

## **Applied Microbiology: 11:680:494**

### **Description:**

Applied Microbiology is a 4 credit course with two 1 hour 20 min lectures plus a 3 hour laboratory class per week. This is a lecture plus laboratory course which is offered each Fall semester.

This course covers principles of applied microbiology and microbial technology. The course provides an overview on the utilization and application of microbes in different products and processes, and the importance of disease causing organisms as they relate to these processes and public health.

### **Prerequisites and Registration Restrictions:**

Pre-requisites: 11:680:390 General Microbiology, or approved equivalent course.

### **Faculty:**

Dr. Max Haggblom: Rm. 121, email: [haggblom@aesop.rutgers.edu](mailto:haggblom@aesop.rutgers.edu)

### **Text:**

**Industrial Microbiology. An Introduction** (M.J. Waites, N.L. Morgan, J.S. Rockney & G. Highton) Blackwell Science Publishers, 2001; ISBN 0-632-05307-0.

### **Laboratory Manual:**

Diane Davis & Ines Rauschenbach. *Applied Microbiology Laboratory Exercises*, Department of Biochemistry and Microbiology. Available through the Department of Biochemistry and Microbiology.

### **Electronic Notebooks:**

Ipads are provided in the laboratory to keep an electronic notebook. Students are responsible for the cost of the LabArchives platform. Details will be provided before the semester begins.

### **Grading:**

Class grade is based on three examinations (75%) and an aggregate laboratory assessment (25%). The examinations have a short and extended answer format with some calculations. The laboratory grading is an

aggregate assessment based on reports and quizzes throughout the semester in combination with a practical laboratory examination. The laboratory section of the course is an integral component. A student must satisfactorily complete the laboratory section in order to pass the class.

### **Overall Learning Goals:**

Students are expected to gain a fundamental understanding of how microorganisms are utilized and controlled for the benefit of humankind and develop the laboratory skills needed to study these applications.

### **Learning Goals for Applied Lecture:**

#### **After completion of the lecture component of the course, successful students will be able to:**

1. Summarize and explain the roles of microbes in industrial and food processes
2. Relate their knowledge of traditional microbiological techniques to the utilization and control of microorganisms.
3. Calculate and evaluate microbial growth and death rates.
4. Assess the use of microbes as tools in biotechnology.
5. Describe microbial biochemical pathways and relate them to important industrial processes.

### **Learning Goals for Applied Microbiology Laboratory:**

After completion of this laboratory, students should be able to:

1. Show the ability to efficiently and independently use a phase contrast microscope to observe microorganisms and be able to describe observed characteristics.
2. Relate their knowledge of traditional microbiological techniques to how microorganisms are utilized and controlled
3. Select appropriate traditional and molecular biological methods to study and characterize microbial isolates
4. Demonstrate aseptic technique to handle cultures, microbiological media, and environmental samples safely and effectively.
5. Choose various statistical and mathematical methods to critically evaluate data
6. Devise experiments according to the scientific method and collect, interpret, and present scientific data in microbiology and related fields

## Lecture Topics

1	Introduction to course, Historical perspective
2	Microbial Diversity: physiology & ecology; Industrial microbes
3	Identification of microorganisms, Culture collections
4	Microbial growth and nutrition: environmental conditions
5	Microbial growth: measurement & kinetics; Bioreactors
6	Microbial death and control: physical/chemical methods, preservation
7	Food spoilage
8	Food borne illnesses: <i>Salmonella</i> , <i>E. coli</i> O157:H7 and others
9	Food microbiology, lactic acid fermentations
10	Fermented milk products
11	Yeasts & fermentation: anaerobic metabolism, alcohol
12	Alcoholic fermentations and beverages: beer, wine
13	Industrial microbiology: production of diverse metabolites
14	Antibiotics
15	Enzymes - Metabolic review
16	Large scale fermentations
17	Microbial biomass production, Single cell protein
18	Sanitation, Water quality testing, Water treatment
19	Microbial aerosols, sick-building syndrome
20	Environmental biotechnology - Wastewater treatment technologies
21	Environmental biotechnology - Bioremediation and other technologies
22	Environmental biotechnology - Metal leaching & mining technologies
23	Bioenergy
24	Applications of our microbiomes