

**SRI KRISHNADEVARAYA UNIVERSITY:: ANANTAPURAMU**

**REVISED SYLLABUS OF  
ORGANIC FARMING COURSES  
Under C.B.C.S. pattern  
(w.e.f. 2020-'21 Academic Year)**

**The Commissionerate of Collegiate Education  
Government of Andhra Pradesh  
Vijayawada**

**REVISION OF ORGANIC FARMING COURSES UNDER C.B.C.S.  
W.E.F.2020-21**

Semester	Course	Title of the Course	Hrs./ Week	Credits	CCE	E.E.	Total
<b>FIRST YEAR</b>							
Sem.-I	1	Basics concepts of Organic Farming	4	4	25	75	100
		Basic concepts of Organic Farming Practical	2	1	-	50	50
Sem.-II	2	Practices in Organic Farming	4	4	25	75	100
		Practices in Organic Farming Practical	2	1	-	50	50
1 <sup>st</sup> Internship: Community Oriented Project Work (02 months) during the Summer vacation							
<b>SECOND YEAR</b>							
Sem.-III	3	Fundamentals of Soil Microbiology	4	4	25	75	100
		Fundamentals of Soil Microbiology Practical	2	1	-	50	50
Sem.-IV	4	Principles of Agronomy	4	4	25	75	100
		Principles of Agronomy Practical	2	1	-	50	50
	5	Biofertilizers and Biopesticides	4	4	25	75	100
		Biofertilizers and Biopesticides Practical	2	1	-	50	50
2 <sup>nd</sup> Internship: Community Oriented Project Work (02 months) during the Summer vacation							
<b>THIRD YEAR</b>							
Sem. -5	6	Domain related Skill Enhancement Courses (02). Three (3) pairs of courses (each pair has 2 related courses) will be offered, student has to choose a pair of courses.	4	4	25	75	100
			2	1	-	50	50
	7		4	4	25	75	100
			2	1	-	50	50
Sem.-6	8	Apprentice/On Job Training for 06 months	-	-	-	-	-

**CBCS / Semester System (w.e.f. 2020-'21 Admitted Batch)**  
**I Semester /Organic Farming Core Course - 1**  
**Basic concepts of Organic Farming**  
(Total hours of teaching – 60 @ 04 Hrs./Week)

**Theory :**

**Learning Outcomes :** On successful completion of this course, the students will be able to :

- Develop a critical understanding of ill effects of conventional farming and benefits of organic farming.
- Demonstrate skills on different composting methods.
- Explain the various methods for crop protection.
- Acquire managerial skills of organic farming.

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**Unit – 1 : Introduction to Organic Farming** **12 Hrs.**

1. Organic farming: Introduction and status.
2. Organic farming and its components.
3. Organic farming - Concepts and principles.
4. SWOT Analysis of Organic Farming.

**Unit – 2 : Sustainable Agriculture** **12 Hrs.**

1. Sustainable Agriculture.
2. Key indicators of sustainable agriculture.
3. Organic farming and climate change.
4. Principles of compost production.

**Unit – 3 : Vermicompost Production Technology** **12 Hrs.**

1. Vermicompost production technology.
2. Enriched Vermicompost production technology.
3. Vermicompost quality and marketing.

**Unit – 4 : Crop Protection** **12 Hrs.**

1. Introduction to pest and disease Management.
2. Pest and disease management in organic farming – preventive methods.
3. Pest and disease management in organic farming – physical and mechanical methods.
4. Pest and disease management in organic farming using allowed bio-pesticides.

**Unit – 5 : Basics of Organic Crop Management** **12 Hrs.**

1. Introduction to Organic Crop Management – land preparation, planting technic, nutrient management.
2. Factors considered for nutrient management; recommended nutrient quantity – blanket, major problems; balance sheet method.
3. Nutrient composition of some organic resources, right timing of nutrient application.
4. Right method of nutrient application, nutrient use efficiency.

## Books for Reference :

- **Rana, S.S., 2016.** Organic Farming, CSK Himachal Pradesh KrishiVishvavidyalaya, Palampur
- **MamtaBansal, 2020.** Basics of Organic Farming, CBS Publihers and Distributors Pvt.Ltd., New Delhi
- **Palaniappan, S.P., & .Annadurai, 2016.**Organic Farming : Theory and Practice, Scientific Publishers, Jodhpur
- **Reddy, S.R., 2017.** Principles of Organic Farming, Kalyani Publishers, New Delhi
- Organic Farming for Sustainable Agriculture, <https://nptel.ac.in/courses/126/105/126105014/#>

### **Practical syllabus of Organic Farming Core Course – 1/ Semester – I**

#### **Basic concepts of Organic Farming**

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs./Week)

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**Course Outcomes:**On successful completion of this course students shall be able to :

- Identify various sources of organic manures and can apply them in farming.
  - Prepare FYM and compost and use them for organic farming.
1. Study of various implements used in Agriculture.
  2. Study of different green manures and their morphological features.
  3. Studying the earth worm species used to make vermicompost.
  4. Studying various types of organic manures.
  5. Trench method of preparing Farm Yard Manure (FYM).
  6. Quality and composition of FYM.
  7. Composting –Bangalore process.
  8. Composting – Coimbatore process.
  9. Making a vermicompost bed and vermicompost pit.
  10. Steps in making vermicompost (bed and pit method), harvesting and precautions.

### **Model Question Paper for Practical Examination**

Semester – I/ Organic Farming Core Course – 1

#### **Basic concepts of Organic Farming**

Max. Time: 3 Hrs.

Max. Marks: 50

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1. Experiment 'A' (Demonstrate procedure for preparing farm yard manure.) 10 M
2. Experiment 'B' (Demonstrate a process of composting.) 10 M
3. Experiment 'C' (Demonstrate procedure of making vermicompost bed/pit or steps in making vermicompost) 10 M
4. Identify the following and justify with reasons 2 x 5 = 10 M

- D. Implement used in Agriculture
  - E. Green manure/organic manure
5. Record + Viva voce 5 + 5 = 10

**Suggested co-curricular activities for Organic Farming Core Course -1 in Semester-I:**

**A. Measurable :**

**a. Student seminars :**

1. Historical account of Organic Farming.
2. Ideological differences between organic and conventional (chemical) farming.
3. Relevance of Organic Farming in the present context.
4. The international scenario of organic farming.
5. Masanobu Fukuoka –Japanese natural farming.
6. Perma Culture –Bill Mollison.
7. Biodynamic agriculture.
8. Ecological Farming.
9. Palekar model.
10. Green Revolution – a boon or bane.

**b. Student Study Projects:**

1. A study report on Agriculture and climate change.
2. A case study on ill effects of chemical fertilizers and pesticides on human health in India.
3. A study report on export and import of organic food products in India.
4. A report on organic agriculture and horticulture in his/her native district.
5. A report on government initiatives towards organic farming.
6. A test report on composition and quality of compost.
7. A study report on loss of nutrients during preparation, handling and storage.

**c. Assignments:** Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

**B. General :**

1. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.
2. Visit to organizations working on Organic Farming/ interaction with farmers practicing O.F.

**CBCS / Semester System (w.e.f. 2020-'21 Admitted Batch)**  
**II Semester / Organic Farming Core Course - 2**  
**Practices in Organic Farming**  
(Total hours of teaching – 60 @ 04 Hrs./Week)

**Theory :**

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**Learning Outcomes :** On successful completion of this course, the students will be able to :

- Cultivate various crop plants using principles of organic farming.
  - Realize the importance of Integrated Farming System for production of quality products.
  - Explain the benefits of organic products as food and fodder.
  - Develop critical understanding on organic certification process and marketing of produce.
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**Unit – 1 : Organic Crop Management -1** **12 Hrs.**

1. Organic vegetable crop management – Potato
2. Organic vegetable crop management – Tomato.
3. Organic food crop management – Rice
4. Organic food crop management – Wheat

**Unit – 2 : Organic Crop Management -2** **12 Hrs.**

1. Organic pulse crop management – Red gram
2. Organic oil seed crop management – Ground nut
3. Organic fruit crop management – Mango
4. Organic plantation crop management – Tea

**Unit – 3 : Transition to Organics** **12 Hrs.**

1. Introduction on transition to organic crop production.
2. Crop planning and rotation design in organic system.
3. Integrated Farming System (IFS) and urban agriculture.
4. Quality of organic food.

**Unit – 4 : Organic foods – benefits** **12 Hrs.**

1. Natural sources of antioxidants for health defense.
2. Antioxidant capacity of fruits and vegetables.
3. Organic food and human health.
4. Organic standard.

**Unit – 5 : Certification and Marketing of Organics** **12 Hrs.**

1. Organic certification process – definition, need, aim and scope, requirements to maintain certification.
2. Organic certification process – labeling of products, NPOP, organic quality control, standards, accreditation, inspection and certification.
3. Operational structure of organic certification.

4. Marketing of organic products.

**Books for Reference :**

- **Vandana Shiva, Poonam Pande and Jitendra Singh, 2004.** Principles of Organic Farming - Renewing the Earth's Harvest, Navdanya, New Delhi.
- **Sujit Chakrabarty, Sumati Narayan, Farooq Ahmad Khan, 2019.** Arts and Science of Organic Farming, Purna Organics
- **Thapa, U., and P. Tripathi, 2016.** Organic Farming in India, Agrotech Publications, Udaipur
- **Peter, V. Fossel, 2007.** Organic Farming ( Everything You Need to Know), Voyageur Press, USA
- Organic Farming for Sustainable Agriculture, <https://nptel.ac.in/courses/126/105/126105014/#>

**Practical syllabus of Organic Farming Core Course – 2/ Semester – II  
Practices in Organic Farming**

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs./Week)

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**Course Outcomes:** On successful completion of this course, the students shall be able to :

- Prepare organic biostimulants and apply them at various growth stages of crop plants.
  - Make biocontrol products for organic farming.
  - Demonstrate skills on various cropping systems in organic farming.
1. Preparation of Jeevamrutham (liquid and solid).
  2. Preparation of Beejamrutham.
  3. Preparation of Neemastram.
  4. Preparation of Brahmastram.
  5. Preparation of Agniastram.
  6. Preparation of Dasaparnikashayam.
  7. Study of mulching.
  8. Study of intercropping method.
  9. Study of water management in Organic Farming.
  10. Study of live stock component in Organic Farming.

**Model Question Paper for Practical Examination**

Semester – II/Organic Farming Core Course – 2

**Practices in Organic Farming**

Max. Time: 3 Hrs.

Max. Marks: 50

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|--|--------------|
| 1. Experiment 'A' (Preparation of Jeevamrutham/Beejamrutham)         | 10 M         |
| 2. Experiment 'B' (Preparation of Neemastram/Brahmastram/Agniastram) | 10 M         |
| 3. Experiment 'C' (Mulching or inter cropping practice)              | 10 M         |
| 4. Identify the following and justify with reasons                   | 2 x 5 = 10 M |
| D. Irrigation method   |              |

- E. Live stock component  
5. Record + Viva voce 5 + 5 = 10 M

**Suggested co-curricular activities for Organic Farming Core Course -2 in Semester-II:**

**A.Measurable :**

**a. Student seminars :**

1. Chemical fertilizers-history, practical aspects, positive and negative aspects of chemical fertilizers.
2. Bio-intensive nutrient management.
3. Soil populations and processes.
4. Principles of microbial degradation - Action of microorganism.
5. Losses of nutrients from FYM during preparation, handling and storage.
6. Ways to minimize the losses from FYM during handling.
7. Integrated Farming system (Combination of Organic and Inorganic).
8. Different cropping systems in relation to Organic Farming.
9. Plant nutrients and their functions in plant growth and development.
10. Recycling of organic matter in organic Agriculture.
11. Organic Agri-Horticulture in Urban & Semi urban areas of India.
12. Importance of Neem in organic Agriculture.

**b. Student Study Projects:**

1. A case study on organic farming of a horticulture crop from beginning to ending.
2. A case study on organic farming of a food crop from beginning to ending.
3. A case study on organic farming of a pulse crop from beginning to ending.
4. A case study on organic farming of a fruit crop from beginning to ending.
5. A case study on organic farming of a plantation crop from beginning to ending.
6. A study on economics of a crop in conventional and organic farming methods.
7. A case study on getting certification for an organic farm product.
8. A report on soil chemistry in a conventional and organic crop field.

**c. Assignments:** Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

**B. General :**

1. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.
2. Visit to organizations working on Organic Farming/ interaction with farmers practicing O.F.



**CBCS / Semester System (w.e.f. 2020-'21 Admitted Batch)**  
**III Semester / Organic Farming Core Course - 3**  
**Fundamentals of Soil Microbiology**  
(Total hours of teaching – 60 @ 04 Hrs./Week)

**Theory :**

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**Learning Outcomes :** On successful completion of this course, the students will be able to :

- Develop a critical understanding of soil biota.
  - Explain the role of microbes in mineralization of nutrients for plants.
  - Realize the operation of various biogeochemical cycles in nature.
  - Explain the formation of soil organic matter due to activities of soil microbes.
  - Realize the interaction among soil biota and between microbes – plants.
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**Unit -I :Soil as a living medium**

1. Soil - definition and composition; soil structure and characteristic features.
2. Role of humus and clay in ion exchange and nutrient availability.
3. Soil as a habitat for microorganisms; soil microbes – algae, bacteria, actinomycetes, fungi, protozoa and nematodes.
4. Microbial balance in soil; molecular markers for ecological studies of soil micro organisms.

**Unit II :Microbes in rhizosphere**

1. Rhizosphere and rhizoplanemicro organisms; reasons for increased microbial activity in rhizosphere.
2. Composition of root exudates factors affecting exudation, rhizosphere microorganisms, rhizosphere effect.
3. Factors affecting microbial community in soil-soil moisture, organic and inorganic chemicals.
4. Nitrogen cycle: microbiology and biochemistry of Ammonification, nitrification and denitrification, utilization of various nitrogen sources.
5. Nitrogen fixation, diversity of diazotrophs, associative and symbiotic Nitrogen fixation. Mechanism of nodulation and nitrogen fixation, role of various genes in these processes.

**Unit III :Microbial transformation of minerals**

1. Microbial transformation of Phosphorus—Phosphorus cycle.
2. Source of organic and inorganic phosphates in soil and elsewhere, mineralization of inorganic phosphates; factors affecting phosphate solubilization and mechanism.
3. Microbial transformation of sulphur- Sulphur cycle; source of Sulphur, Sulphur oxidizing and reducing microorganisms (*Thiobacillus* and *Desulfovibrio*), biochemistry of transformation. Sulphate and Sulphur reduction, H<sub>2</sub>S formation.
4. Role of *Thiobacillus* in agriculture and soil reclamation.
5. Microbial transformation of Iron, Manganese, Zinc, Copper and Potassium

**Unit – 4 :Soil organic matter**

1. Soil organic matter. Organic matter decomposition; Organic matter dynamics in soil.
2. Microbial decomposition of cellulose, hemicellulose and lignin.
3. Factors affecting organic matter decomposition (litter quality, temperature, aeration, soil pH, inorganic chemicals, moisture).
4. Pesticide degradation in soil, effects of pesticides on soil microflora, soil microbial biomass as an index of soil fertility.

#### **Unit –V :Interactions among soil microbes**

1. Microbial interactions; negative interactions. Ammensalism, competition, parasitism and predation (mycoparasitism, mycophagy, nematophagy – predaceous fungi),
2. Commensalism positive interactions – mutualism, synergism.
3. Associative symbiosis - cyanobacterial, bacterial (*Rhizobium* legume symbiosis), actinomycetes (actinorrhiza –*Frankia* non root legume symbiosis) and fungal symbiosis – types and significance of mycorrhiza.
4. Concept of beneficial microorganisms.

#### **Books for Reference :**

- **SubbaRao, N.S., 2017.** Soil Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- **SubbaRao, N.S., 1995.** Soil Microorganisms and Plant Growth, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- **Martin Alexander, 1986.** An introduction to Soil Microbiology, Wiley, New Jersey.
- **Paul, E.A., 2007.** Soil microbiology Ecology and Biochemistry, Academic press, Cambridge.

### **Practical syllabus of Organic Farming Core Course – 3/ Semester – III Fundamentals of Soil Microbiology**

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs./Week)

**Course Outcomes:** On successful completion of this course, the students shall be able to :

- Perform various tests on physico-chemical parameters of soil.
  - Isolate and culture various soil microbes in the laboratory.
  - Determine the organic matter in a given soil sample.
1. Study of soil composition and structure.
  2. Isolation of bacteria from a soil sample using serial dilution or streaking method and culture.
  3. Demonstration of Gram staining technique.
  4. Isolation and culture of Cyanobacteria from a soil sample.
  5. Isolation and culture of algae from a soil sample.
  6. Isolation and culture of Actinomycetes from a soil sample.

7. Identification of *Rhizobia* from root nodules of a legume.
8. Isolation of microbes from phylloplane.
9. Isolation of mycorrhiza.
10. Determination of soil organic matter.

**Model Question Paper for Practical Examination**

Semester – III/ Organic Farming Core Course – 3

**Fundamentals of Soil Microbiology**

Max. Time: 3 Hrs.

Max. Marks: 50

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|--|--------------|
| 1. Experiment 'A' (Soil composition and structure)                           | 10 M         |
| 2. Experiment 'B' (Isolation of bacteria/cyanobacteria/algae/ Actinomycetes) | 10 M         |
| 3. Experiment 'C' (Soil Organic Matter)                                      | 10 M         |
| 4. Identify the following and justify with reasons                           | 2 x 5 = 10 M |
| D. Mycorrhiza  |              |
| E. Rhizobia  |              |
| 5. Record + Viva voce  | 5 + 5 = 10 M |

**Suggested co-curricular activities for Organic Farming Core Course -3 in Semester-III:**

**A.Measurable :**

**a. Student seminars :**

1. Soil atmosphere and water.
2. Soil pH and temperature.
3. Rhizosphere as a habitat.
4. Organic matter decomposition and humification.
5. Types of mycorrhizae.
6. Acquisition and transport of nutrients in mycorrhizae.
7. Soil fauna.
8. Soil profile.
9. Soil microorganisms and carbon cycle.
10. Classification of soil types.

**b. Student Study Projects:**

1. A report on composition of different soil samples.
2. A study report on microbes from a soil sample.
3. Determination of water, pH and temperature of different soil samples.
4. Microbes on phylloplane of a crop plant.
5. Microbes from rhizosphere of a crop plant.

6. Isolation and identification of cellulolytic microbes from soil sample of a crop field.
7. Isolation and characteristics of Rhizobium from some leguminous plants.
8. Study report on microbes from spermosphere of some crop plants.

**c. Assignments:** Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

**B. General :**

1. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.
2. Visit to soil science and microbiology laboratories in Agriculture/ Horticulture University/ Research station.

**CBCS / Semester System (w.e.f. 2020-'21 Admitted Batch)**

**IV Semester / Organic Farming Core Course - 4**

**Principles of Agronomy**

(Total hours of teaching – 60 @ 04 Hrs./Week)

**Theory :**

**Learning Outcomes :** On successful completion of this course, the students will be able to :

- Develop critical understanding on various aspects of agronomy.
- Explain the nutrition and application of nutrients to plants.
- Explain the cropping methods and crop rotation.
- Realize various weed management practices.
- Explain the different aspects of crop harvesting.

**Unit – 1 :Basics of Agronomy**

1. Agronomy- definition, scope; role of Agronomist and relationship of Agronomy with other sciences.
2. Tillage - definition, objects of tillage, types of tillage, tillage implements and factors affecting tillage, Effect of tillage on soil and crop growth.
3. Tillage- definition, characteristics and ideal tillage; modern concepts of tillage, minimum, zero and stubble mulch tillage, importance of puddling.
4. Seed - definition, characteristics of quality seed, seed treatment and its objectives; methods of sowing seed and sowing implements.

**Unit – 2 :Crop communities**

1. Effect of plant population on growth and yield, planting geometry viz., solid, paired and skipped row planting.
2. Role of plant nutrients in crop production, Importance of manures and fertilizers and its classification.
3. Methods and time of application of manures, fertilizers and green manuring.
4. Nutrient use efficiency, meaning and factors affecting nutrient use efficiency.

**Unit – 3 :Growth and development**

1. Growth and development- definition, growth curve and factors affecting growth and development.
2. Plant ideotypes - definition and types of ideotypes.
3. Crop rotation, its definition, principles and advantages of crop rotation.
4. Study of crop adaptation and its distribution.

**Unit – 4 : Weed management**

1. Weeds, its definition, characteristics of weeds, merits and demerits of weeds.
2. Classification of weeds, meaning of crop weed competition and its period in different crops.
3. Principles and methods of weed management viz., cultural, mechanical, chemical, biological weed control methods and integrated weed management.
4. Classification of herbicides, its selectivity and resistance, Allelopathic effect of weed.

**Unit – 5 :Crop harvesting**

1. Crop harvesting, signs of maturity in different field crops; physiological and crop maturity.
2. Methods of threshing crops, cleaning, drying and storage of field crops.
3. Rainfed agriculture: Introduction, types, History of rainfed agriculture and watershed in India.
4. Problems and prospects of rainfed agriculture in India; Soil and climatic conditions prevalent in rainfed areas.

**Books for Reference :**

- **Gopal Chandra De. 1980.**, Fundamentals of Agronomy. Oxford and IBH Publishing Co. Ltd., Bangalore.
- **Panda, S.C., 2006.** Agronomy, Agribios Publication, New Delhi.
- **Reddy, S.R. 2011.** Principles of Agronomy Kalyani Publishers, Ludhiana, India.
- **Sankaran, S. and V.T. Subbiah Mudliyar, 1991.** Principles of Agronomy. The Bangalore Printing and Publishing Co. Ltd., Bangalore.
- **Rao V.S., 2006.** Principles of Weed Science. Oxford and IBH Publishing Co., New Delhi, India.

**Practical syllabus of Organic Farming Core Course – 4/ Semester – IV  
Principles of Agronomy**

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs./Week)

**Course outcomes :** On successful completion of this course, the students shall be able to :

- Study and record the growth parameters in plants in relation to agro-climatic conditions.
  - Apply fertilizers and pesticides as per the requirement at different stages of crop growth.
1. Identification of seeds and crop plants at different growth stages.
  2. Identification of different tillage implements.
  3. Identification of fertilizers and pesticides.
  4. Identification of weed flora in different field crops.
  5. Study of agro climatic zones of Andhra Pradesh and India.
  6. Operational tillage viz., primary, secondary, inter-tillage, sowing, harvesting, harvesting implements, Working with them.
  7. Calculation of plant population, seed rate, fertilizer and herbicide dose for different field crops.
  8. Determination of purity and germination percentage of seed, Methods of seed germination.
  9. Study of viability test and practice of seed treatments in different field crops.
  10. Study of yield contributing characters and yield estimation in different field crops.
  11. Methods of application of herbicides in different field crops.

12. Measurement of air and soil temperatures, tabulation and variation.

**Model Question Paper for Practical Examination**

Semester – IV/ Organic Farming Core Course – 4

**Principles of Agronomy**

Max. Time: 3 Hrs.

Max. Marks: 50

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- |   |              |
|---|--------------|
| 1. Experiment 'A' (Operational tillage)   | 10 M         |
| 2. Experiment 'B' (Calculation of plant population, seed rate, fertilizer and herbicide dose for a field crop). | 10 M         |
| 3. Experiment 'C' (Seed germination/viability test)   | 10 M         |
| 4. Identify the following and justify with reasons<br>D. Seed/tillage implement<br>E. Fertilizer/pesticide/weed | 2 x 5 = 10 M |
| 5. Record + Viva voce   | 5 + 5 = 10 M |

**Suggested co-curricular activities for Organic Farming Core Course -4 in Semester-IV:**

**A. Measurable :**

**a. Student seminars :**

1. Water Resources of India and Andhra Pradesh and Development.
2. Soil- water-plant Relationship.
3. Classification of Soil Water, Soil Moisture Constants, Soil Moisture characteristic Curve.
4. Water requirement of different Agronomic crops.
5. Water Use efficiency of crops, Irrigation Efficiencies and factors affecting it.
6. Crop management techniques in problematic areas i.e. saline, alkaline, acidic soils.
7. Study of Drip System, Fertigation, Care and Maintenance of Drip system.
8. Study of Pressurized irrigation system, Sprinkler, Rain gun.
9. Top dressing and foliar feeding of nutrients.
10. Studies on cropping pattern of different rainfed areas in the country.
11. Drought - classification and effect on crop growth.
12. Post-harvest management in Organic Farming.

**b. Student Study Projects:**

1. Morphological description of kharif season crops.
2. Morphological description of rabi season crops.
3. Study of yield contributing characters and yield calculation of a kharif season crop.
4. Study of morphological characteristics of rabi crops.
5. Identification of weeds in rabi season crops.
6. Study of yield contributing characters of rabi season crops.
7. Study the effect of seed size on germination and seedling vigour of kharif season crops.
8. Study the effect of seed size on germination and seedling vigour of rabi season crops.

**c. Assignments:** Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

**B. General :**

1. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.
2. Visit to research centers of related crop; Visit to rainfed research station/ watershed areas.



**CBCS / Semester System (w.e.f. 2020-'21 Admitted Batch)**  
**IV Semester / Organic Farming Core Course - 4**  
**Biofertilizers and Biopesticides**  
(Total hours of teaching – 60 @ 04 Hrs./Week)

**Theory :**

**Learning Outcomes :** On successful completion of this course, the students will be able to :

- Realize the importance of ecofriendly fertilizers and pesticides.
- Demonstrate skills on culture and mass production of biofertilizers and biopesticides.
- Acquire sound knowledge on application of the biofertilizers and biopesticides for various crops.
- Study the efficacy of biofertilizers and biopesticides in organic farming.

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**Unit – 1 : Basics of Biofertilizers**

**12 Hrs.**

1. Biofertilizers – definition, importance and advantages.
2. Sources of Biofertilizers - Bacteria, Cyanobacteria, Mycorrhiza and PSM.
3. Outlines of production technology of biofertilizers- isolation, selection of strain, preparation of mother culture, starter culture, mass culturing.
4. *Rhizobium* – Mass multiplication, starter culture, mass cultivation, inoculant formulations and application method.

**Unit – 2 : Culture of Bacterial and fungal Biofertilizers**

**12 Hrs.**

1. *Azotobacter*- Mass multiplication, maintenance of culture, application and crop response.
2. *Azospirillum* - Mass multiplication, inoculant formulations, associative effect and crop response.
3. *Anabaena*- Characteristics, *Azolla-Anabaena* association, *Azolla* production and application.
4. VAM- mass production - substrate, substrate free, in-vitro methods and crop response.

**Unit – 3 : Biofertilizer Production Technology**

**12 Hrs.**

1. PSM- Isolation, mass inoculum production and field application.
2. Culturing of microorganisms: Fermentation Method-Bioreactor and protocol.
3. Inoculant formulations – Carrier properties, Types of formulations: Powders, Granules and Liquids.
4. Quality Management: Output quality standards- Viable cell count, contamination level, Density of strain, effect on target crop.

**Unit – 4 : Botanical and fungal biopesticides**

**12 Hrs.**

1. Biological control agents and their characteristics.
2. Types of biopesticides – bacterial, fungal and viral; advantages and disadvantages.
3. Properties of botanical biopesticides; pesticide products in *Azadirachta*, *Pongamia* and *Annona*.
4. Characteristics of biological fungicides-*Trichoderma*, *Pseudomonas* and *Fusarium* species; production and processing of biological fungicides.

**Unit – 5 : Bioinsecticides and nematicides**

**12 Hrs.**

1. Mode of action of biological insecticides and nematicides.

2. Characteristics of biological insecticides-*Bacillus thuringiensis*, *Methylophilium*, and *Beauveria bassiana*; Ha – NPV and SL-NPV
3. Production and processing of biological insecticides.
4. Biological nematicides – *Bacillus firmus* and *Paecilomyces lilacinus*.

**Books for Reference :**

- Kannaiyan, S., 2003. Bioethnology of Biofertilizers, CHIPS, Texas.
- Mahendra K. Rai, 2005. Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.
- Reddy, S.M. et. al., 2002. Bioinoculants for sustainable agriculture and forestry, Scientific Publishers, Jodhpur.
- SubbaRao N.S., 1995 Soil microorganisms and plant growth Oxford and IBH publishing co. Pvt. Ltd. New Delhi.
- Saleem, F. and A.R. Shakoory, 2012. Development of Bioinsecticide, Lambert Academic Publishing, Latvia, European Union.

**Practical syllabus of Organic Farming Core Course – 5/ Semester – IV  
Biofertilizers and Biopesticides**

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs./Week)

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**Course outcomes :** On successful completion of this course, the students shall be able to :

- Handle the equipment and tools to produce biofertilizers and to apply biopesticides.
- Culture microbes used as biofertilizers and biopesticides.
- Estimate the application dosage of biofertilizers and biopesticides for a crop.
  1. Study of equipment for production of bio-fertilizers.
  2. Isolation and culture techniques of 3 types of biofertilizers as per the theory syllabus
  3. Characteristics, isolation and identification of *Rhizobium*, *Azotobacter* and *Azospirillum*.
  4. VAM- isolation and inoculum production.
  5. Identification of biological control agents.
  6. Isolation and culture of *Trichoderma*, *Pseudomonas* and *Fusarium species*.
  7. Isolation and culture of *Bacillus thuringiensis*, *Methylophilium*, *Beauveria bassiana*.
  8. Study of Ha – NPV and SL-NPV.
  9. Demonstration of application equipments for biopesticides.
  10. Calculations of dosage and application technique of biopesticides.

**Model Question Paper for Practical Examination**

Semester – IV/ Organic Farming Core Course – 5

**Biofertilizers and Biopesticides**

Max. Time: 3 Hrs.

Max. Marks: 50

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|--|------|
| 1. Experiment 'A' (Isolation and culture of a biofertilizer) | 10 M |
| 2. Experiment 'B' (VAM- isolation and inoculum production).  | 10 M |

3. Experiment 'C' (Isolation and culture of fungal/bacterial insecticide). 10 M
4. Identify the following and justify with reasons 2 x 5 = 10 M
  - D. Equipment for Biofertilizer production.
  - E. Equipment for application of Biopesticide.
5. Record + Viva voce 5 + 5 = 10 M

**Suggested co-curricular activities for Organic Farming Core Course -4 in Semester-IV:**

**A. Measurable :**

**a. Student seminars:**

1. Chemical fertilizers – environmental issues and human health hazards.
2. Comparison of chemical fertilizers, organic manures and Biofertilizers.
3. Dinitrification and role of Nitrogenase.
4. Free living, asymbiotic and symbiotic nitrogen fixers.
5. Phosphate Solubilizing Microbes (PSM).
6. Physiology and Genetics of Nitrogen fixation.
7. Environmental issues and human health hazards due to chemical pesticides.
8. Comparison of chemical and biopesticides.
9. Microbial diseases of crop plants.
10. Economics of chemical vs biopesticides.

**b. Student Study Projects:**

1. Isolation, identification and culture of free living and asymbiotic Nitrogen fixers from local crop fields.
2. Isolation, identification and culture of symbiotic Nitrogen fixers from legume and non-leguminous plants in a locality.
3. Isolation, identification and culture of Phosphate Solubilizing Microbes from a local crop field.
4. Isolation and identification of Mycorrhiza associated with some local plants.
5. Isolation, identification and culture of Denitrifying bacteria from a local crop field.
6. A report on efficacy of Botanical pesticides on a plant pathogen.
7. A report on efficacy of Biopesticide on a plant pathogen.
8. A report on efficacy of Bioinsecticide on an insect pest.
9. A study report on application of Biofertilizers in India and Andhra Pradesh.
10. A study report on application of Biopesticides in India and Andhra Pradesh.

**c. Assignments:** Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

**B. General :**

1. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.
2. Visit to research centers and firms making Biofertilizers and Biopesticides.

## RECOMMENDED ASSESSMENT OF STUDENTS:

### Recommended continuous assessment methods for all courses:

Some of the following suggested assessment methodologies could be adopted. Formal assessment for awarding marks for Internal Assessment in theory.

#### (a) Formal:

1. The oral and written examinations (Scheduled and surprise tests),
2. Simple, medium and Critical Assignments and Problem-solving exercises,
3. Practical assignments and laboratory reports,
4. Assessment of practical skills,
5. Individual and group project reports,
6. Seminar presentations,
7. Viva voce interviews.

#### (b) Informal:

1. Computerized adaptive testing, literature surveys and evaluations,
2. Peers and self-assessment, outputs form individual and collaborative work
3. Closed-book and open-book tests,

### Common pattern for Question Paper for Theory Examination(s) at Semester end

Max. Time : 3 Hrs.

Max. Marks : 75 M

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#### Section – A

Answer all the following questions.

5 x 2 = 10 M

- ✓ One question should be given from each Unit in the syllabus.

#### Section – B

Answer any three of the following questions. Draw a labeled diagram wherever necessary

3 x 5 = 15 M

- ✓ One question should be given from each Unit in the syllabus.

#### Section – C

Answer any five of the following questions. Draw a labeled diagram wherever necessary

5 x 10 = 50 M

- ✓ Two questions (a & b) are to be given from each Unit in the syllabus (internal choice in each unit). Student has to answer 5 questions by choosing one from a set of questions given from a Unit.

**Note :** Questions should be framed in such a way to test the understanding, analytical and creative skills of the students. All the questions should be given within the frame work of the syllabus prescribed.

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## *Annexure*

### **Objectives and General Outcomes of Programme and Domain Subject**

**Programme (B.Sc.) Objectives:** The objectives of bachelor's degree programme with Organic Farming are:

1. To provide a through insight on various aspects related to Organic Farming.
2. To inculcate a sound knowledge on latest developments in the field of Organic Farming with a practical approach.
3. To produce a student who thinks independently, critically and discuss various aspects of Organic Farming.
4. To enable the graduate to prepare and pass through various examinations related to the domain subject.
5. To empower the student to become an employee or an entrepreneur in the field of Organic Farming and to serve the nation.

**Programme Outcomes :**

1. Understand the basic concepts of Organic Farming in relation to its allied core courses.
2. Decide the importance of Organic Farming for the welfare of humans.
3. Demonstrate simple experiments related to plant sciences, analyze data, and interpret them with the theoretical knowledge.
4. Work in teams with enhanced inter-personal skills and hence develop the critical thinking with scientific temper.
5. Effectively communicate scientific ideas both orally and in writing.
6. Realize the potential of the horticulture to become an entrepreneur – self employment.

**Domain Subject (Organic Farming) Objectives :**

1. To create awareness on various principles Organic Farming.
2. To teach cultivation practices for various crops cultivated using organic farming methods.
3. To provide in depth knowledge on importance of soil microbes in farming.
4. To provide a practical experience on agronomic principles for cultivation of plants under different agro-climatic regions.
5. To give sufficient knowledge on pests and diseases of horticulture plants and measures to control the same.

**Domain Subject (Horticulture) Outcomes:**

1. Students will be able to design, execute the establishment and manage an organic farm for a crop.
2. Students will be able to cultivate crops using principles of organic farming.
3. Students will be able study the soil biota of a given region.
4. Students will be able to discuss various agronomical aspects of a given crop species.

5. Students will be able discuss various aspects related to production and use of biofertilizers and biopesticides.
  6. Students will be able to examine, identify and control different pests and diseases of plants in an organic farm.
  7. Students will think independently and may become an employ in the said sector or may become an entrepreneur by taking up organic farming.
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