Affordable Materials Grants, Round 19:

Continuous Improvement Grants

(Spring 2021 -Spring 2022)

Proposal Form and Narrative

# Applicant and Team Information

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| --- | --- |
| Requested information | Answer |
| Institution | Kennesaw State University |
| Applicant name | Sandip Das |
| Applicant email | [sdas2@kennesaw.edu](mailto:sdas2@kennesaw.edu) |
| Applicant position/title | Associate Professor |
| Submitter name |  |
| Submitter email |  |
| Submitter position/title |  |

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| --- | --- | --- |
| Team member | Name | Email address |
| Team member 1 | Craig Chin | [cchin2@kennesaw.edu](mailto:cchin2@kennesaw.edu) |
| Team member 2 | Sheila Hill | [sdoneho1@kennesaw.edu](mailto:sdoneho1@kennesaw.edu) |
| Team member 3 |  |  |
| Team member 4 |  |  |
| Team member 5 |  |  |

If you have any more team members to add, please enter their names and email addresses in the text box below.

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# Project Information

| Requested information | Answer |
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| Type of Project | * *Revision of open educational resources (OER) used in existing courses* * *Creation of ancillaries for existing OER courses* |
| Requested Amount of Funding | *$6,500* |
| Course Titles and Course Numbers | Circuit Analysis – I (EE 2301) |
| Final Semester of Project | Spring 2022 |
| Currently Existing Resource(s) to be Revised/Ancillaries Created | EE 2301 – Laboratory Manual  [OneDrive Link to the existing Lab Manual](https://kennesawedu-my.sharepoint.com/:b:/g/personal/sdas2_kennesaw_edu/EYjMkiT48oNOrUKHGuLqTOQBK8Ln06jCN9OWpiHWInMWAg?e=MUB8Lf). |

# Project Goals

The goal of this project is to enhance the student learning experience and the associated learning outcomes by revising the current lab manual and creating new lab instructional and learning materials for a junior-level course, Circuit Analysis-I (EE 2301). This is a required and highly important course for students in three different degree programs at Kennesaw State University – Electrical Engineering, Computer Engineering and Mechatronics Engineering. The topics investigated via these lab materials are also relevant for required Electrical Engineering courses within the USG. Such courses include: Fundamentals of Circuit Analysis (ECSE 2170+L) at UGA, Circuit Analysis I (ENGR 2334) at GSU and Circuit Analysis (ENGR 2334) at GA Tech. The current lab manual is provided to students in electronic PDF document format, which saves students’ money by eliminating the need to purchase a lab manual/lab book from a publisher. However, substantial improvements of the existing lab manual/instructional materials are required to improve quality of delivery, student learning experience and learning outcomes.

In this project, we will transform the existing Circuits lab instructions/learning resources by modifying the [current lab manual](https://kennesawedu-my.sharepoint.com/:b:/g/personal/sdas2_kennesaw_edu/EYjMkiT48oNOrUKHGuLqTOQBK8Ln06jCN9OWpiHWInMWAg?e=MUB8Lf), creating datasheets for experimental data recording, integrating pre-lab simulation exercises using industry-standard [LTspice circuit simulator](https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html) and producing videos to assist with lab exercises and learning LTspice. Currently, the Circuits lab exercises are focused on experimental verification of the various circuit theories learned in the lecture part of the course – thus lacking the necessary instructions and learning resources to help develop circuit design skills that can connect to real-world applications of circuit analysis techniques. To improve this aspect, in this project, we aim to create two new additional “design and application”-oriented lab exercises to satisfy the dual objectives of requiring students use the engineering design process to complete the lab exercises (satisfying [ABET student outcome 2](https://www.abet.org/wp-content/uploads/2018/11/E001-19-20-EAC-Criteria-11-24-18.pdf)) and exposing students to more practical applications of circuit theory. Currently, 10 sections of EE 2301 are offered during regular Spring and Fall semesters. Each section has a capacity of 20 students. In addition, multiple sections (2-4) are offered during the Summer. Therefore, the efforts undertaken in this project are expected to benefit approximately 450 students taking this course every year at KSU as well as students from other USG institutions previously mentioned. The lab instructional materials created in this project will be scaled and implemented department-wide in all EE2301 sections offered at KSU.

# Action Plan

Our proposed Action Plan is divided into four major tasks as detailed below:

**Task 1.** *Modify current Lab Manual and create Datasheets:* We will fully revise to improve the current lab manual document. We will rewrite various sections of the manual as necessary and apply coherent formatting for improved clarity and make it interactive with hyperlinks for easy navigation and accessing relevant learning materials as students read through. In addition, we will create word/pdf data entry forms for in-lab and pre-lab data recording and data analysis applications. At present, students submit lab reports of their own without any lab-specific template. The newly developed datasheets will be specifically designed for each lab that will contain electronic forms and/or tables for experimental data entry and data analysis. This will provide a lab-specific template to better guide students to prepare their lab reports and improve in-lab efficiency, so that students can complete experiments in a timelier manner and streamline the electronic report preparation and submission process.

**Task 2.** *Develop LTspice-based pre-Labs and Video Tutorials:* Circuit simulation is an important skill for electrical, computer and mechatronics engineering graduates. We will develop pre-lab exercises based on the industry-standard LTspice circuit simulator and integrate the pre-labs with each hands-on lab exercise. To help students quickly explore and easily learn LTspice software, we will create a series of 10 LTspice video tutorials with Closed Captions.

**Task 3.** *Develop “Design and Application”-oriented Labs with Handouts:* We will develop two new lab exercises that are focused toward ‘Design’ and ‘Practical Applications’ of circuit analysis techniques. Some design problems will be kept open-ended. Hence, handouts will be prepared to provide information on general design principles/strategies and include examples of some completed practical design problems.

**Task 4.** *Create Introductory Videos for in-Lab exercises*: To better prepare students for the in-lab exercises, we will produce introductory videos (with Closed Captions) to complement each lab exercise, which will contain a quick review of theoretical background, information on in-lab equipment operation and data analysis methods.

This project is undertaken by three Electrical Engineering faculty at the Kennesaw State University – Sandip Das, Craig Chin, and Sheila Hill. Each will contribute equally and share the workload as indicated in the Table below:

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|  | **Task 1**  (Revise current Lab Manual and create Datasheets) | **Task 2**  (Develop LTspice pre-Lab exercises and video tutorials) | **Task 3**  (Develop two new ‘Design & App’ labs with Handouts) | **Task 4**  (Create introductory videos to assist with each lab exercise) |
| Sandip Das | × | × |  |  |
| Craig Chin | × |  | × |  |
| Sheila Hill | × |  |  | × |

# Timeline

Timeline for the completion of the stated tasks are projected as follows:

Task 1: Revise current Lab Manual and create Datasheets; Duration: May 2021 – Aug 2021.

Task 2: Develop LTspice pre-Lab exercises and video tutorials; Duration: Sep 2021 – Apr 2022.

Task 3: Develop “Design and Application”-oriented Labs with Handouts; Duration: Sep 2021 – Apr 2022.

Task 4: Create Introductory Videos for in-Lab exercises; Duration: Sep 2021 – Apr 2022.

Note that Task 2, 3 and 4 have same duration listed above since they will be performed concurrently by the three team members individually. The PI, Dr. Sandip Das will be coordinating with the other team members and schedule monthly team meetings to keep track of the project progress.

# Budget

The total requested budget for this project is $6,527. Each faculty will draw a summer salary of $2,000. (3×$2,000 = $6,000). $50 is requested to purchase miscellaneous circuit components (resistors, inductors, capacitors etc.) for the instructors (and student assistants) to develop new design labs. $477 is requested to purchase video production gears – a high quality video capable [digital camera](https://www.amazon.com/PANASONIC-Megapixel-VARIO-ELMARIT-Stabilization-DMC-ZS100K/dp/B010NU5AX8/) ($398) with a [tripod](https://www.amazon.com/Abithid-Professional-Portable-Aluminium-Camcorder/dp/B07GV8HGQX/) ($79) to produce professional quality videos by the instructors.

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# 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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| The Letter of Support from the Chair of the Electrical and Computer Engineering Department, KSU is attached with the application.  **Name of the Department Chair:** Benjamin Klein |

# Grants or Business Office Letter of Acknowledgment

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

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| --- |
| **Kimberly Hunt**, Grants and Contract Manager, Office of Research, Kennesaw State University. |