

MECHANICAL ENGINEERING DEPARTMENT

SA 10.SUMMATIVE LEARNING PROJECT POLICY AND PROCEDURES

A Bridge to a Better Community

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SUMMATIVE LEARNING PROJECT | POLICY AND PROCEDURES

1. CORE VALUES

The Summative Learning Project (SLP) experience provides students the opportunity to apply the knowledge they attain in more than four years of studies to formulate, develop, create, or build a system, algorithm, or artifact that is relevant to the community and related to their field of study. Students teams are expected to transform an idea into reality. The SLP is the platform to have a holistic engineering experience that mimics what engineers are expected to do in the real world. The SLP experience conforms to the core values of the Mechanical Engineering Department that are articulated in its mission, vision, and objectives. The values, which the SLP is designed to conform to, are: time and resources' management and planning, deal with complexity and the unknown, concern for the community, experiencing entrepreneurial venture, advancing creative ability, improving effective communication and critical thinking skills.

2. SLP IN CONTEXT

As students embark on college education, a new phase in their life begins; attitudes formed, purpose defined, and direction formed. They increasingly begin to view themselves as part of the world around them. They grow more sensitive to the needs and aspirations of the community in which they live. As they acquire knowledge and become more mature they become aware of the ramifications of their learning and develop motivation to contribute to better life is seeded.

The SLP provides students with a transitional experience from the academic world to the real world, sort of a bridge the "student" crosses in search for a positive role in the professional world of engineering. The SLP aims to engage students in a team-oriented comprehensive, integrative, meaningful design experience requiring the solution of open-ended problems that draw from knowledge acquired in the lead-up courses. In a highly competitive global arena fueled by rapid changes in technology the SLP experience is vital.

Student teams, normally three to five, will be required to select a project at the beginning of the fall semester of their graduation year. Teams are actively guided by the project supervisor to work on the project and complete it by the end of the following spring semester.

3. GOALS, OBJECTIVES AND OUTCOMES

The project activity is a culmination of your past experience as an engineering student. The project is designed to serve as a platform in which RHU students engage in a meaningful design experience that draws from knowledge acquired in the lead-up courses to better prepare them to enter the real world of engineering practice.

3.1 Goals

The goals of the SLP project is to provide students with a comprehensive, integrated experience in which students apply knowledge and skills acquired in the lead-up courses, conduct research on new material to realize solutions to relevant, open-ended and complex problems. The goals of the project are twofold: technical and non-technical.

Knowledge and Skills Areas: To enhance students' ability to creatively formulate and complete open-ended real-world problems with relevant constraints, design and conduct experiment, and integrate computer-integrated analysis and design tools and technologies to realize novel ideas.

Attitudes and Awareness Areas: To improve communications and teamwork skills, understand and manage group dynamics, shoulder responsibility, importance of planning and efficiency on project activities, social implications of engineering, professionalism and ethical practices.

3.2 Objectives

The SLP objective is to engage students, to the extent possible, by simulating a real world experience involving many aspects of future professions, from the inception of an idea to the realization and prototype testing of a device for a specific application. Those objectives give the students the opportunity to:

1. Attain entrepreneurial experience in transforming germane idea into a useful product;
2. Conduct independent research to acquire new knowledge and learn new skills;
3. Apply engineering fundamentals to solve open-ended, relevant, multidisciplinary problems;
4. Use modern design tools and technologies to produce novel designs;
5. Design and conduct experiments, collect and analyze data, and take appropriate decisions;
6. Develop awareness and integrate technical and non-technical constraints engineers have to confront (ethical, political, aesthetic, environmental, economic, cultural, etc.);
7. Practice teamwork and the ability to deal with other technical and nontechnical professionals as the project requires;
8. Strengthen their oral and written communication skills by submitting a report and making oral presentation.

Program →	1	2	3	4
SLP ↓				
1	x	x	x	
2	x			
3	x			
4	x	x		
5	x	x		
6			x	x
7			x	x
8			x	

3.3 Outcomes

Upon completion of the SLP, students shall have improved their ability to:

1. Manage time and resources
2. Communicate with various groups in various media
3. Write effective reports and deliver effective presentations
4. Deal with often conflicting constraints
5. Consider alternative solutions
6. Manage complexities involved in transforming idea into a product
7. Integrate knowledge learned and self-attained with modern tools in solving relevant engineering problems
8. Apply creativity enhancing techniques in reaching viable solutions
9. Recognize ethical dilemmas and professional responsibilities

Program →	a	b	c	d	e	f	g	h	i	j	k	l
SLP ↓												
1						x						
2								x	x			
3									x			
4											x	x
5		x	x		x		x				x	

6					x	x						
7	x	x	x	x			x				x	
8					x							
9										x		

4. PROMOTING THE ENTREPRENEURIAL SPIRIT

The team-oriented project experience is meant to flare up the entrepreneurial spirit in the hearts and minds of future engineers and help them develop the skills that lead to success. In a competitive world characterized by compressed product-life cycles, constantly emerging new technologies, rapid changes in global marketplace, diverse and discriminating customers demand specialized smart products, changes in the nature of economic transactions, and increasing time and cost pressures companies operate under, it is imperative that engineers are more and more involved in startup companies so that understanding of practical knowledge of business is now as vital as their understanding of technology and sciences. This is precisely the reason for requiring an entrepreneurship course, to enable students to apply entrepreneurial principles to the SLP project directly and make them closer to innovating the project's idea. The ultimate dream is that some of those ideas will culminate in innovative marketable products with its positive ramification on the community. Starting a company is a major undertaking that requires skillful navigation through interdisciplinary spaces. The entrepreneurship course teaches students how to articulate a well-reasoned, easily understood business plan, set and achieve targets, prepare budgets, find capital by effectively communicating the idea to those who can finance it, hire the right mix of marketing and technical talent, know the market by engaging in real time market research, and focus on the customer.

5. FORMING PROJECT TEAMS

It has been determined that a team of three to four members is an optimal number to keep the team focused on the project's targets and accomplish the task. Consider that you have a big idea and driven to succeed in a dynamically changing world. To succeed you need to assemble a mix of talent by forming a team with individuals who share your dream of making it big. You could form the team of 3 or 4 (five if justified) engineers in one of two ways.

1. You are a team that have an entrepreneurial spirit and about to engage in the most exciting endeavor of your lives. You have an innovative idea that you want to realize and in doing so you will be rich in ways more than one. This idea is to design, develop, manufacture, assemble, and test a device that is needed in a specific application. So you want to start-up a new company, *Unlimited Horizons' Engineering*, to manufacture and market your product.
2. You are a team of engineers that work for the *Innovative Engineering Solutions* start-up consulting firm. *Smart Devices Inc.* is soliciting your expertise in order to design, develop, manufacture, and assemble, and test a device they need for a given product. *Smart Devices Inc.* needs this device in four months.
3. A "do or die" world leaves you with only one option: think big and work hard to control your future.

6. PROJECT SELECTION

The project a team chooses may be either a project proposed by a faculty member or one the team proposes. Ideas for student generated project proposals can come from many sources; based on life's experience, passion, or urge to solve a relevant community problem - and problems are plentiful, through personal contact with practicing engineers, proposed by industry, or to improve an existing system.

Each Student group submits the SLP Selection form. On the form the student group chooses three projects and the corresponding advisors, prioritized according to the group's preference. The SLP

coordinator meets with the department faculty members and finalizes the selection process according to the following criteria:

1. The project that will be assigned to a team is one of the three choices the team had made
2. If a project is funded by an external enterprise the faculty member who had received the funds has the priority to supervise a team that had chosen the related project.
3. No faculty member is assigned more than two first choice projects unless each faculty member had been assigned one first choice project.
4. In case of a conflict the Chairperson of the department is empowered to make a final decision after his/her effort to resolve the issue had failed.

7. STUDENTS' RESPONSIBILITIES

A meaning and successful SLP Project experience requires students to shoulder responsibilities to achieve the stated goals and objectives. The students are responsible to:

1. Secure financial support from private institutions and enterprises.
2. Form the project team and choose a project by the end of the second week of the fall semester.
3. Conduct research through related literature and patents and hold brainstorming sessions to discuss, understand, define objectives and possible outcomes, and articulate the scope of work by the end of December.
4. Submit a detailed plan for completing the project by the end of October.
5. Submit biweekly reports to the advisor(s) on progress that has been made.
6. Develop preliminary project/product specification and requirements and submit first report by the first week of January.
7. Develop possible solutions and select a concept that would satisfy the project specifications.
8. Sketch the final concept and define a preliminary Part's List or bill-of-materials (BOM) and necessary tools to realize the concept. Estimate project cost by the end of January.
9. Submit by the first week of February an updated proposal that include: Objectives and a summary of the proposed project, literature review, problem specifications, identify subsystems, concept generation, concept selection, and timeline indicating milestones. This document becomes the template on which the final report is based.
10. Implement the plan and build the system and/or develop detailed solution by first week of April
11. Put it all together, test the prototype, assess the performance by the middle of April
12. Submit the final report, prepare the poster, and deliver a presentation by end of April.

8. ADVISOR'S RESPONSIBILITIES

The role of the advisor is to mentor the team throughout the project duration. Advisor's responsibilities include: hold regular meeting (weekly or bi-weekly), set weekly targets, provide guidance, offer technical support, ensure that milestones are achieved, help mitigate team troubles, ensure the soundness of the approaches used, and provide feedback to students.

9. SLP COORDINATOR'S RESPONSIBILITIES

The Department Chairperson shall appoint a faculty member to serve as the SLP coordinator for the year before the fall semester classes begin. The responsibilities of the coordinator include:

1. Revise and disseminate the SLP policy and related material as necessary.
2. Compile and publish the list of projects to be offered by the faculty members.
3. Prepare an email list of all students and advisors to communicate pertinent information to all in a timely manner.
4. Send reminders of the deadlines of various milestones.
5. Prepare and announce the final list of selected projects.

6. Prepare projects' presentation schedule, select the judges, and prepare the venue.
7. Collect the grades and calculate the final scores.

10. DEPARTMENT RESPONSIBILITY

The department shall:

1. Meet with students to discuss the policy and expectations.
2. Create the necessary conditions for successful completion of all projects according to the published timeline.
3. Empower the students to choose the project they like without coercion.
4. Provide modest financial support to each project.
5. Communicate all important information and deadlines to the students and advisors through the coordinator.
6. Write letters in support of students seeking funds from external sources.
7. Ensure that advisors are providing proper guidance to student groups.
8. Ensure that deadlines are met.

11. EXTERNALLY FUNDED PROJECTS

Students, faculty members, the chairperson of the department or the Dean of the Faculty may pursue clients who are willing to fund certain projects of mutual interest to RHU and to the client(s). Externally funded projects shall be managed according to the following:

1. An agreement must be drafted and signed by the faculty member(s) supervising the project, the chairperson of the department, the Dean of the Faculty, and the client.
2. The agreement must include: the responsibilities of each party, the amount of funds allocated for the project, the procedures for receiving and spending the allocated funds, the anticipated deliverables, expected timeline, and the intellectual and property rights of the outcomes.
3. The faculty supervisor(s) is responsible for guiding the funded project team to ensure that the results are delivered as expected and in a timely manner.

12. MAJOR MILESTONES

- The Department Chair appoints an SLP coordinator before fall semester classes begin.
- The SLP Coordinator collects project proposals from faculty and students.
- The SLP Coordinator publishes the projects list by the first week of the fall semester.
- The SLP Coordinator meets with all teams and advisors to discuss SLP policy and procedures.
- Project teams are formed and project selection is completed by the second week of September.
- Students submit first report to the faculty advisors by the second week of December.
- Report submitted, posters prepared, and presentations delivered by the end April.

Milestone	9/15				10/15				11/15			
	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
SLP Coordinator selected												
Project proposals collected												
Projects list published												
Project teams formed												
SLP Coordinator meet teams												
Teams meet with advisor(s)												
Team submit progress reports												
Teams Search for funds/sponsors												

Team submits a plan													
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Milestone	01/15				02/16				03/16			
	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
Teams meet with advisor(s)												
Team submit progress reports												

Milestone	04/16				05/16			
	W1	W2	W3	W4	W1	W2	W3	W4
Teams submit draft report								
Teams submit final report								
Teams submit final poster								
Presentation schedule published								

13. ASSESSMENT CRITERIA

The projects are assessed on their own merits. Assessment components include the report, poster, presentation, and the project's outcome. The final grade received by each student consists of the group grade (60 points) and the individual grade (40 points). The individual grade is assigned mainly by the project supervisor(s). The group grade breakdown is as follows:

1. Quality of the technical treatment (design approach, analysis and synthesis) and deliverables – 15 points
2. Clarity, relevancy and potential realization of the project - 10 points
3. Addressing of sustainability matters – 5 points
4. Level of creativity and innovation – 5 points
5. Quality and completeness of the report – 10 Points
6. Appeal and completeness of the poster – 5 points
7. Quality of the oral presentation –10 points

14. RELATED FORMS

The following documents are used in implementing the SLP policy:

1. Projects' Proposal form
2. 2014/2015 final projects' list
3. Team formation and students' preference form
4. Project final selection form
5. Presentation and judging schedule
6. Report/Demonstration/Presentation/Individual assessment forms
7. Assessment Form – SLP Examiners
8. Final grade report form
9. Assessment Form - Students

APPENDIX I

REPORT STRUCTURE

A report on the project should be submitted (electronically with a hard copy) one week before the presentation date. The report must be prepared using a word processor, spreadsheet, and/or any other relevant software package. Figures should be drawn using a computer-based graphics package, e.g., AutoCAD, Excel, Matlab, LabVIEW, etc. The report must include all essential ideas and concepts used in the development of the project as indicated below.

1. Project Summary

This section should include a brief summary of the overall project, its objective, methodologies used, and outcome.

2. Introduction and Project Aims

This section summarizes the existing literature on the problem at hand. It should include descriptions and specifications of related products and patents, a summary of related journal articles and books, etc. This section should also state clearly the objectives of the project, why it was chosen, the purpose it will serve, etc. Additionally, it should include a brief description on the chapters to follow.

3. Problem Description and System Overview

This section should begin with a brief overview of possible alternative solutions considered and the process of selecting the final one. Then, the project's deliverables, all the subsystems of which it consists, the operation of each subsystem and how they all are integrated are discussed with supporting charts, figures, tables, sketches, circuit diagrams, and CAD drawings as applicable. Performance criteria should be established and articulated, constraints are discussed, and expected outcomes are envisaged.

4. Design Analysis and Synthesis

This section should include engineering analysis and or synthesis of the major subsystems included in the Project. It should introduce pertinent relations, state assumptions that have been made, and the result of calculations performed. Include flowcharts and explain algorithms that have been developed as applicable.

5. System integration

In this section elaborate on the integration of the various subsystems to build the whole. How well the subsystems perform, problems arisen, and generation and implementation of possible solutions.

6. Assessment

Assess the performance of the system and how well it accomplishes the intended task in accordance with the established target performance criteria. Reflect on the assumptions made in light of the results attained. Suggest changes and implement them as possible.

7. Conclusion and Recommendations

In this section, articulate any conclusion that could be made based on the project outcome and provide insights and ideas that if implemented could improve the outcomes.

8. References

List the books, websites, magazine articles, etc. that were used to obtain information cited in the report.

9. Appendices

This section should include reference materials such as relevant background information, component specs, computer code, detailed drawings, photos, table of parts list (Bill of Materials BOM) with part number and manufacturer, quantity used, cost analysis, etc.

APPENDIX II

PRESENTATION TIPS

(This is a copy of an ASME publication)

The ideas you implemented in your project will enjoy acceptance by the public first from their quality and second by how well you present them. Uphold the standard of excellence of your project by preparing an interesting and informative presentation. You, the team, control the reaction of the audience. Maintain favorable reaction by following the suggestions outlined below.

PREPARE A SUCCESSFUL PRESENTATION

Here are some pointers to help you prepare a concise and interesting presentation:

DO NOT Read Your Report!

The written word is for the eye, not the ear. Your audience wants to hear you talk, not listen to you read.

Make Notes

Use index cards. Use one card for each item. When you have followed the advice given below, organize your cards and number them clearly according to the order in which you will use them.

Secure the Attention of Your Audience

1. Make a statement of the purpose of your presentation. Confine it to one simple, declarative sentence. Example: "I want to tell you about a new design for a solar tracker which has resulted in considerable improvement in solar tracking."
2. State a compelling thing about your project. Make it sharp and short. Use a question if possible. Example: "Is it possible to generate enough solar energy to drive a personal transporter?" This will be your opening sentence. Join it to your statement of purpose with a connecting sentence or phrase. Example: "We have made an investigation and _____."

Divide Your Project into Main "showcase" Ideas

1. State each showcase idea in a short sentence on its own index card.
2. Arrange them in the most logical order for your listeners to grasp.
3. Add to each a series of key words or phrases to remind you of what you need to tell your audience about each idea.

Use Connective Sentences and Phrases

The ear cannot check back nor jump ahead as can the eye. Therefore, you must remind your audience of what it has just heard and prepare it for what it is about to hear whenever you go from one idea to another. Example: "Now that you have a clear idea of what the benefits of solar energy, it is time to look into the advantages of for personal transporter."

Summarize

1. State your subordinate conclusions. Confine them to one sentence if possible, or to a small

series of very short sentences. Example: "I think you will agree, then, that poor sealing is a result of self-induced growth of tiny initial leaks. In addition, you will agree that high-pressure steam sealing depends upon..."

- a. _____
- b. _____
- c. _____

2. State your main conclusion. Confine it to one simple sentence. Example: "And I believe you will conclude with me, that better sealing can be obtained through the use of this new design for valve seals."

Time Your Talk

Rehearse your speech. Learn to handle your index cards naturally. If you are using slides, allow no more than one minute for any one slide. If you exceed your allotted time limit, cut down on your explanations. Continue to condense until you are within the limit. This will assure adequate time at the session for discussion.

THINGS TO REMEMBER

- Learn from effective speakers by watching videos (e.g., Steve Jobs on U-Tube)
- Talk To Your Audience.
- Use Short, Simple Sentences.
- Speak Clearly and With Vitality.
- Repeat the essential concepts and ideas constantly
- Speak into the Microphone at All Times.
- Deliver your speech as if you are telling a story.

IT'S UP TO YOU TO MAKE YOUR PRESENTATION A SUCCESS!

SUMMATIVE LEARNING PROJECT | PROPOSAL FORM

This form shall be filled by the faculty member for each project he/she wishes to propose. All projects shall be consolidated by the SLP Coordinator and posted for students by the second week of the Fall Semester.

Year	2015-2016	Date	September 3, 2015
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PROJECT TITLE

Design and build a solar powered autonomous vehicle to collect and sort road-side trash

PROJECT SYNOPSIS

Trash litters the roadsides everywhere in Lebanon, a country that by-and-large live on tourism! Cleaning up the mess is costly. This project aims to build an autonomous vehicle that could draw energy from the sun as it moves and collects the trash, sort it, and store it in bins for recycling and or disposal.

PROJECT CATEGORY

Mechatronics

PROJECT ADVISORS

1. ..
- 2.

NUMBER OF STUDENTS

4 or 5

REQUIRED SKILLS TO COMPLETE THE PROJECT

1. Knowledge of sensors, actuators, and microcontroller programing
2. Machine design
3. Kinematics
4. Solar energy

EXPECTED OUTCOMES

A prototype of a working vehicle operating in a structured environment

SUMMATIVE LEARNING PROJECT | 2015-2016 PROJECTS

This table is to be prepared by the SLP Coordinator after receiving the list of projects proposed by ME faculty members.

No.	Project Title	Advisors	# students
1	Design and build a solar powered autonomous vehicle to collect and sort road-side trash		5 or 6
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
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28			

SUMMATIVE LEARNING PROJECT | STUDENT TEAM PREFERENCE

This form is filled by the student teams indicating their preference of projects. List preferred project according to priority. Students must understand that the project they chose as first priority may not be assigned to them.

Student Name	ID	Signature
1.		
2.		
3.		
4.		
5.		
6.		

Priority	Project #	Project Title
1		
2		
3		
4		