King Fahd University of Petroleum and Minerals

Electrical Engineering Department

Center for Energy and Geo-Processing (CeGP)

Undergraduate Research

Coordinator Guidelines

EE490: Undergraduate Research

KFUPM- Georgia Tech

Important Disclaimer

This version is a draft and not approved yet. It cannot be used for any legal action and the institutions are not responsible for the content. It is only meant to provide early information. Your feedback and questions are welcomed at **muqaibel@kfupm.edu.sa**

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1. Introduction

A few factors define an undergraduate research experience. To distinguish undergraduate research from other project-based experience, students are expected to *gain* literature review skills; *read* conference and journal papers and *understand* the scientific publication terms; *identify* research methodologies: statistical, theoretical, experimental or simulation; and *generate* results, critically *compare* and *analyze* them. Course coordinator will definitely foster his research and advising skills. He will notice that his research is becoming organized and procedural.

The objective of this write-up is to provide guidelines to help the coordinator/instructor of undergraduate research (UG) to run the experience successfully. This will guarantee a sustainable UG research program. It is expected that the coordinator has read the two other sets of guidelines for students and mentors. It is also expected that the coordinator has access to electronic resources through the course website/ course Blackboard. (Contact: Dr. Ali Muqaibel or Dr. Samir AlGhadhban). Sample HW, quizzes and presentations can be made available.

The importance of UG research, course description, objectives, learning outcomes, references can be found in the introduction to the course and student guidelines. In this document, we focus on the resources required by the coordinator like the class by class schedule, grading rubrics.

2. Coordinator Role and Timeline

The coordinator role is vital to the success of the research experience. The work of the coordinator starts early. In the semester that proceed the offering term. The coordinator may request a graduate assistant to help in managing the course. Here are some of the activities to be done in a chronological order:

1. The coordinator will make sure that proper announcement for the course is out through posters and Facebook, electronic boards, and other outlets.
2. The coordinator will make sure that the course is offered properly with limited seating to control the quality. The suggested time is two meeting per week that spans the lunchtime to allow enough time for site visits and social lunch events.
3. The coordinator will send a request for proposals to all interested faculty in the department and make sure the topics are diverse. (available resources: sample email, undergraduate research proposal form)
4. Prepare a list of all topics with prerequisites and details and make them available before the early registration.
5. The coordinator shall conduct an awareness workshop for the mentors. Mentors guidelines will be discussed. (presentation available)
6. By the end of first week, all student should be assigned to research problems.

7. The coordinator shall review all the available resources and prepare a tentative class by class schedule.
8. Plan the site visits and get all the official paper work ready. (Sample resources are available)
9. The coordinator will make sure all the components of the experience are balanced. That includes knowledge about research methods, technical research experience, site visits, presentations and writing skills, Expos and conference participation.
10. Grades should be assigned at the end of the course that reflects the knowledge gained. Input from the advisors and mentors need to be acquired.
11. Follow up and encourage students to make sure they indulge in international conferences and get their first technical paper published.
12. Keep the course impact high by sharing news and successful stories through: Website, Facebook, or other outlets. Professional videos can be also developed and reviewed by the University Public Relation for external use.

3. Available Course Resources

- Course Facebook Site (https://www.facebook.com/KFUPMGREU/)
- Course website: current address (http://faculty.kfupm.edu.sa/ee/muqaibel/Courses/EE490%20Undergraduate%20Research/KFUPMEEUndergraduateReserach.html
- YouTube videos, like: https://www.youtube.com/watch?v=6smgUI9URa8
- Course Blackboard
- Georgia Tech Undergraduate Research Website: http://www.undergradresearch.gatech.edu/
- Newly established Undergraduate Research Office at KFUPM under the Student Excellence Center.

4. Breakdown of Course Contents

The first meeting in the week is usually with the course instructor (Coordinator) to learn about research methodology. The second time slot is usually reserved for meeting with the graduate mentor and the research advisor. There will be some self-reading material and students will be quizzed on the material. The material will come from selected sources. The student will gain and apply knowledge to a specific research problem related to the field of the instructor. Possible research areas include: robotics and automation, distributed compression, autonomous vehicles and fusion of sensors, devices and sensors for healthcare, power load distribution in Saudi Arabia…etc. Specific research problems will be identified to clearly have a research nature and distinguish the course from other senior design problems. The major building blocks for the course are listed in the table below.

Week	Module	Topic
1-2	1	Overview of the course, student expectations, & introductions Problem Statement, Significance of Study, **Proposal**, Methodology, References, & Timeline
3-4	2	Literature Review
5-7	3	Research Methods: Statistical, Experimental, Analytical, Simulation
8-10	4	Discussion and Analysis of Results
11-12	5	Writing Technical Papers
13-14	6	Presentation
15	Term Paper Presentations & Final Paper submission	

5. Site Visits

As part of the course, student should visit local research and development centers. Possible visits include the Research Institute (RI) at KFUPM, Fablab at KFUPM, Exploration and Petroleum Engineering Center (EXPEC) at Saudi Aramco, Dhahran Techno Valley, King Abdulaziz City for Science and Technology (KACST), and King Abdullah Univ. of Science and Technology (KAUST).

6. Tentative Grading Policy

It is very important to keep record of the student performance as they progress through the research experience. Conducting quizzes and feeding the grades back to the student will reduce the anxiety caused by joining a non-classical course. The table below provide a tentative distribution of grades:

Item	Equivalent to	Points
Proposal	HWS	5
Weekly progress reports		10
Selected Readings (Quizzes)	Quizzes	5
Literature Review Report	Exam 1	15
Reproducing results in pre-selected or pre-assigned paper or two	Exam 2	15
Term paper	Term project	20
Expo or Local		10
Presentation	Final	20

- Grading rubrics are available in Appendix A.
- The term paper should have new contribution to the field and the paper must be submitted to a conference or a journal before the end of the semester. The student is expected to go through the submission process.

Always encourage students to participate in local and regional scientific events, conferences, and expos. Part of the progress reports grade could be assigned to that.

7. Typical Weekly Class Outline

Sample Class Outlines for Term 162

Week	Class	Material	Note
1	S	• Questionnaire (Doc) • Introduction to the course (PPT Set A)	Questionnaire to check the level of the knowledge about research so cross check can be done at the end.
	T	• Visiting the mentor labs (CeGP and TRL) • Every mentor briefly introduced his projects. • Deciding on project group	• Bring printed Journals, Letters, Conference Proceedings, share some papers
2	S	• **Scholarly outcomes**: Journal Papers, Conference Papers, Patents, Books. • Citations, Impact Factors. • Introducing Scopus, Web of Science, Google Scholar, IEEE Xplore • Social Networks for Researchers (Researchgate.com, http://orcid.org/) • Edas.info	• Students are encouraged to create their own ID. • HW1: Analyze the scholarly outcomes of your research project professor. [Due Tuesday Class] • Student share what they did with their mentor.
	T	• Discussion on Scholarly Outcomes. • **How to read a paper**: Distribute reading assignment (). • Proposal Structure (>=5%)	• Share a full funded proposal format • Students identify the key paper with their mentor before coming to Sunday class.
3	S	• Quiz on How to read a paper • **The key paper**! Assignment • Introduction to **Research Management Software** e.g. Mendeley® https://www.youtube.com/watch?v=Gv6_HuCYExM https://www.youtube.com/watch?v=xLtk6n8cFdk • Time Management and Online access control (Pomodoro) https://youtu.be/DMWyG6enXxE • Task Management [KanBanFlow.Com] https://www.youtube.com/watch?v=W9k0OhJkjQ0	• Visit video on how to use Mendeley • Reminder about proposal • DOI: Digital Object Identifier • HW2: summarize the key paper using the how to read a paper form. [Due Sunday Class]
	T	Research LAB	
4	S	How to write literature review	• HW2 is due
	T	**RI Visit** CoRE-RE Lab CER, High voltage and material Lab CCITR CENT	This visit should be planned for at least 2 hours.
5	S	Research Lab Work	
	T	**Proposal** Presentation	RI Visit Report is Due
6	S	Participation in IEEE GCC meeting Participation in KFUPM Student Conference	

	T	Focus group meeting with Undergraduate research committee at student success center.	Reading assignment (Literature survey)
7	S	Research Lab Work	
	T	Research Lab Work	Literature survey Online Quiz
8	S	Research Lab Work	
	T	Meeting with groups: 15 min per group in their lab 12:45PM 1:00PM, TRL, 1:00PM-1:15PM TRL, 1:15PM-1:30PM TRL, 1:30PM-1:45PM CeGP,	
9	S	Research Lab Work	
	T	**Literature Review** Presentations	
10	S	Research Lab Work	HW3, Submit a copy of your KFUPM forum paper.
	T	How to write a technical paper	
11	S	Research Lab Work	They know that there will be progress presentation and the should use the Research lab work to catch up.
	T	Aramco Expec Arc Visit	
12	S	Research Lab Work	Internal Student Forum for the Saudi Student Conference
	T	Progress Presentations	Very important
13	S	Research Lab Work	
	T	Research Lab Work	
14	S	Research Lab Work	
	T	Research Lab Work	
	Th.	Expo	Requires coordination with the Expo organizing committee. Students participate with posters. (They print themselves, they are expected to prepare small A4 copies, bring their own display if needed) Award is secured for the best UG Research group Roll up for the course is available. PPT presentation is also prepared to be presented on the large (Mall) and small display (our own)
15	S	**Final Presentations**	Evaluation Forms are prepared. Mentors are expected to evaluate.
	T	**Survey** of Undergraduate Research Experience	Survey link is sent

8. Best Practices:

1. Pair the students teams with their mentors on the first day of classes

2. Have a clear plan for each project with the proper resources (papers, codes, … etc.) ready before the semester starts
3. Encourage the students in each team to maintain a Google sheet (to be shared by the mentor and the faculty advisor) where they have multiple sheets including:
    a. A log sheet of all activities by each team member
    b. A Gannt chart of the planned activities
4. The mentor meets with the team regularly (office hours) and every time they go together over the Google sheet and review progress
5. While the mentor serves as the person to go to for help, the faculty advisor becomes the one who challenges the team and directs them to think as researchers. The advisor is best to ignite the exploration spark in each of the students.
6. Encourage the students to search for "potential" conferences where they can publish their work at the end or after the end of the semester. Having such a glory goal and deadline in front of the students will serve them well and will keep them motivated.

Appendix A: Grading Rubrics

A.1 Undergraduate Research Proposal Form

King Fahd University of Petroleum & Minerals

Electrical Engineering Department

EE490: Undergraduate Research

Undergraduate Research Proposal Form (version 2.0)

Instructions:

The objective of this short proposal is to help UG researchers to select the appropriate research problem that matches their interest and capability. When filling the form please observe the following recommendation:

1) The selected problem should be within the research of the mentor (usually PhD) student. This will eliminate additional load and the outcome will be relevant to his degree or work.
2) The outcome of the research should be publishable. The work should not be mere reproduction of previous work.
3) We will take care of introducing the students to research methods and technical writing. Mentors will also gain some advising skills through a short workshop.

Advisor Name: Dr.

Mentor Name:

Mentor contact email:

Mentor mobile phone:

Research Title:

Short Description:

Key paper if already identified:

Recommended background, courses:

Suggested undergraduate students: (Students already committed ( )Yes ( )NO)

1)

2)

This form is prepared as part of the GREU Education Project Supported by CeGP/KFUPM 2018

A.2 Literature Review Rubric

Name(s): **ID:** **Research Title:**

Description of Assignment:

You are to locate research articles on your approved topic. You are to write a 5 – 10 page literature review summarizing the general themes of these articles as it pertains to your topic. You need also to indicate the research progress, direction, contribution, and the shortcomings of these papers. At the end of the review, you should motivate your research, indicate your contribution, and formulate your research question. A list of references, listing the articles, should also be included (this does not count toward your page limit). This review should serve as the background/foundation for your paper. The typed literature review should adhere to IEEE format. For this assignment, use 12 points font size, single column and double line spacing.

Grading Rubric:

	Rating			Score
	3	**2**	**1**	
1. Articles	Information is gathered from up-to-date multiple, research-based sources.	Information is gathered from outdated or a limited number of sources.	Information is gathered from a single source.	
2. Introducing the idea: Problem statement	The topic is introduced, and groundwork is laid as to the direction of the report.	Readers are aware of the overall problem, challenge, or topic that is to be examined.	Neither implicit nor explicit reference is made to the topic that is to be examined.	
3. Flow of the report	The report goes from general ideas to specific conclusions. Transitions tie sections together, as well as adjacent paragraphs.	There is a basic flow from one section to the next, but not all sections or paragraphs follow in a natural or logical order.	The report appears to have no direction, with subtopics appearing disjointed.	
4. Coverage of content	The appropriate content is covered in depth without being redundant. Sources are cited when specific statements are made. Significance to purpose is unquestionable.	All major sections of the content are included, but not covered in as much depth, or as explicit, as expected. Significance to purpose is evident.	Major sections of pertinent content have been omitted or greatly run-on. The topic is of little significance to the purpose.	
5. Clarity of writing and writing technique	Writing is crisp, clear, and succinct. Meaning is explicit.	Writing is generally clear, but unnecessary words are used. Meaning is sometimes hidden. Paragraph or sentence structure is too repetitive.	It is hard to know what the writer is trying to express. Misspelled words, incorrect grammar, and improper punctuation make reading difficult.	
6. Research Question	Research question(s) are formed through the literature review and clearly stated.	Research question(s) are formed through the literature review, but not clearly stated.	Research question(s) were not formed and are not apparent from the literature review.	
7. References	Information is cited properly and in IEEE format.	Information is cited, but has errors.	Information is not cited or is cited incorrectly.	
8. Format	Font and spacing are correct.	Font or spacing is correct.	Font and spacing are incorrect.	
9. Grammar	There is 1 or less grammatical error.	There are 2 grammatical errors.	There are 3 or more grammatical errors.	
10. Spelling	There is 1 or less error.	There are 2 errors.	There are 3 or more errors.	
TOTAL POINTS (30)				

A.3 Final Presentation Evaluation Form

S.	Student	Research Topic	A 5	B 5	C 5	D 5	E 5	F 5	G 5	H 5	I 5	Sum 45
1												
2												
3												
4												
5												
6												
7												

The evaluation rubrics are (*See next page*) :

(A) Content
(B) Knowledge and understanding of significance of research
(C) Coherence and Organization
(D) Knowledge and understanding of methodology and results
(E) Knowledge and understanding of results
(F) Speaking Skills
(G) Communication
(H) Response to Questions
(I) Scientific Contribution

Additional Notes:

Evaluator Name:

A.4 FINAL ORAL PRESENTATION RUBRICS

Dimension	Excellent (4-5 points)	Competent (2-3 pts)	Needs work (0-1 pt)
(A) Content	The presentation contained an abundance of material which clearly related to the main arguments. Research was used to justify arguments or solutions.	The presentation contained material to support the main arguments, but: 1) not all material clearly related to the main arguments; 2) limited research was used to justify or arguments or solutions.	The audience had to make considerable effort to understand the underlying logical and flow of ideas. Major aspects of the analysis or recommendations were absent. No research was used to justify arguments or solutions.
(B) Knowledge and understanding of significance of research	The presentation demonstrates a depth of understanding by using relevant and accurate detail. Significance and goals have been clearly identified.	The presentation shows moderate understanding by using mostly relevant and accurate detail. Significance and goals are partially or vaguely described.	The presentation uses little relevant or accurate information. Significance and goals have not been identified.
(C) Coherence and Organization	The research problem, argument and solution were clearly stated and examples were appropriate. The transitions and flow were easy to follow. Slides were error- free and logically presented.	The research problem, argument and solution were clearly stated, but: 1) not all examples were supportive illustrations; 2) the transitions and /or flow were somewhat difficult to follow; and/or 3) slides contain few errors but logically presented.	The research problem, argument, solution and examples were not clearly stated. The conclusion was unclear. The transitions and flow were not logical. Slides contained errors and a lack of logical progression.
(D) Knowledge and understanding of methodology	Methods are described clearly and concisely; limitations in methodology are acknowledged.	Overview of methods is omitted, methodological details are emphasized.	Methods are not described, or incorrectly described.
(E) Knowledge and understanding of results	Major results have been identified, explained, and placed in context.	Some of the major results are explained, but details are overemphasized, or context or interpretation is minimal.	Description of major results are poorly explained and interpretation of results is lacking.

(F) Speaking Skills	Speakers demonstrated good volume, and eye contact. Enthusiasm and confidence were exuded. The presentation fit into the time allotment of 15 minutes.	Speakers demonstrated fair volume and/or eye contact was broken with audience; and/or light discomfort with public speaking was exuded; and/or the presentation slightly went over the 15 minute allotment.	Team members were often inaudible and/or hesitant and relied heavily on notes. Speakers made distracting gesture with little or no audience eye contact. A high level of discomfort with public speaking was exuded. The presentation went over the 15 minute allotment.
(G) Communication	The presentation of the material was original and presented in a creative way that held audience attention. The presentation is imaginative and effective in conveying ideas to the audience.	The presentation of the material was appropriate, but only somewhat held audience attention. The presentation techniques used are effective in conveying main ideas, but they are a bit unimaginative.	The presentation is uninteresting or confusing. The presentation lacked creativity and did not hold audience attention.
(H) Response to Questions	Demonstrates full knowledge of topic; explains and elaborates on all questions.	Shows ease in answering questions but does not elaborate.	Demonstrates little grasp of information; has undeveloped or unclear answers to questions.
(I) Scientific Contribution	Original and Novel Contribution. Significant to the field of study.	Slightly novel contribution. Very good advance in knowledge.	Trivial or non-significant contribution.

A.5 Final Paper Rubric

Name_____ Title:
_____ Date:_____

Standards	5 - 4 Exemplary	3 - 2 Satisfactory	1-0 Unacceptable	Score	Weight	Total Score
Title	Crisp and concise. Uses Keywords. Avoids Jargon. Reflects the actual work. Uses correct format for Author names and affiliation.	Could be improved to be more specific. Slightly captures the work. Correct author information format.	Too general, does not reflect the actual work. Wrong Author information format.		X 1	
Abstract	Clearly states problem and question to be resolved; clearly summarizes method, results, and conclusions. A stand alone condensed version of the paper.	Summarizes problem, method, results, and conclusions but lacks some details.	Is vague about the problem; does not provide a summary of the whole project		X 2	
Keywords	Captures all keywords.	Some keywords are missing.	List irrelevant Keywords.		X 1	
Introduction	Provides background research into the topic and summarizes important findings from the review of the literature; describes problem to be solved; justifies the study; explains the significance of the problem to an audience of non-specialists	Provides background research into the topic and describes the problem to be solved	Provides background research into the topic but does not describe the problem to be solved; insufficient or nonexistent explanation of details to non-specialists		X 2	
Thesis Statement	Clearly and concisely states the paper's purpose in a single paraghraph, which is engaging, and thought provoking.	Thesis statement could be interpreted from the text but was not stated clearly.	Missing and/or unfocused		X 1	
Methodology	Clearly formulates the problem and the processes used to solve the problem, prove or disprove the hypothesis. Use illustrations to clarify ideas.	Methodology and problem formulation could be improved. Not using illustrations effectively.	Methodology is not clear and hard to understand.		X 2	
Results/ Discussion/ Findings	Addresses the topic with clarity; organizes and synthesizes information; and draws conclusions. Presents a logical explanation for findings;	Addresses the topic; lacks substantive conclusions; sometimes digresses from topic of focus.	Presents little to no clarity in formulating conclusions and/or organization. Does not adequately explain findings		X 2	

Standards	5 - 4 Exemplary	3 - 2 Satisfactory	1-0 Unacceptable	Score	Weight	Total Score
Conclusion	The conclusion is engaging and restates the work. It Presents clear recommendations and/or implications for future research.	The conclusion does not adequately restate the thesis.	Incomplete and/or unfocused		X 2	
Body and Organization	Each paragraph has thoughtful supporting detail sentences that develop the main idea. Writer demonstrates logical and subtle sequencing of ideas through well-developed paragraphs; transitions are used to enhance organization.	Each paragraph lacks supporting detail sentences. organization of ideas not fully developed.	Each paragraph fails to develop the main idea. No evidence of structure or organization.		X 1	
Clarity of writing and writing technique	Writing is crisp, clear, and succinct. Meaning is explicit.	Writing is generally clear, but unnecessary words are used. Meaning is sometimes hidden. Paragraph or sentence structure is too repetitive.	It is hard to know what the writer is trying to express. Misspelled words, incorrect grammar, and improper punctuation make reading difficult.		X 1	
Mechanics and documentation	Is free or almost free of errors of grammar, spelling, and writing mechanics.	Has errors but they don't represent a major distraction;	Has errors that obscure meaning of content or add confusion.		X 1	
Citation	All cited works, both text and visual, are done in the correct format with no errors.	Few cited works, both text and visual, are done in the correct format.	Absent		X 1	
References	Up-to-date. Contains more than three key papers. Use correct format.	Not up-to-date. Contains two or three key papers. Use correct format.	Only one key paper and/or using incorrect format.		X 1	

Reviewer_____
Grand Total _____