

Course Code	Course Title	Credit Hours
ENS-823	Applied Environmental Microbiology	3 (2+1)

### Course Description

The course is designed to disseminate the best available information about the genetics, biochemical, environment and agriculture related properties of the microorganisms and their possible exploitation in the production of food, vaccines, fermented products, antibiotics, diseases resistant crops, bioremediation, solid waste treatment and other similar areas in the most efficient and economic manner.

### Course Outline

**Fermentation Technology:** Stages of fermentation process, Isolation, screening, preservation and improvement of industrial microorganisms, Media formulation, Sterilization, Inoculum development- The range of fermentation process, Submerged, Solid state fermentation The chronological development of the fermentation industry, The component parts of a fermentation, process Continuous culture, Fed-Batch culture, Chemo stat culture.

**Process Engineering:** Bioreactor- Design, Operation, Cell Harvesting, and Disruption, Product recovery and Purification, Instrumentation and Process Control, Types of bioreactors.

**Fermentation Products:** Alcohols, Alcoholic beverages, Organic acids, Polysaccharides, antibiotics, Vitamins, Fermented Foods, Organic acids

**Environmental Aspects:** Mineral leaching with bacteria, microorganisms involved in the sulfide mineral leaching, chemistry of sulfide mineral oxidation by bacteria, exploitation of bacterial sulfide mineral oxidation, dump and heap leaching, in-situ bacterial leaching of ore, mineral concentrate-leaching - utilization of bacterially generated solvents, heavy metal pollutants removal by bioaccumulation, Degradation of toxic wastes, mechanisms of detoxification, biotechnological remedies, waste recovery, single cell protein, biogas technology.

**Bioremediation:** Microbial control of environmental pollution, Transport and fate,

Biodegradation, microbial activities and Environmental effects on biodegradation, transformation of metal pollutants, Phytoremediation: Mechanisms involving removal of hazardous compounds and heavy metals from soil and water.

### **Lab work**

Production of Fermented Food Tempeh, Water analysis, Isolation and screening of metal resistant bacteria, Isolation and screening of metal resistant fungi, Demonstration of Fermenter, Sterilization Techniques, Identification of microbes, Small (short term) Projects

### **Recommended Books**

1. Patrick, K. J. (2004). Environmental Microbiology Principles and Applications. Biological Sciences Department, University of Cincinnati, Cincinnati, Ohio, USA.
2. Glazer, A. N. (2007). Microbial Biotechnology: Fundamentals of Applied Microbiology (2nd ed). Hiroshi Nikaido, Cambridge University Press, New York, USA.