

## **GIFTS – Utilizing MATLAB’s Online Tutorial in First-Year Engineering Courses**

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Dr. Ashish Borgaonkar works as Asst. Professor of Engineering Education at the New Jersey Institute of Technology’s Newark College of Engineering located in Newark, New Jersey. He has taught several engineering courses primarily in the first year engineering, civil engineering, and mechanical engineering departments and won multiple awards for excellence in instruction. He also has worked on several research projects, programs and initiatives to help students bridge the gap between high school and college as well as preparing students for the rigors of mathematics. His research interests include engineering education, excellence in instruction, water and wastewater treatment, civil engineering infrastructure, and transportation engineering.

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## Introduction

Students typically do not have many opportunities to learn much about fundamental MATLAB knowledge until they take some higher-level engineering courses. Students then find themselves short on the basic skills they need to quickly adapt to the course material and succeed. We use Analytical Methods for Engineering Applications (ENGR 101) course, to introduce the basic knowledge of using MATLAB to the students. Starting this semester, in addition to the use of traditional lab instruction to teach MATLAB, we have started offering extra credit opportunity for students to complete MATLAB’s online teaching platform –Onramp. The idea came to the authors while attending the sponsored MATLAB workshop at 2018 FYEE conference.

## MATLAB Onramp and Its Implementation

The MATLAB Onramp is a free, self-paced, hands-on MATLAB online training course that takes about two hours to complete. There are eleven main topics introduced in the training as shown in Table I. The course starts by introducing some fundamental MATLAB commands, then focuses on importing and visualizing data. In the end, a final project where students can utilize and test the introduced skills is to be completed. The final project requires the students to use MATLAB to analyze the light recorded from a star to make a binary decision on if the star is moving towards or away from Earth.

In addition to the Onramp course, there are other similar courses available on the MATLAB academy training portal. These include MATLAB Fundamentals, MATLAB for Data Processing and Visualization, MATLAB Programming Techniques, Simulink Onramp etc.. Once finished with the MATLAB Onramp module, students are also encouraged to finish other trainings to continue their learning process.

| Topic                              | Description  |
|------------------------------------|--|
| Commands                           | Enter commands in MATLAB to perform calculations and create variables      |
| Vectors and Matrices               | Create MATLAB variables that contain multiple elements                     |
| Importing Data                     | Bring data from external files into MATLAB                                 |
| Indexing into and Modifying Arrays | Use indexing to extract and modify MATLAB arrays                           |
| Array Calculations                 | Perform calculations on entire arrays at once                              |
| Calling Functions                  | Call functions to obtain multiple outputs                                  |
| Obtaining Help                     | Use the MATLAB documentation to discover information about MATLAB features |

|                |   |
|----------------|---|
| Plotting Data  | Visualize variables using MATLAB's plotting functions |
| MATLAB Scripts | Write programs in script                              |
| Logical Arrays | Use logical expressions in MATLAB                     |
| Final Project  | Bring together the introduced concepts with a project |

Table I: Main topics of MATLAB Onramp training

The students receive a course certification from MathWorks by completing this online training. We offered an extra credit incentive in our first-year analytical methods for engineering applications course to encourage the students to participate and learn more about MATLAB by using the Onramp training platform.

### Results and Conclusion

Majority of the students (70% of the class) finished the Onramp training and reported that the MATLAB Onramp training platform is very helpful for learning MATLAB. A survey was conducted at the end of the semester. The survey asked students to pick an option on the Likert scale (1-5) for the following statements:

1. The MATLAB Onramp platform is helpful for learning basics of MATLAB.
2. I will continue to explore other tutorials available on this online platform to gain further expertise.
3. I recommend using the online training platform for first-year engineering students.

As shown in Fig. 1, results show that students greatly appreciate the training provided by the Onramp platform. Most of the students would like to explore more training content available on the MATLAB training platform. We plan to extend this activity to our fall student population, which is a much larger class.

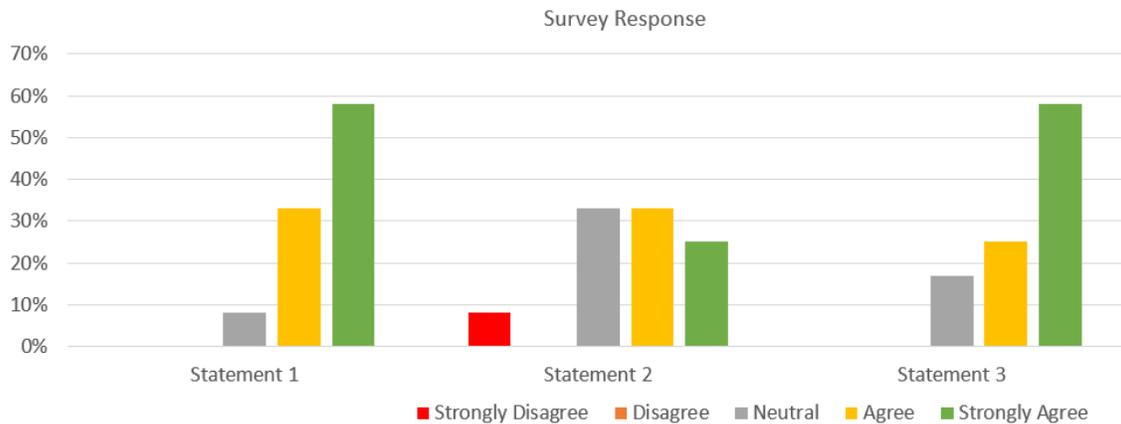


Figure 1. Response collected from the post-survey