

# SRI KRISHNADEVARAYA UNIVERSITY :: ANANTAPUR

## DEPARTMENT OF BIOTECHNOLOGY

### M.Phil/Ph.D. Written Examination

#### Broad Area of Research: **INDUSTRIAL AND MICROBIAL BIOTECHNOLOGY**

#### Syllabus for Paper II : Special Paper

**Microbial Diversity** – Prokaryotes (Archaeobacteria, Eubacteria) and eukaryotes. Taxonomic diversity of useful microorganisms. Microbial diversity as rich sources of specific and useful products. Improvement of industrial microorganisms by genetic and recombinant methods. Genetics and molecular biology of *Streptomyces* sp., *Bacillus* sp., *Saccharomyces* sp., and *Aspergillus niger*. Maintenance and preservation of strains of industrial importance.

**Upstream processing** – Raw material selection, carbon sources, energy sources, nitrogen sources, non-nutritional supplements, addition of precursors and metabolic regulators to media, Medium formulation and sterilization of nutrient solutions.

**Fermentor** – Basic design of fermentor for microbial, animal and plant cell cultures. Different types of fermentors, sterilization of fermentors, Growth kinetics of microorganisms. Preparation of inocula for fermentation. Fermentation processes – submerged and solid state fermentation. Control of process variables – pH, O<sub>2</sub> and temperature. Stirring and mixing, gas exchange and mass transfer. Manual and automatic control, use of computers in control of variables.

**Downstream processing** – Recovery and purification of fermentation products. Harvesting of microbial cells – Filtration, centrifugation, processing of microbial cells. Cell disruption methods. Extraction methods. Liquid-liquid extraction of chromatographic methods, Membrane process, Drying, Crystallization, whole broth processing.

**Production of microbial insecticides** – *Bacillus thuringiensis* and its crystalline inclusion bodies, endotoxins, *Bacillus sphaericus*, *Bacillus popilliae*. Baculoviruses – Biology of baculoviruses, baculoviruses as insecticides.

**Production of Microbial enzymes** – Cellulases, Glucose isomerases, Pectinases, Laccase, Glucose oxidase. Stabilization of enzymes, applications of microbial enzymes. Immobilized enzymes – Methods of immobilization, Comparison of kinetics of immobilized and free enzymes, Large-scale applications of microbial enzymes.

**Production of fuels from biomass** – Basic components of plant biomass – cellulose, hemicellulose and lignin. Architecture and composition of wood cell. Feed stocks to fermentable sugars, Sugars to alcohol – *Saccharomyces* and *Zymomonas mobilis*.

**Production of amino acids** – Production of amino acids by wild type strains and recombinant strains – Tryptophan, L-lysine L-Glutamic acid.

**Production of organic acids** – Citric acid, Itaconic acid, Lactic acid, Kojic acid.

**Production of microbial polysaccharides and polyesters** – Bacterial polysaccharides – Xanthan gum, Polyhydroxyalkanoates (biodegradable polymers), random copolymers of 3-hydroxy butyrate and 3-hydroxyvalerate. Genetic engineering of microorganisms for 3-hydroxyalkanoate.

**Production of antibiotics** – Classes of antibiotics – Antibacterial agents, antifungal agents and antitumor antibodies. Production of aminoglycosides and  $\beta$ -lactam antibiotics.

**Microbial transformation of steroids and sterols** – Types of bioconversions, procedures for biotransformation, transformation of steroids.

**Single Cell Protein** – Production of single cell protein from alkanes, wood and carbohydrates.

**Microorganisms in minerals recovery** – Organisms for leaching, chemistry of microbial leaching and commercial processes.

**Production of proteins and recombinant vaccines** – Impact of biotechnology on vaccine development, subunit vaccines for Hepatitis B, peptide vaccine for FMDV. Yeasts as living factories for production of macromolecules.