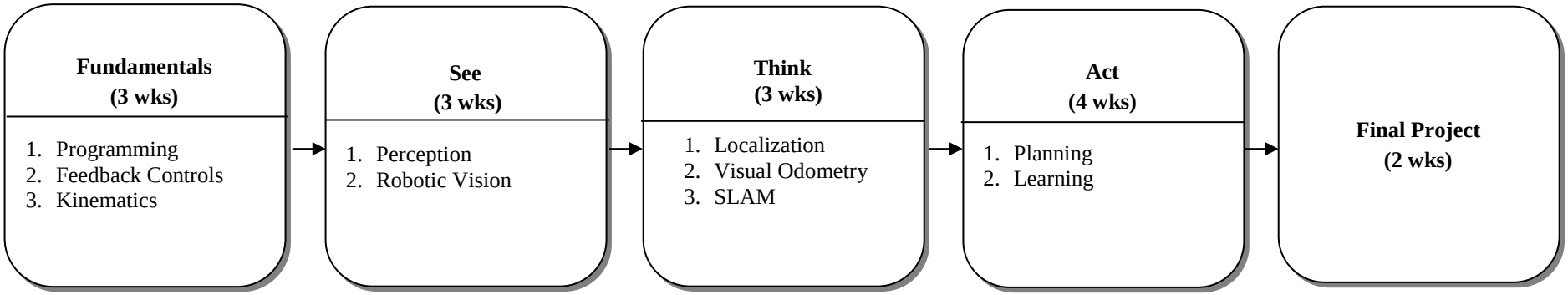
ME 59700
AUTONOMOUS SYSTEMS

Course Outcomes [Related ME Program Outcomes in brackets]

1. Learn how autonomous mobile robots interact with the world through the see-think-act cycle. [1,2]
2. Discuss breadth of robotics system tools particularly those related to timely research developments. [2,7]
3. Introduce perception, localization, and planning foundation for autonomous mobile systems. [1,7]
4. Gain hands-on knowledge of autonomy concepts and develop creative problem solving skills. [6,7]
5. Implement ideas presented in the course into a comprehensive, hands-on final project. [6,7]



Laboratory Experiments

1. Basics of Programming and Robot Operating System (Week 1)
2. Timing based Control (Week 2)
3. Obstacle Avoidance (Week 3)
4. Robotic Vision (Week 4-6)
5. Visual Odometry (Week 8-9)
6. Path Planning (Week 10-11)
7. Final Project (Week 12-15): Use ROS, computer vision, and high level planning to autonomously negotiate a challenging course based on a model town. This project requires a thourough understanding of the see-think-act cycle. The aquired knowledge in perception, localization, and planning will form a foundation that enables students to contribute to robotics research or work in industry.

Revision Date: 09/13/19

COURSE NUMBER: ME 59700

COURSE TITLE: Autonomous Systems

REQUIRED COURSE OR ELECTIVE COURSE: Elective

TERMS OFFERED: Spring

TEXTBOOK/REQUIRED MATERIAL: "Introdution to Autonomous Mobile Robots" by Siegwart, Nourmakhsh, and Scaramuzza

PRE-REQUISITES: ME37500

COORDINATING FACULTY: N. Mahmoudian

COURSE DESCRIPTION: This course introduces key concepts for developing an autonomous mobile system. The lecture focuses on studying the see-think-act cycle of robotics and presents topics at a survey level to provide an overview of knowledge and an opportunity for in depth learning. In the lab component, students learn to program an autonomous system on their own: developing software, implementing into the hardware, and testing and trouble shooting. The intensive final project takes 4 weeks and involves students programming their system to perform multiple tasks continously. For example, having their cars navigate autonomously through a model town.

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ASSESSMENTS TOOLS:

1. Weekly Pre-Labs and Labs
2. Homework
3. Mid-term and Final Exam
4. Final Project

PROFESSIONAL COMPONENT:

1. Engineering Topics: Engineering Science – 1.5 credits (50%)
   Engineering Design – 1.5 credits (50%)

RELATED ME PROGRAM OUTCOMES:

1. Engineering fundamentals
2. Engineering design
3. Communication skills
4. Ethical/Prof. responsibilities
5. Teamwork skills
6. Experimental skills
7. Knowledge acquisition

NATURE OF DESIGN CONTENT: Weekly labs requires students to develop Python code to interface with sensors, decide on actions, and actuate components. Labs will progress in complexity and design freedom through the semester, culminating in an open ended challenge for the final project: create a robot that can autonomously navigate through a model town while obeying traffic laws. While standard car kits will be provided, customization is encouraged to maximize information gained from sensors.

COMPUTER USAGE: Weekly labs will be completed using individual robotic car kits based on the Raspberry Pi platform. The labs will progress through the semester from fundamentals to full autonomy. Programming will be completed in Python using the Robot Operating System.

COURSE STRUCTURE/SCHEDULE:

1. Lecture – 2 days per week at 50 minutes.
2. Lab – 1 day per week at 150 minutes.

PREPARED BY: N. Mahmoudian

REVISION DATE: **Oct** 10, 2019