

RESEARCH EXPERIENCES FOR TEACHERS – SUMMER 2022

Enhancing Teacher Knowledge & Skills in Modern Manufacturing

Update: 6jun22

Project #1: Traditional Manufacturing – 12 teachers

- 1) Focus: 3-weeks on fundamentals of traditional manufacturing processes, materials, and metrology.
- 2) Lab training and integrated project:
 - Safety rules.
 - Technical drawing: Orthographic sketching. Sectioning. Dimensioning.
 - Metrology: Hand tools and systems for measurement of dimension, form, and surfaces.
 - Lab practice: Fabricate a 3D star and customized pen-holder set.
 - Computer-aided machining: computer-aided drafting (CAD) and machining (CAM). Fusion 360 and NC code generation. CNC engraving.
 - Integrated project: this exercise combines all lessons and labs to solve a problem. The final solution will be presented during the last week. Some components may be fabricated during 4th-5th weeks using available processes and materials. See details in appendix.
- 3) Authentic research experience: Participants will gain basic manufacturing skills and safety knowledge; understand the relationship between material and process.
- 4) Equipment:
 - Fabrication: Manual lathe, saw, drill, buff, mill, brake, shear, resistance spot welder, CNC mill, Fusion 360 software.
 - Metrology: Calipers, micrometer, indicator, height gage, go/no-go gage, measuring microscope, surface profilometer, optical profile projector, 3D digital profiler, coordinate measuring machine.
- 5) Expected outcomes: At the end of this training, the participants should:
 - Be technically competent using basic metrology tools.
 - Experience with manual machine tools, stamping equipment and typical operations.
 - Understand basic commands of Fusion360 software and CNC principles.
 - Understand and practice design process.
 - Have the first draft of curriculum integration

Date	Topic	By	Location
Mon Jun 6 9am 12pm 1pm	Orientation: introduction, program overview and expectations, stipends, accommodation, parking, recreation center, library, lab safety, guest wifi, assessment/feedback, research, curriculum integration, assessment, pre/post-program surveys, poster, field trip... Lunch break Lec 1: Design process. Project assignments	All Wayne	122 Thom
Tue Jun 7 9am 12pm 1pm	Lec 2: Metrology Lunch break Lec 3: Machining theory 1/3	Wayne Wayne	122 Thom
Wed Jun 8 9am. 12pm 1pm	Lec 3: Machining theory 2/3 Lunch break Lec 3: Machining theory 3/3	Wayne Wayne	122 Thom

Thu Jun 9 9am 12pm 1pm	Lec 4: Engineering materials Lunch break Lab 1: Metrology-1	Wayne Anthony	Lab @112A
Fri Jun 10 9am 12pm 1pm	Lab 1: Metrology-2 Lunch break Design project 1: pen holder set	Anthony Wayne	Lab @112A
Mon Jun 13 9am 12pm 1pm	Lab 2: Stamping Lunch break Lec 5: Stamping	Anthony, Wayne Wayne	Lab @110
Tue Jun 14 9am 12pm 1pm	Lab 4: Machining-1 Lunch break Lec 5: Technical sketching 1/3	Anthony Mathew	Lab @112
Wed Jun 15 9am 12pm 1pm	Lab 4: Machining-2 Lunch break Lec 5: Technical sketching 2/3	Anthony Mathew	Lab @112
Thu Jun 16 9am 12pm 1pm	Lab 4: Machining-3 Lunch break Lec 5: Technical sketching 3/3	Anthony, Jacob Mathew	Lab @112
Fri Jun 17 9am 12pm 1pm	Lab 4: Machining-4 Lunch break Design project 2: Drone attachment	Anthony, Jacob Wayne	Lab @112 Thom
Mon Jun 20 9am 12pm 1pm	Lec 6: Computer-aided drafting 1/3 Lunch break Lec 6: Computer-aided manufacturing	Jacob	Lab @115B
Tue Jun 21 9am 12pm 1pm	Lec 6: Computer-aided drafting 2/3 Lunch break Lec 6: Computer-aided manufacturing	Jacob	Lab @115B
Wed Jun 22 9am 12pm 1pm	Lec 6: Computer-aided drafting 3/3 Lunch break Lec 6: Computer-aided machining 1/2	Jacob	Lab @115B
Thu Jun 23 9am 12pm 1pm	Lec 6: Computer-aided machining 2/2 Lunch break Lab 5: CNC engraving	Jacob	Lab @115B
Fri Jun 24 9am 12pm 1pm	Lab 5: CNC engraving Lunch break Mid-program assessment. Feedback.	Jacob Shelly	Lab @115B

APPENDIX: Integrated design and fabrication project

A drone is given to each participant. Members can work individually or in a team of two to solve a problem.



Fig. 1. A robust drown with built in propeller protection for safety.

[www.amazon.com/Upgraded A20 Mini Drone](http://www.amazon.com/Upgraded-A20-Mini-Drone)

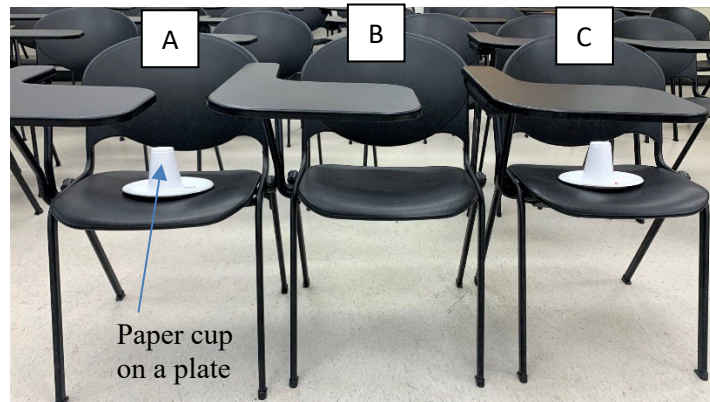


Fig. 2. Drone task and flight path

Problem: Fly a drone to pick and place a paper cup.

Apply the design process for this assignment. Maneuver your drone (Fig. 1) to pick up a paper cup on chair A, fly it underneath chair B, and then place (release) the cup on a plate on chair C before flying away (Fig. 2).

Constraints:

- a) Your design must be safe for demonstration. No fire or toxic chemical is allowed.
- b) You may modify a cup within 2 minutes and have 3 minutes to complete an attempt.
- c) The cup is positioned down on a plate at each chair A and C. The provided plastic plates are heavy enough so they will not be blown away by the approaching drone.
- d) A team will have 3 attempts. The best attempt is recorded with the shortest time and showmanship to complete the task.
- e) An attempt is a failure if battery is drained out during flight, or the drone is malfunctioned.
- f) Although the team can use lab and available materials to modify a cup or drone, no budget is provided for fabrication or purchasing additional materials.

Judging criteria:

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|--------------------|-------|
| 1) Task completion | 40pts |
| 2) Shortest time | 20pts |
| 3) Showmanship | 20pts |
| 4) Workmanship | 20pts |