**Auburn Institute Summer 2024 Short Course Program**

**Course 1: Introduction to Smart Agriculture**

**Credits:** This is a 1-credit class with 16 contact hours.

**Time:** The course will be daily (M-F) from 9:00 am-10:30 am from July 10-23, 2024 on the HZAU campus.

**Prerequisites:** all undergraduate or graduate students

**Description:** As the world continues to grow and prosper, we must produce food more efficiently than ever before. Smart Agriculture (SA) is defined as applying the right amount of inputs at the right place at the right time. SA has emerged as the next concept in food production, especially in developed nations. It combines sensors, remote sensing techniques, variable rate equipment and big data concepts to improve the efficiency of crop production. In this class, we will explore farming at different spatial scales, yield monitors, global positioning systems, sensors, causes of spatial yield variability, soil sampling, remote sensing, unmanned aerial vehicles, variable rate fertilizer and irrigation and crop modeling.

**Course 2: Environmental Soil Physics**

**Credits:** This is a 2-credit class with 32 contact hours.

**Time:** The course will be daily (M-F) from 9:00 am-12:00 am from July 10-23, 2024 on the HZAU campus.

**Prerequisites:** all students 3rd year or higher who have taken a physics and a soils class.

**Description:** Soil physical properties, transport of water, heat, and gas through soils. Soil-plant-atmosphere-continuum and processes in agricultural, urban, and natural land uses. Field instrumentation, measurement, and assessment of physical properties. Special emphasis is given to the role of water in soils as soil water affects other physical properties such as thermal, gas, mechanical, etc.

**Course 3: Microbiology in Biotechnology**

**Credits:** This is a 2-credit class with 32 contact hours.

**Time:** The course will be daily (M-F) from 13:30-16:30 pm from July 10-23, 2024 on the HZAU campus.

**Prerequisites:** all students 3rd year or higher, a Biology class and preferably a class in genetics

**Description:** Scientists and biotechnologists continually push boundaries by developing new genetically modified organisms. We live in an age where we can create novel biological organisms for utilitarian purposes. In molecular biology, microbial organisms are often the interface through which we design, build, construct, and apply these genetic modifications.  Furthermore simple microbes like *E.coli* and baker’s yeast are cellular models that reflect consistent patterns in biology. This short course will outline basics of microbiological biotechnology. Lecture topics will cover applications of *Escherichia coli*, *Saccharomyces cerevisiae*, *Wolbachia,* *Bacillus*, *Mycoplasma* and *Serratia* amongst others. Techniques covered will include introductions to genetic modification of prokaryotes and eukaryotes, recombinant protein expression, paratransgenesis, symbionts, plasmid construction, CRISPRcas9, and RNAi. Assignments will include reading and discussing primary literature articles (in English) and designing PCR primers to create genetic modifications. The course will be offered in an online lecture format. Lectures will be recorded and made available to students for further study and review. Two exams will be given to split the course content into two halves. The first mid-term will be administered on the median day of the course and the final exam on the last.

**Course 4: Humans and the Environment**

**Credits:** This is a 2-credit class with 32 contact hours.

**Time:** The course will be daily (M-F) from 13:30-16:30 pm from July 10-23, 2024 on the HZAU campus.

**Prerequisites:** 3rd year undergraduates and higher.

**Description:** Human activities created environmental challenges, from the degradation of soils in the Fertile Crescent by the earliest civilizations to the current global climate changes. This course will introduce the fundamental concepts in environmental science, including ecosystem services, the nature of systems and climate processes, food production, climate change mitigation, sustainability, and pollution control. Each topic will be explained through scientific reasoning, data exploration, and practical case studies. Emphasis will be given to developing critical thinking synthesis of multiple fields of interest (science, economics, and policy) and on a global perspective. Throughout the course, students will reflect upon their role in the environment.

**Course 5: Operations Research Methods**

**Credits:** This is a 2-credit class with 32 contact hours.

**Time:** The course will be daily (M-F) from 9:00 am-12:00 pm from July 10-23, 2024 on the HZAU campus.

**Description:** Introduction to mathematical programming, emphasizing modeling, interpretation and problem analysis. The primary focus of the course will be on linear programming methods including integer programming and MOTAD modeling. Access to Microsoft Excel is required.

**Course 6: Introduction to Ethics**

**Credits:** This is a 2-credit class with 32 contact hours.

**Time:** The course will be daily (M-F) from 13:30-16:30 pm from July 10-23, 2024 on the HZAU campus.

**Description:** Major ethical theories from the history of philosophy, their foundations in epistemology and metaphysics, and their extension into social thought.