UNIT I: Biofertilizers

Introduction, History, Concept, and Scope in India

- **Introduction**: Definition and significance of biofertilizers.
- **History**: Development and evolution of biofertilizers globally and in India.
- **Concept**: Principles underlying the use of biofertilizers in agriculture.
- **Scope**: Potential and prospects of biofertilizers in India.

Classification and Microorganisms Used

- **Classification**:
  - Bacterial Biofertilizers: Rhizobium, Azotobacter, Azospirillum.
  - Fungal Biofertilizers: Mycorrhizae, Trichoderma.
  - Algal Biofertilizers: Blue-green algae, Azolla.

Symbiotic and Asymbiotic Microorganisms

- **Symbiotic Microorganisms**: Rhizobium-legume symbiosis.
- **Asymbiotic Microorganisms**: Free-living nitrogen fixers like Azotobacter.

Mechanism of Nodulation and Nitrogen Fixation

- **Nodulation**: Process of nodule formation in leguminous plants.
- **Nitrogen Fixation**: Conversion of atmospheric nitrogen into ammonia by microorganisms.

UNIT II: Mycorrhizal Biofertilizers (10 hours)

Importance and Types

- **Importance**: Role of mycorrhizae in enhancing plant nutrient uptake and soil health.
- **Types**:
  - Ectomycorrhizae: Characteristics and plant associations.
  - Endomycorrhizae (Arbuscular Mycorrhizae): Characteristics and plant associations.

Mechanism of Phosphorus Solubilization

- **Mechanism**: How mycorrhizal fungi solubilize and mobilize phosphorus in soil.

Uptake of Phosphates by Roots

- **Process**: How plants uptake phosphorus through mycorrhizal associations.

Consortium-Based Inoculums and Significance

- **Consortium-Based Inoculums**: Use of multiple microbial strains to enhance efficacy.
- **Significance**: Benefits of using consortium-based inoculums in agriculture.

UNIT III: Biopesticides (10 hours)

Definition, Concept, History, Scope, and Importance

- **Definition**: What are biopesticides?
- **Concept**: Basic principles of biopesticide use.
- **History**: Development of biopesticides over time.
- **Scope**: Potential applications and market scope.
- **Importance**: Environmental and agricultural benefits of biopesticides.

Classification

- **Botanical Biopesticides**: Neem, pyrethrin.
- **Bacterial Biopesticides**: Bacillus thuringiensis (Bt).
- **Fungal Biopesticides**: Trichoderma viride.
- **Viral Biopesticides**: Nuclear polyhedrosis virus (NPV).

Mechanism of Action

- **Bacillus thuringiensis**: Mode of action as a biocontrol agent.
- **Trichoderma viride**: Mode of action as a biocontrol agent.

UNIT IV: Mass Production Techniques (10 hours)

Media and Preparation

- **Media Types**: Various media used for culturing microorganisms.
- **Preparation**: Techniques for preparing culture media.

Methods of Isolation and Identification

- **Isolation Techniques**: Streak plate, spread plate, and pour plate techniques.
- **Purification and Identification**: Methods to purify and identify biofertilizer and biopesticide microorganisms.

Mass Production and Packing Techniques

- **Mass Production**: Scaling up the production of microorganisms.
- **Packing Techniques**: Methods for packing biofertilizers and biopesticides to ensure viability.

UNIT V: Field Application Methods (10 hours)

Preparation of Carrier-Based Inoculum

- **Carrier Materials**: Use of sphagnum, peat, and vermiculite as carriers.
- **Preparation Techniques**: Methods to prepare carrier-based inoculums.

Dosage Standardization

- **Dosage**: Determining the appropriate dosage for various applications.

Application Techniques

- **Seed Treatment**: Methods for treating seeds with biofertilizers/biopesticides.
- **Foliar Application**: Applying biofertilizers/biopesticides to plant leaves.
- **Root Dressing**: Applying directly to plant roots.
- **Soil Application**: Incorporating biofertilizers/biopesticides into the soil.

Storage and Maintenance of Inoculum

- **Storage**: Optimal conditions for storing inoculums.
- **Maintenance**: Ensuring the long-term viability and efficacy of inoculums.