Affordable Materials Grants, Round 21:

Transformation Grants

(Spring 2022-Spring 2023)

Proposal Form and Narrative

# Notes

* The proposal form and narrative .docx file is for offline drafting and for our review processes. Submitters must use the online Google Form for proposal submission, including uploading this document.
* The only way to submit the official proposal is through the Google Form. The link to the online application is on the [Round 21 RFP Page](https://www.affordablelearninggeorgia.org/about/rfp_r21).
* The italic text provided below is meant for clarifications and can be deleted.

The Round 21 Kickoff will include an asynchronous training module, required for all team members to complete, followed by the synchronous Kickoff Meeting on March 25, 2022 from 1pm-4pm. At least two team members from each awarded team (unless the award is for one individual) are required to attend the synchronous Kickoff Meeting.

# Applicant and Team Information

*The* ***applicant*** *is the proposed Project Lead for the grant project. The* ***submitter*** *is the person submitting the application (which may be a Grants Officer or Administrator). The submitter will often be the applicant—if so, just list leave the submitter blank.*

| Requested information | Answer |
| --- | --- |
| Institution(s) | Georgia Southern University |
| Applicant name | Mohammad Ahad |
| Applicant email | mahad@georgiasouthern.edu |
| Applicant position/title | Associate Professor |
| Submitter name | Mohammad Ahad |
| Submitter email | mahad@georgiasouthern.edu |
| Submitter position/title | Associate Professor |

Please provide the first/last names and email addresses of all team members within the proposed project. Include the applicant (Project Lead) in this list. Do not include prefixes or suffixes such as Ms., Dr., Ph.D., etc.

| Team member | Name | Email address |
| --- | --- | --- |
| Team member 1 | Mohammad Ahad | mahad@georgiasouthern.edu |
| Team member 2 | Rami Haddad | rhaddad@georgiasouthern.edu |
| Team member 3 | Thomas Murphy | tmurphy@georgiasouthern.edu |

# Project Information

| Requested information | Answer |
| --- | --- |
| Priority Category / Categories  *Projects in these categories will receive three extra points in the final score for fitting a priority of these particular rounds of Transformation Grants. The type of funding for the project is determined by the funding categories criteria above. As of Round 18, projects can be a part of more than one category. Note that the below categories only indicate priority, not which applications qualify for a grant. Select all that apply.* | *Student Participation in Materials Evaluation and/or Development.*  *Departmental scaling (implemented in all sections of the course)* |
| Requested Total Amount of Funding  *$30,000 maximum total award per grant* | *$18,680* |
| Final Semester of Project | *Spring 2023* |
| Using OpenStax Textbook?  *This is to indicate to OpenStax that they can provide additional support and resources to your team during the adoption process.* | *No* |

# Impact Data

Please fill in the data below with impact data in below with one course (all sections) in each table, and only include courses and instructors that are specifically part of the scope of this grant proposal. Add or remove tables as needed. **Please only put a single averaged or totaled (as appropriate) number in each box. Do not put ranges or mathematical equations in any of these boxes.** If the materials used by different instructors in a course vary drastically, it is possible to enter one course per instructor.

For a multi-course project, if a significant amount of students are assumed to take courses in a sequence and only one textbook is used for these courses, please take this into account in your total *(i.e. only include that book in the first course they would purchase it for OR adjust the number of students affected. Please explain in the notes section if making such adjustments).*

## Course 1

| Row # | Requested information | Answer |
| --- | --- | --- |
| N/A | Course title and number | Digital Design Lab, ENGR 2323 |
| N/A | Course instructors | Mohammad Ahad, Thomas Murphy |
| 1 | Average number of students enrolled per section | 20 |
| 2 | Average number of affected course sections scheduled in a summer semester | 0 |
| 3 | Average number of affected course sections scheduled in a fall semester | 3 |
| 4 | Average number of affected course sections scheduled in a spring semester | 2 |
| 5 | Total number of course sections scheduled in an academic year  *Add up rows 2-4.* | 5 |
| 6 | Total number of student section enrollments per academic year  *Multiply row 1 and row 5.* | 100 |
| 7 | Original required commercial materials  *Include each title, author, price for a new copy purchased from either your campus bookstore, the publisher, or Amazon, and a URL to the book showing the price.* | Digital Design Laboratory Manual by Thomas Collins and Christopher Twigg.  Price: $66.15 (By publisher)  URL: https://he.kendallhunt.com/product/digital-design-laboratory-manual |
| 8 | Original cost per student section enrollment  *Add up the cost of all materials in row 7.* | $66.15 |
| 9 | Average post-project cost per student section enrollment | $0 |
| 10 | Average post-project savings per student section enrollment  *Subtract row 9 from row 8.* | $66.15 |
| 11 | Projected total annual student savings per academic year  *Multiply row 10 and row 6.* | $6,615 |

# Narrative Section

## 1. Project Goals

The primary goal of the project is to transform a sophomore electrical and computer engineering course, Digital Design Lab, by providing students with an improved learning experience and save the students money on course materials. The course currently uses a lab manual that is not tailored for the lab equipment in our labs. The project will replace the current lab manual with a free lab manual that is tailored more for the development boards and bench equipment in the lab. It will incorporate the use of the most current CAD software and development boards. The chosen CAD software will also be available free to students for them to use outside of the lab.

The resources will be available in electronic form and include written text, lab assignments, and both written and multimedia tutorials for the software, development boards, and bench equipment. Students will be able to print the written materials if desired.

## 2. Statement of Transformation

Digital Design Lab (ENGR 2323) is a required course for electrical and computer engineering students at Georgia Southern University. Several sections are offered both in fall and spring semesters. No sections are currently offered in the summer, but this may change if enrollment increases. Georgia Southern University has three campuses, and this course is taught on two of them (Statesboro, Armstrong). The course is uniform in the curriculum: same course, content, textbooks, software, and learning outcomes. The labs the course is taught in have the same equipment on both campuses. ENGR 2323 is a 2-credit hour laboratory course (4 contact hours) and is the first hardware-based lab course that electrical and computer engineering students take. The course prerequisite is Digital Logic Design (ENGR 2332).

Many students struggle with the lab as the course involves using CAD software, discrete logic and power protoboards, FPLD development boards, and bench equipment such as oscilloscopes and logic analyzers. The new resources will be designed to improve the students’ lab experience and their lab performance. The resources developed will include a lab manual along with written and multimedia tutorials for the CAD software and lab equipment.

The impact of this project will be:

* On average, 100 students take this course each academic year and the free resources will result in a savings to students of $6600 per year. The course materials will all be at no cost to students.
* The resources can be tailored for the learning outcomes for the course.
* The resources can be better tailored for the CAD software and equipment used in the course.
* The resources will include more interactive formats such as multimedia videos and provide students with a better learning experience.
* The electronic resources will be always available to students so there will be no delays in acquiring textbooks and students will have all access to all of the necessary resources the first week of lab. The availability can also allow students to refresh their knowledge of the perquisite course material.
* The electronic resources can be more easily modified/maintained so as to reflect modern state-of-the-art software, hardware, and techniques for digital design.
* This course, as the first laboratory course, can be a bottleneck for some students in the program and course completion should increase and allow more students to progress in their degree program.
* Similar courses are offered at other institutions that offer electrical and computer engineering programs both within the University System of Georgia and outside the state. These resources could also benefit faculty and students in those programs.

## 3. Action Plan

Laboratory manuals are typically very specific if developed in house for a specific engineering program. Due to the pace of change in the field, they also need to be updated regularly. The team has found several electronic versions of digital design lab manuals. They either predominantly have discrete logic activities or FPLD board activities whereas the Digital Design Lab activities are a mix of the two. They also are tailored for different CAD software, different development boards, and a different set of bench equipment. Intel Inc. provides free resources as part of its education programs, but these are all FPLD board based and many are for a more advanced audience.

The goal of this project is to create electronic resources that will replace the existing Digital Design Lab manual and provide additional resources to improve the students’ lab experience and aid students in achieving the course learning objectives. As much as the team would like the developed resources to be general and usable with a variety of CAD software, development boards, and bench equipment, for an introductory digital logic lab course, students typically need detailed instructions and help to learn to use the specific software and equipment at the institution. This has become even more of an issue the last two years as many lab courses have been impacted due to remote or socially distanced learning.

All team members are subject matter experts and have taught or are currently teaching digital design laboratory courses. The team member’s roles and responsibilities are detailed below:

* Dr. Mohammad Ahad is an Associate Professor of Electrical and Computer Engineering and the project lead. He is the course coordinator for ENGR 2323. He will coordinate the overall project, develop course materials, and oversee the sustainability plan.
* Dr. Rami Haddad is an Associate Professor of Electrical and Computer Engineering and the Coordinator for the Computer Engineering Program at Georgia Southern. Dr. Haddad oversees the assessment work for the department for the Accreditation Board for Engineering and Technology (ABET). He will develop assessment instruments, develop course materials, oversee the alignment of teaching pedagogy to learning outcomes, and oversee the data collection and assessment of the materials.
* Dr. Thomas Murphy is an Associate Professor of Electrical and Computer Engineering and the primary instructor for Armstrong campus sections of ENGR 2323. He is very active in engineering education and has developed OER materials for an Introductory Programming Course using MATLAB. He has also developed a variety of written and multimedia tutorials for using design software and lab equipment. He will develop course materials and oversee the formatting and editing of the manual.

The transformation will follow the plan below:

**Stage I: Determine CAD software, development board, and lab activities.**

* Identify activities appropriate for the learning outcomes.
* Decide on the CAD software for the course.
* Decide on the new FPLD development boards for the course. The current discrete logic equipment and bench equipment will be used.

**Stage II: Develop and test lab activities**

* Develop and write up the lab activities (8 to 10) aligning them to course learning outcomes.
* Develop and write up the guidelines for a team design project.
* Perform the lab activities and identify topics/equipment that need additional resources or tutorials.
* Revise lab activities if needed.

**Stage III: Create electronic lab manual and written/multimedia tutorials**

* Write lab manual.
* Develop written and multimedia tutorials for using the CAD software, development boards, bench equipment, and other identified areas.
* Create an electronic bundle of lab manual and written tutorials.
* Develop lecture slides for either video or in person lectures.
* Create solutions for the lab activities.
* Create an easily accessible repository of multimedia tutorials.

**Stage IV: Incorporate resources into the course and disseminate**

* Organize a workshop to introduce the new resources to all instructors for all sections. Discuss the new materials, resources, and teaching pedagogies that can be used.
* Develop the assessment materials.
* Collect and analyze student performance data for improvement and sustainability.
* Provide an electronic repository of the resources for maintenance and dissemination.

## 4. Quantitative and Qualitative Measures

Upon completion of this project at the end of the Spring 2023 semester, both quantitative and qualitative measures will be applied to assess the efficacy of the transformation to OER Digital Design Lab. We will compare results from the labs using traditional Digital Design materials with those using the New Digital Design materials outlined in this proposal.

**Quantitative measures:**

* Comparison of the student’s adjusted performance in the new proposed Digital Design lab with its previous offerings.
* Comparison of pre- and post-content tests for each class, broken down by course learning objectives.
* Comparison of scores on a common Final Exam.
* Comparison of DFW (Drop, Fail, Withdrawal) rates between classes.

**Qualitative measures:**

* Comparison of surveys on student attitudes and opinions regarding course materials.
* Survey on perceptions of engineering faculty using the new course format.

All these quantitative and some of the qualitative measures will be statistically analyzed using statistical software to infer statistical significance of our findings. Additionally, these results will be disseminated in a peer-reviewed Scholarship of Teaching and Learning publication and shared with the professional community.

## 5. Timeline

**February 2022:**

* Two team members attend the kickoff meeting.
* Research Digital Design CAD software. The software must have a no cost version.
* Research FPLD development boards. It is desirable for one with an inexpensive counterpart that students could purchase if desired.

**March - May 2022:**

* Complete a student survey in Spring 2022 sections of ENGR 2323 to get student impressions of the current labs and their sequencing, the current CAD software, and the current FPLD development board.
* Recruit student research assistants for the project.
* Identify lab activities that will support the course outcomes.
* Compile student performance data from past two years for quantitative assessment.

**June – July 2022:**

* A dedicated website will be created to host the project and all its material that will be publically available.
* Develop the initial set of lab activities.
* Student research assistants will test the lab activities and provide feedback. Identify topics/software/equipment that tutorials should be developed for.
* Refine and finalize the lab activities.
* Draft of lab manual.

**August 2022:**

* Finalize lab manual. Create an electronic version.
* Student research assistants generate lab solutions.
* Develop written and multimedia tutorials.
* Develop assessment instruments.
* Meet and discuss the new materials and how to incorporate them with all Digital Design Laboratory instructors.

**September – December 2022:**

* Use the newly created materials (lab manual, tutorials, etc.) in all sections of the Digital Design Laboratory course.
* Maintain a working document including suggestions, comments, etc. from all instructors teaching the course.
* Compile qualitative and quantitative assessment data for the courses from Fall 2022.
* Revise lab manual and tutorials if errata is found.

**January – April 2023**:

* Analyze the assessment data and identify if any changes to the materials are needed.
* Contact faculty at other USG institutions who teach similar courses and share lab manual and teaching strategies.
* Analyze the assessment data and present this work at an ASEE conference.

## 6. Budget

Summer salary and fringe benefits for Dr. Mohammad Ahad - $5,000

Summer salary and fringe benefits for Dr. Rami Haddad - $5,000

Summer salary and fringe benefits for Dr. Thomas Murphy - $5,000

Student Research assistants - $2,880 (2 students, $12 per hour, 20 hours a week for 6 weeks and fringe benefits)

Travel for one team member to present the work at ASEE SE Southeast Section Conference - $800

## 7. Sustainability Plan

The Digital Design Lab course is a required course for both Electrical and Computer Engineering programs. The course content, particularly the design tools and circuit implementation methods, tend to change fairly rapidly. This will require the materials to be updated on a regular basis.

CAD software typically gets updates/new versions every year, but the software interface often does not change much each update. Development board changes follow a similar pattern. After each academic year assessment cycle, the Digital Design Lab course coordinator will meet with the instructors who regularly teach the course to assess the effectiveness and determine the need for course material updates. The notes from these meetings will be compiled and kept in a working document used to track material changes and the reasons for changes. The Digital Design Lab course is also assessed every year as part of the program's regular ABET assessment which will help ensure that regular assessment of materials occurs.

Minor updates such as correcting errata, clarifying confusing areas, and adding additional written or multimedia tutorials will be performed every year between the spring and fall semesters. Major updates such changing the materials to reflect a change in CAD software, change in development board, or major update to the lab bench equipment will occur as needed but probably in the four to six year range. Two members of the project team, Drs. Ahad and Murphy regularly teach the course and Dr. Ahad serves as the course coordinator. They will bear the initial maintenance responsibility and ensure that the materials are updated. They will also serve as the points of contact for faculty at other institutions interested in adopting the course materials.

The yearly enrollment for the Digital Design Lab course has been steadily increasing and there will be additional faculty teaching the course. The increasing enrollment should also mean a larger savings to students over time. The course coordinator will meet with instructors new to the course before the start of the fall semester to introduce the materials and teaching strategies. The course materials (manual, written and multimedia tutorials, syllabi, weekly schedules, lecture notes, lab solutions) will be provided to GSU faculty through an internal departmental storage site. An externally accessible mirror will also be maintained to provide material access to students and faculty at other institutions. This will not include some of the materials such lab solutions but faculty at other institutions can obtain them via request.

At least one project team member will travel to disseminate this work at the ASEE Southeast Section Conference in Spring 2023. Initial assessment results and teaching strategies used with the materials will be shared with the faculty at other institutions at the above-mentioned conference.

# Creative Commons Terms

*I understand that any new materials or revisions created with ALG funding will, by default, be made available to the public under a Creative Commons Attribution License (CC-BY), with exceptions for modifications of pre-existing resources with a more restrictive license.*

# Accessibility Terms

*I understand that any new materials or revisions created with Affordable Learning Georgia funding must be developed in compliance with the specific accessibility standards defined in the Request for Proposals.*

# Letter of Support

*The Department Chair from the corresponding project, or the Department Chair’s direct report such as the Dean or Provost, must provide a signed Letter of Support for the project. This letter should acknowledge the following:*

* *The department will provide support for fund disbursement in correspondence with the Grants/Business Office.*
* *The department approves of the work on the proposal by the applicant(s).*
* *The department acknowledges the sustainability of the use of these affordable resources after the grant work is complete.*

*In the case of multi-institutional affiliations, all participants’ institutions must provide a letter of support.*

*Please provide the name and title of the department chair (or other administrator) who provided you with the Letter of Support.*

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| --- |
| Youakim Kalaani  Professor and Chair of the Dept. of Electrical and Computer Engineering |

# Grants or Business Office Acknowledgment Form

*Institutional Grants/Business Offices will be responsible for fund disbursement, often in correspondence with the Department Chair, including expense and travel reimbursement. All applicants will need to provide a signed Acknowledgement Form, the template for which is linked on the RFP page, stating that the Grants/Business Office knows about the applicant’s intent to apply for an Affordable Materials Grant. Either the Department Chair or the Project Lead can work with the Grants/Business Office to get this signed form.*

*In the case of multi-institutional affiliations, all participants’ institutions must provide this form.*

*Please provide the name and title of the grants or business office representative who provided you with the acknowledgement form.*

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| --- |
| Laura Regassa  Associate Provost for Research |