copyright violation in such situations.

\* Students with documented ADA accommodations are governed under the signed Audio Recording Agreements.

**Note on the Syllabus**

Faculty reserve the right to make changes to the course syllabus as needed. However, every attempt will be made to keep such changes to a minimum and are usually made in response to university, program, or Connecticut State Department of Education rules or regulations.

**Electronic Communication**

Students are expected to receive, read, and respond to their email in a timely fashion. Some communications may be time-sensitive or contain important classroom announcements, and students are responsible for checking their email so they can react to such information. Additionally, all electronic communications relevant to the course should take place within the ECSU email system. Do not assume that email sent by outside providers will be received by your professor.

**Weather Cancellations:**

Call (860) 465-4444 or (800) 578-1449, or go online and subscribe to the alert system: [www.easternct.edu/easternalert](http://www.easternct.edu/easternalert)

Students are responsible for familiarizing themselves with the University’s numerous policies and procedures contained in the University Catalog and Student Handbook. The Code of Conduct policies and the Policy on Academic Misconduct are of special significance, since cheating, plagiarism, and personal misconduct are strictly prohibited and carry severe penalties. Students should read and understand Eastern's Academic Misconduct Policy, which can be found in the student handbook. <http://ecsu-svkb2.easternct.edu/index.php?View=entry&EntryID=307>

All violations will be handled under the procedures established in this policy.

**Academic Success Center:** Students are encouraged to use the support offered by the Academic Success Center (ASC) located on the ground floor of the Library. Its *Writing Center* is excellent in supporting your class writing assignments. For the most updated hours of operation, check the ASC website at [http://www.easternct.edu/asc/***.***](http://www.easternct.edu/asc/)

**Academic Misconduct**: Students are responsible for familiarizing themselves with the University’s numerous policies and procedures contained in the University Catalog and Student Handbook. The Code of Conduct policies and the Policy on Academic Misconduct are of special significance, since cheating, plagiarism, and personal misconduct are strictly prohibited and carry severe penalties. Students should read and understand Eastern's Academic Misconduct Policy, which can be found in the student handbook. <https://easternct.makekb.com/entry/307/>