

# **GURU KASHI UNIVERSITY**



## **M.Sc. Agronomy**

**Session : 2022-23**

**Department of Agronomy**

### **Programme Outcomes (POs)**

- 1.** To acquire knowledge about efficient production systems for major field crops, to enhance the quality & productivity of crop production, to introduce new technologies in crop production: fertigation & new varieties, to understand the morphology & physiology of crops
- 2.** To learn principles and techniques for agronomy of *rabi* oil seed, *kharif* oil seed, fibre crops, sugar crops, forage crops, medicinal and aromatic crops along with their estimation for quantitative and qualitative parameters for growth, yield and quality
- 3.** To learn production technology of *kharif* and *rabi* fodder crops, principles and methods of hay and silage making, value addition of poor quality fodder, seed production techniques of fodder crops
- 4.** The skills of cropping systems under different land use pattern, farming systems, allelopathic effects, selection of plants for dry land, forage crop production, different indices like LER, CEY etc
- 5.** To learn the different methods of irrigating different field crops and managing water as precious element of crop production and increasing water use efficiency. To develop the skill for measurement of soil moisture by different direct and indirect methods
- 6.** To learn the weed control by different methods in field crops, herbicide structure factors affecting herbicide selectivity in different situations, calculation of cost benefit ratio, weed control efficiency
- 7.** To get familiar with the physical source, soil and water management in cropping system, concept of sustainability in cropping system, different types of cropping system, crop diversification for sustainable productivity, concept of organic farming, organic standards and classifications in relevant to India and global agriculture, organic manures and their applicability for sustainable agriculture
- 8.** To learn about the crop growth analysis, quantitative agro-biological principles, crop yield equation, physiology of grain yield in cereals, concept of ideal plant type, yield and environmental stress, resources conservation technology and crop residue management- recycling and precision agriculture
- 9.** It provides concepts of soil fertility and productivity, essential plant nutrients & their importance, transformation; it also imparts preparation and use of Farm Yard Manures, commercial manure and fertilizers, fertilizer mixtures, ways to increase fertilizer use efficiency.

**10.** Statistical principles apply in all the areas of experimental work and they have a very important role in agriculture, decision making, agriculture development and estimates agriculture and national income

### **Programme Specific Outcomes (PSOs)**

- Develop proficiency in different methods of different types of field crops cultivation and resource utilization problems
- Cultivate rational thinking in the students by the introduction of the conditions of rationality in the areas of consumption, production and distribution
- Understand firm and farm level decision rules for the efficient growing and handling of organic farming at field and standard for export of these
- Be able to analyze soil fertility status to check the availability of various plant essential nutrients before sowing of the crop
- Develop knowledge in area of dryland farming and integrated farming system and efficient utilization of water resources in dry land regions.
- Makes the scholars responsible citizens and professionals which have the capability of critical thinking and independent clarifying suggestions for farmers problems
- Be able to present ideas effectively in oral and written forms to those in the agricultural and related fields

### **Programme Structure**

<b>Semester- Flexible</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Type of Course</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
MAR101	Agronomy of Major Cereal and Pulse crops	Core course	3	0	0	3
MAR102	Lab- Agronomy of Major Cereal and Pulse crops	Skill based	0	0	2	1
MAR103	Agronomy of Oilseed, Fiber, Sugar and Important Medicinal and Aromatic Crops	Core course	2	0	0	2

MAR104	Lab- Agronomy of Oilseed, Fiber, Sugar and Important Medicinal and Aromatic Crops	Skill based	0	0	2	1
MAR105	Agronomy of Fodder and Forage/ Pasture Crops	Core course	1	0	0	1
MAR106	Lab -Agronomy of Fodder and Forage/ Pasture Crops	Skill based	0	0	2	1
MAR107	Dry Land Farming and Water Shed Management	Core course	2	0	0	2
MAR108	Lab -Dry Land Farming and Water Shed Management	Skill based	0	0	2	1
MAR109	Irrigation Water Management	Core course	2	0	0	2
MAR110	Lab -Irrigation Water Management	Skill based	0	0	2	1
MAR111	Weed Management	Core course	2	0	0	2
MAR112	Lab - Weed Management	Skill based	0	0	2	1
MAR113	Cropping system and Sustainable Agriculture	Core course	3	0	0	3
MAR114	Modern Concepts in Crop Productions	Core course	2	0	0	2
MAR117	Crop production in Problem Soils and Water	Core course	2	0	0	2
MAR118	Lab- Crop productions in Problem Soils and Water	Skill based	0	0	2	1
MAR119	Plant Physiology	Core course	2	0	0	2
MAR120	Lab- Plant Physiology	Skill based	0	0	2	1
MAR121	Agricultural Statistics	Compulsory foundation	3	0	0	3

MAR122	Lab- Agricultural Statistics	Skill based	0	0	2	1
MAR123	Seminar-I		NA	NA	NA	1
MAR123A	Seminar-II		NA	NA	NA	1
MAR124	Lab -Fundamentals of Computer Applications	Open elective		-	2	1(NC)
MAR125	Lab -Library and Information Services	Open elective		-	2	1(NC)
MAR126	Lab-Technical Writing and Communication Skills	Ability enhancement		-	2	1(NC)
MAR127	Masters Research		-		48	24(NC)
<b>Discipline Elective (Any one of the following)</b>						
MAR128	Soil Fertility and Fertilizer Use	Discipline Elective	2	0	0	2
MAR129	Lab- Soil Fertility and Fertilizer Use		0	0	2	1
MAR130	Agronomy of medicinal, aromatic and under-utilized crops		2	0	0	2
MAR131	Lab: Agronomy of medicinal, aromatic and under-utilized crops		0	0	2	1
<b>Grand Total: 41+ 27 NC</b>						

### **Evaluation Criteria for Theory Courses**

#### **A. Continuous Assessment: [25 Marks]**

Continuous Assessment 1: [10 Marks]

Continuous Assessment 2: [10 Marks]

Continuous Assessment 3: [05 Marks]

#### **B. Mid Semester Test-1: [30 Marks]**

#### **C. Mid Semester Test-2: [20Marks]**

**D. End-Term Exam: [20 Marks]**

**E. Attendance: [5 Marks]**

For the CAs the teacher shall take surprised test/term, paper/quiz/assignments etc.

**Evaluation Criteria for practical Courses**

The syllabus of subject is divided into five experiments, each experiment contains 20 marks (10 lab performance, 5 viva, 5 lab record)- Total marks 100

**Evaluation Criteria for Seminar**

It is of total Marks-100

Collection of review of literature - 20marks

Data Analysis -20 marks

Power Point Presentation - 20 marks

Presentation skills - 20 marks

Viva voce - 20 marks

**Evaluation Criteria for Master Research**

The evaluation is Satisfactory or Unsatisfactory on the basis of the performance of the candidate.

**Course Title: Agronomy of Major Cereal and Pulse crops**

**Course Code: MAR101**

L	T	P	C
3	0	0	3

**Learning Outcomes:**

On successful completion of this course, the students will able to:

1. Learn about efficient production systems for major field crops: wheat, gram, rapeseed & mustard, oat, barley.

2. Fulfill the demands of commercial firms, farmers, industrials and consumers
3. Attain knowledge about enhance the quality & productivity of crop production
4. New technologies in crop production: fertigation & new varieties.
5. Get knowledge of cropping and farming systems

### **Course Contents**

#### **UNIT-I**

**Hours-13**

Origin, history, area, production, classification, morphology, phenology, physiology, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of kharif cereals - rice, maize, sorghum, millets

#### **UNIT-II**

**Hours-12**

Origin, history, area, production, classification, morphology, phenology, physiology, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of Rabi cereals - wheat, barley

#### **UNIT-III**

**Hours-9**

Origin, history, area, production, classification, morphology, phenology, physiology, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of KHARIF PULSES- Pigeonpea, mungbean, urdbean

#### **UNIT-IV**

**Hours-11**

Origin, history, area, production, classification, morphology, phenology, physiology, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of RABI PULSES- chickpea and lentil

#### **Transaction Mode**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

#### **Suggested Readings**

Das NR. 2007. Introduction to Crops of India. Scientific Publ.

Hunsigi G & Krishna KR. 2022. Science of Field Crop Production. Oxford & IBH.

Jeswani LM & Baldev B. 1997. Advances in Pulse Production Technology. ICAR.

Khare D & Bhale MS. 2000. Seed Technology. Scientific Publ.

Kumar Ranjeet & Singh NP. 2003. Maize Production in India: Golden Grain in Transition. IARI, New Delhi.

Pal M, Deka J & Rai RK. 1996. Fundamentals of Cereal Crop Production. Tata McGraw Hill.

Prasad, Rajendra. 2002. Text Book of Field Crop Production. ICAR.

Singh C, Singh P & Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH.

Singh, SS. 1998. Crop Management. Kalyani.

Yadav DS. 1992. Pulse Crops. Kalyani.

### Web Sources

- <https://www.perennia.ca/wp-content/uploads/2018/03/Cereal-Crops-Production-Guide-web.pdf>
- <https://www.britannica.com/topic/cereal-farming>
- [https://saipatform.org/wp-content/uploads/2006/06/sai\\_platform\\_principles\\_practices\\_cereals.pdf](https://saipatform.org/wp-content/uploads/2006/06/sai_platform_principles_practices_cereals.pdf)

**Course Title: Lab- Agronomy of Major Cereal and Pulse crops**

**Course Code: MAR102**

L	T	P	C
0	0	2	1

### Learning Outcomes:

After successful completion of this course, the students will be able to:

1. Know about the phenological studies at different crop growth stages
2. Acquire knowledge about formulation of cropping scheme for various farm sizes
3. Know about working of growth indices of prominent intercropping systems
4. Attain knowledge about skill development regarding : planning and layout of the field experiments
5. Get knowledge about skill development regarding the termination of cost cultivation and working out harvest index of various crops
6. Understand about various seed production techniques of crops



### Course Content

Phenological studies at different growth stages of crop. Estimation of crop yield on the basis of yield attributes; Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities; Working out growth indices of prominent intercropping systems of different crops; Estimation of protein content in pulses; Planning and layout of field experiments; Intercultural operations in different crops; Determination of cost of cultivation of different crops; Working out harvest index of various crops; Study of seed production techniques in various crops; Visit of field experiments.

### Suggested Readings

- Das NR. 2007. Introduction to Crops of India. Scientific Publ.
- Hunsgi G & Krishna KR. 2022. Science of Field Crop Production. Oxford & IBH.
- Jeswani LM & Baldev B. 1997. Advances in Pulse Production Technology. ICAR.
- Khare D & Bhale MS. 2000. Seed Technology. Scientific Publ.
- Kumar Ranjeet & Singh NP. 2003. Maize Production in India: Golden Grain in Transition. IARI, New Delhi.
- Pal M, Deka J & Rai RK. 1996. Fundamentals of Cereal Crop Production. Tata McGraw Hill.
- Prasad, Rajendra. 2002. Text Book of Field Crop Production. ICAR.
- Singh C, Singh P & Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH.
- Singh, SS. 1998. Crop Management. Kalyani.
- Yadav DS. 1992. Pulse Crops. Kalyani.

**Course Title: Agronomy of Oilseed, Fiber, Sugar and Important Medicinal and Aromatic Crops**

L	T	P	C
2	0	0	2

**Course Code: MAR103**

### Learning Outcomes:

After successful completion of this course, the students will be able to:

1. Learn introduction and evaluation of new improved lines of spice crops and medicinal crops.
2. Know about the improved agronomic practice
3. Get knowledge about improved cultivars and productivity.
4. Attain knowledge about Management of pest and diseases.
5. Learn about improved post-harvest techniques for major medicinal and aromatic crops.

### **Course content**

#### **UNIT-I**

**Hours-11**

Origin and history, area and production, classification, morphology, phenology, physiology, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition quality component, handling and processing of the produce for maximum production of *kharif* oilseed crops (Groundnut, sesame, castor, sunflower, soybean,), fiber crops (Cotton, jute, sunnhemp) and sugar crops (Sugar- beet and sugarcane).

#### **UNIT-II**

**Hours-13**

Origin and history, area and production, classification, morphology, phenology, physiology, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition quality component, handling and processing of the produce for maximum production of *rabi* oilseed crops (rapeseed and mustard, linseed)

#### **UNIT-III**

**Hours-12**

Description, distribution, climate, soil requirements, cultural practices, processing and important constituents/ quality of medicinal, aromatic, plantation and under-utilized crops, viz., Isabgol, Mentha, Lemongrass, Citronella, Lathyrus, Sesbania,

#### **UNIT-IV**

**Hours- 9**

Description, distribution, climate, soil requirements, cultural practices, processing and important constituents/ quality of medicinal, aromatic, plantation and under-utilized crops Clusterbean, French bean, Celery, Fenugreek, Grain Amaranth, Coffee, Tea and Tobacco Turmeric.

#### **Transaction Mode**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

#### **Suggested Readings**

- Das NR. 2007. Introduction to Crops of India. Scientific Publ.  
Das PC. 1997. Oilseed Crops of India. Kalyani.

Lakshmikantam N. 1983. Technology in Sugarcane Growing. 2ndEd. Oxford & IBH.

Prasad, Rajendra. 2002. Text Book of Field Crop Production. ICAR.

Singh C, Singh P & Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH.

Singh SS. 1998. Crop Management. Kalyani

**Web Sources**

- <https://www.scientificpubonline.com/bookdetail/introduction-crops-india-2nd-ed/9789386652294/0>
- <https://www.bagchee.com/books/BB40303/introduction-to-crops-of-india>
- <https://www.indianjournals.com/ijor.aspx?target=ijor:ija&type=home>

**Course Title: Lab- Agronomy of Oilseed, Fiber, Sugar and important Medicinal and Aromatic Crops**  
**Course Code: MAR104**

L	T	P	C
0	0	2	1

**Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Learn about the promotion of cultivation and conservation of medicinal plants.
2. Attain knowledge about cultivation techniques including quality plant materials, irrigation, fertilizer, plant protection and processing, which are cost effective in different agro-climatic regions of the state.
3. Employ latest techniques to improve the production system
4. Gain knowledge about the Improved agronomic practice cultivars and productivity
5. Acquire knowledge improved post-harvest techniques for major medicinal and aromatic crops and Management of pest and diseases.

**Course Contents**

Planning and layout of field experiments. Cultivation of sugarcane crop and estimation of its quality parameters. Intercultural operations in different crops; Cotton seed treatment; Working out growth indices of prominent intercropping systems; Judging of physiological maturity in different crops and working out harvest index; Working out cost of cultivation of different crops; Estimation of crop yield on the basis of yield attributes; Formulation of cropping schemes for various farm sizes and calculation of cropping and

rotational intensities; Determination of oil content in oilseeds and computation of oil yield; Estimation of quality of fiber of different fiber crops; Study of seed production techniques in various crops; Visit of field experiments. Identification of crops based on morphological and seed characteristics; Raising of herbarium of medicinal, aromatic and under-utilized plants.

### **Suggested Readings**

- Das NR. 2007. Introduction to Crops of India. Scientific Publ.  
 Das PC. 1997. Oilseed Crops of India. Kalyani.  
 Lakshmikantam N. 1983. Technology in Sugarcane Growing. 2ndEd. Oxford & IBH.  
 Prasad, Rajendra. 2002. Text Book of Field Crop Production. ICAR.  
 Singh C, Singh P & Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH.  
 Singh SS. 1998. Crop Management. Kalyani

**Course Title: Agronomy of Fodder and Forage/ Pasture Crops**

L	T	P	C
1	0	0	1

**Course Code: MAR105**

### **Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Get knowledge about the production technology of kharif fodder crops.
2. Knowledge about the production technology of rabi fodder crops.
3. Attain knowledge about the principles and methods of hay and silage making.
4. Know about the value addition of poor quality fodder.
5. Get knowledge about the seed production techniques of fodder crops.

### **Course Contents**

#### **UNIT-I**

**Hours-3**

Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti quality factors of important fodder crops like maize, bajra, guar, cowpea, oats, barley, berseem, senji, lucerne etc.

#### **UNIT-II**

**Hours-4**

Adaptation, distribution, varietal improvement, agro-techniques and quality

aspects including antiquality factors of important forage crops like, napier grass, panicum, lasiuras, cenchrus etc

**UNIT-III**

**Hours-4**

Year-round fodder production and management, preservation and utilization of forage and pasture crops. Principles and methods of hay and silage making; chemical and biochemical changes, nutrient losses and factors affecting quality of hay and silage

**UNIT-IV**

**Hours-4**

Use of physical and chemical enrichments and biological methods for improving nutrition. Value addition of poor quality fodder. Economics of forage cultivation uses and seed production techniques.

**Transaction Mode**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

**Suggested Readings**

Chatterjee BN. 1989. Forage Crop Production - Principles and Practices. Oxford & IBH.

Das NR. 2007. Introduction to Crops of India. Scientific Publ.

Narayanan TR & Dabadghao PM. 1972. Forage Crops of India. ICAR.

Singh P & Srivastava AK. 1990. Forage Production Technology. IGFRI, Jhansi.

Singh C, Singh P & Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH.

Tejwani KG. 1994. Agroforestry in India. Oxford & IBH

**Course Title: Lab- Agronomy of Fodder and Forage/ Pasture Crops**

**Course Code: MAR106**

L	T	P	C
0	0	2	1

**Course Outcomes:**

After successful completion of this course, the students will be able to:

1. Understand about the phenological studies at different crop growth stages

2. Knowledge about the formulation of cropping scheme for various farm sizes
3. Learn about working of growth indices of prominent intercropping systems and seed production techniques of crops
4. Know the skill development regarding the planning and layout of the field experiments.
5. Get knowledge about development the termination of cost cultivation and working out harvest index of various crops

### **Course Contents**

Farm operations in raising fodder crops; Canopy measurement, yield and quality estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose etc. of various fodder and forage crops; Anti-quality components like HCN in sorghum and such factors in other crops; Hay and silage making and economics of their preparation.

### **Suggested Readings**

- Chatterjee BN. 1989. Forage Crop Production - Principles and Practices. Oxford & IBH.
- Das NR. 2007. Introduction to Crops of India. Scientific Publ.
- Narayanan TR & Dabadghao PM. 1972. Forage Crops of India. ICAR.
- Singh P & Srivastava AK. 1990. Forage Production Technology. IGFRI, Jhansi.
- Singh C, Singh P & Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH.
- Tejwani KG. 1994. Agroforestry in India. Oxford & IBH

**Course Title: Dry Land Farming and Water Shed Management**  
**Course Code: MAR107**

L	T	P	C
2	0	0	2

### **Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Acquire knowledge about the concept of dry farming
2. Get knowledge about the constraints limiting crop production in dry land areas
3. Learn about the types of the drought and stress physiology and registrants to drought

4. Attain knowledge about the soil moisture conservation and crop production technology in dry land
5. Know about the concept of watershed resource management, problems, approach, and components

### **Course Contents**

#### **UNIT-I**

**5Hours**

Definition, concept and characteristics of dry land farming. Dry land versus rainfed farming. Significance and dimensions of dry land farming in Indian agriculture.

#### **UNIT-II**

10Hours

Soil and climatic parameters with special emphasis on rainfall characteristics. Constraints limiting crop production in dry land areas. Types of drought. Characterization of environment for water availability. Crop planning for erratic and aberrant weather conditions.

#### **UNIT-III**

**5Hours**

Stress physiology and resistance to drought, adaptation of crop plants to drought and drought management strategies. Preparation of appropriate crop plans for dry land areas, mid contingent plan for aberrant weather conditions.

#### **UNIT-IV**

10Hours

Tillage, tith, frequency and depth of cultivation, compaction in soil tillage, concept of conservation tillage, tillage in relation to weed control and moisture conservation, techniques and practices of soil moisture conservation (use of mulches, kinds, effectiveness and economics). Anti-transpirants, soil and crop management techniques, seeding and efficient fertilizer use. Fertilizer placement top dressing foliage application.

#### **Transaction Mode**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

#### **Suggested Readings**

- Dhopte. A.M. 2002. Agro technology for Dry land Farming. Scientific Publ.
- Dhruv Narayana, V.V. 2002. Soil and Water Conservation Research in India. ICAR.
- Rao, S.C. and Ryan, J. 2007. Challenges and Strategies of Dryland Agriculture. Scientific Publishers.
- Singh, P. and Maliwal, P.L. 2005. Technologies for Food Security and Sustainable Agriculture. Agrotech Publishing Company.

Singh, R.P. 1988. Improved Agronomic Practices for Dryland Crops. CRIDA.  
 Singh, R.P. 2005. Sustainable Development of Dryland Agriculture in India. Scientific Publ.  
 Venkateshwarlu, J. 2004. Rainfed Agriculture in India. Research and Development Scenario. ICAR.

**Web Sources**

- <https://www.agrifarming.in/a-guide-to-dryland-farming-techniques-benefits-and-example-crops#:~:text=Dryland%20farming%20techniques%20include%20planting,degradation%20and%20decreased%20crop%20yields.>
- [https://agritech.tnau.ac.in/agriculture/agri\\_majorareas\\_dryland\\_drylandtechnologies.html](https://agritech.tnau.ac.in/agriculture/agri_majorareas_dryland_drylandtechnologies.html)
- <https://prepp.in/news/e-492-dry-land-farming-agriculture-notes>

**Course Title: Lab- Dry Land Farming and Water Shed Management**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Course Code: MAR108**

**Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Get knowledge about skill development of seed treatment
2. Learn about the seed germination and crop establishment in relation to soil moisture Contents
3. Attain the knowledge about development estimation of moisture index, aridity index, spray of anti- transparent and their effect on crops
4. Learn about development collection and interpretation of data for water balance equation water use efficiency and preparation of crop plans
5. Conduct visits the dry land and soil conservation research station and watershed Projects

**Course Contents**

Seed treatment, seed germination and crop establishment in relation to soil moisture contents, moisture stress effects and recovery behaviour of important crops, estimation of moisture index and aridity index; spray of anti-transpirants and their effect on crops, collection and interpretation of data for water balance equations, water use efficiency, preparation of crop plans for different drought conditions. Study of field experiments relevant to dryland



farming, visit to dryland and soil conservation research stations and watershed projects.

### **Suggested Readings**

- P Dhopte. A.M. 2002. Agro technology for Dry land Farming. Scientific Publ.
- Dhruv Narayana, V.V. 2002. Soil and Water Conservation Research in India. ICAR.
- Rao, S.C. and Ryan, J. 2007. Challenges and Strategies of Dryland Agriculture. Scientific Publishers.
- Singh, P. and Maliwal, P.L. 2005. Technologies for Food Security and Sustainable Agriculture. Agrotech Publishing Company.
- Singh, R.P. 1988. Improved Agronomic Practices for Dryland Crops. CRIDA.
- Singh, R.P. 2005. Sustainable Development of Dryland Agriculture in India. Scientific Publ.
- Singh, S.D. 1998. Arid Land Irrigation and Ecological Management. Scientific Publishers.
- Venkateshwarlu, J. 2004. Rainfed Agriculture in India. Research and Development Scenario. ICAR.

### **Course Title: Irrigation Water Management**

**Course Code: MAR109**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

### **Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Empower the farmers to adopt irrigated agricultural practices in place of traditional rainfed agriculture
2. Transfer the location specific technology/ research recommendations of SAUs to the grass root level farmers
3. Motivate the farmers for adoption of improved agricultural practices for enhancement of crop production and productivity
4. Create specific awareness among the farmers to achieve sustainable agricultural production while maintaining soil health & safe guarding environment.
5. Learn about Micro irrigation system and less water requiring crops

### **Course Contents**

#### **UNIT-I**

**2Hours**

History of irrigation in India; Major irrigation projects in India; Water resources development.

**UNIT-II**

**12Hours**

Concepts of irrigation scheduling, Different approaches of irrigation scheduling; Soil water depletion plant indices and climatic parameters; Concept of critical stages of crop growth in relation to water supplies; Crop modeling, crop coefficients, water production functions; Soil water movement in soil and plants, transpiration, soil-water-plant relationships and water absorption by plants.

**UNIT-III**

**8Hours**

Plant response to water stress. Methods of irrigation viz. surface methods, overhead methods, drip irrigation and air conditioning irrigation, merits and demerits of various methods, design and evaluation of irrigation methods; Measurement of irrigation water, application and distribution efficiencies; Management of water resources (rain, canal and ground water) for agricultural production

**UNIT-IV**

**8Hours**

Crop water requirements; Agronomic considerations in tile-design and operation of irrigation projects, characteristics of irrigation and family systems affecting irrigation management; irrigation legislation; Water quality, conjunctive use of water, irrigation strategies under different situation of water availability, optimum crop plans and cropping patterns in canal command areas; Drainage requirement of crops, methods of field drainage, their layout and spacing.

**Transaction Mode**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

**Suggested Reading**

- Paliwal, K.V. 1972. Irrigation with Saline Water. WTC, IARI, New Delhi.
- Panda, S. C. 2003. Principles and Practices of Water Management. Agrobios.
- Prihar, S. S. and Sandhu.B.S.1987. Irrigation of Field Crops - Principles and practices, ICAR, New Delhi.
- Sankara Reddi, G.H. and Yellamanda Reddy, T. 2003 Efficient Use of Irrigation Water. Kalyani , Ludhiana.
- Singh, P. and Maliwal, P. L. 2005. Technologies for Food Security and Sustainable Agriculture. Agrotech Publ.

**Web Sources**

- <https://saipatform.org/wp-content/uploads/2019/02/principles->

[and-practices-for-sustainable-water-management-\\_at-a-farm-level-final-2.pdf](#)

- <https://depws.nt.gov.au/water/water-management/water-management-principles>
- <https://www.shopconnecticutpostmall.com/shopnow/product/water-conservation-and-management-principles-and-practices-by-vincent-ford-hardcover-target-3b7036?model=0&variant=0>

**Course Title: Lab- Irrigation Water Management**

**Course Code: MAR110**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Learn about the development regarding Prevention of excess use of water
2. Have knowledge about the development regarding Prevention of soil erosion
3. Have knowledge to determinate of irrigation requirements.
4. Understand the Maintenance of quality of ground water and downstream surface Water
5. Attain the knowledge about development regarding the Increase in crop yield and maintenance of product quality

**Course Contents**

Measurement of soil water potential by using tensiometer, pressure plate and membrane apparatus. Soil-moisture characteristics curve. Water flow measurements using different devices. Determination of irrigation requirements. Calculation of irrigation efficiency. Determination of infiltration rate. Determination of saturated/ unsaturated hydraulic conductivity. Determination of Consumptive use, water requirement of a given cropping pattern.

**Suggested Readings**

Michael, A.M. 1978. Irrigation: Theory and Practice. Vikas Publishing House, New Delhi.

Mishra.R.D. and Ahamed, M.1993. Manual of Irrigation Agronomy. Oxford and IBH Publishing Co., New Delhi

Paliwal, K.V. 1972. Irrigation with Saline Water. WTC, IARI, New Delhi.

Panda, S. C. 2003. Principles and Practices of Water Management. Agrobios.

Prihar, S. S. and Sandhu.B.S.1987. Irrigation of Field Crops - Principles and practices, ICAR, New Delhi.

Sankara Reddi, G.H. and Yellamanda Reddy, T. 2003 Efficient Use of Irrigation Water. Kalyani , Ludhiana.

Singh, P. and Maliwal, P. L. 2005. Technologies for Food Security and Sustainable Agriculture. Agrotech Publ.

**Course Title: Weed Management**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

**Course Code: MAR111**

**Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Get knowledge about weed and its four stages of development
2. Understand the difference between annual, biennial and perennial weeds
3. Have knowledge about cultural weed controls
4. Know the advantages and disadvantages of the various method of herbicides applications
5. Understand herbicide carryover and how to prevent it

**Course Contents**

**UNIT-I**

**Hours-6**

Weed biology, ecology and crop-weed competition including allelopathy Scope and principles of weed management and control/weed classification, biology, ecology and allopath, crop weed indices.

**UNIT-II**

**Hours-7**

History and development of herbicide. Classification and selectivity of herbicides based on chemical, physiological application and selectivity. Mode and mechanism of action of important herbicides.

**UNIT-III**

**Hours-8**

Herbicide structure- activity relationship and factors affecting the efficiency of herbicides. Herbicide formulations and mixtures. Weed control through herbicides in soil and plants. Herbicide resistance in weeds and crops herbicide rotations.

**UNIT-IV**

**Hours-9**

Weed management in major crops and cropping systems. Management of parasitic weeds and special weed problems. Weed shifts in cropping systems. Aquatic and perennial weed control. Integrated weed management. Cost: benefit analysis of weed management.

**Transaction Mode**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

### Suggested Readings

Aldrich RJ & Kramer RJ. 1997. Principles in Weed Management. Panima Publ.  
Ashton FM & Crafts AS. 1981. Mode of Action of Herbicides. 2nd Ed. Wiley Inter Science.

Gupta OP. 2007. Weed Management – Principles and Practices. Agrobios.  
Mandal RC. 1990. Weed, Weedicides and Weed Control - Principles and Practices. Agro Botanical Publ.

Rao VS. 2000. Principles of Weed Science. Oxford & IBH.

Subramanian S, Ali AM & Kumar RJ. 1997. All About Weed Control.

Kalyani. Zimdahl RL. 1999. Fundamentals of Weed Science. 2nd Ed. Academic Press.

### Web Sources

- [https://coabnau.in/uploads/1587052357\\_PrinciplesofWeedmanagement.pdf](https://coabnau.in/uploads/1587052357_PrinciplesofWeedmanagement.pdf)
- <https://gardening.usask.ca/articles-and-lists/articles-weeds/basic-principles-of-integrated-weed-management-iwm.php>
- <https://agriinfo.in/principles-of-weed-control-341/>

**Course Title: Lab - Weed Management**

**Course Code: MAR112**

L	T	P	C
0	0	2	1

### Learning Outcomes:

After successful completion of this course, the students will be able to:

1. Get knowledge about different weeds.
2. Identify different Herbicides and their mode of action
3. Known about the method of weed control
4. Learn how to preserve weed plants in lab and herbarium
5. Know the advantages and disadvantages of the various method of herbicides applications

### Course Contents

Identification of important crop weeds. Preparation of a weed herbarium. Weed survey in crops and cropping systems. Crop-weed competition studies. Weed indices. Preparation of spray solutions of herbicides for high and low-volume sprayers. Use of various types of spray pumps and nozzles and calculation of swath width. Economics of weed control. Herbicide residue analysis in plant and soil. Bioassay of herbicide residue. Calculation of herbicidal requirement.

**Suggested Readings**

Aldrich RJ & Kramer RJ. 1997. Principles in Weed Management. Panima Publ.  
 Ashton FM & Crafts AS. 1981. Mode of Action of Herbicides. 2nd Ed. Wiley Inter Science.

Gupta OP. 2007. Weed Management – Principles and Practices. Agrobios.  
 Mandal RC. 1990. Weed, Weedicides and Weed Control - Principles and Practices. Agro Botanical Publ.

Rao VS. 2000. Principles of Weed Science. Oxford & IBH.

Subramanian S, Ali AM & Kumar RJ. 1997. All About Weed Control.

Kalyani. Zimdahl RL. 1999. Fundamentals of Weed Science. 2nd Ed. Academic Press.

**Course Title: Cropping system and Sustainable Agriculture****Course Code: MAR113**

L	T	P	C
3	0	0	3

**Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Get familiar with the physical source, soil and water management in cropping System
2. Learn about the concept of sustainability in cropping system and objectives
3. Attain the knowledge about the different types of cropping system, organic manures and their applicability for sustainable Agriculture
4. Get knowledge about the crop diversification for sustainable productivity
5. Get knowledge about the organic farming, organic standards and classifications in relevant to India and global agriculture

**Course Contents****UNIT-I****Hours-12**

Cropping systems- definition, indices and its importance. Physical resources, soil and water management in cropping systems, assessment of land use.

**UNIT-II****Hours-10**

Concept of sustainability in cropping systems, scope and objectives. Production potential under monoculture cropping, multiple cropping, alley cropping, sequential cropping and intercropping. Mechanism of yield advantage in intercropping systems. Multi-storied cropping and yield stability in intercropping. Role of nonmonetary inputs and low cost technologies.

**UNIT-III****Hours-11**

Research need on sustainable agriculture. Crop diversification for sustainability. Organic farming - concept and definition, its relevance to India and global agriculture and future prospects. Soil fertility- nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures and biofertilizers.

#### **UNIT-IV**

**Hours-12**

Farming systems, crop rotations, intercropping in relation to maintenance of soil productivity. Control of weeds, diseases and insect pest management, biological agents, pheromones and biopesticides. Socio-economic impacts. Marketing and export potential, Organic standards, certification, labeling and accreditation procedures. Organic farming and national economy.

#### **Transaction Mode**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

#### **Suggested Readings**

Palaniappan SP & Sivaraman K. 1996. Cropping Systems in the Tropics; Principles and Management. New Age.

Panda SC. 2003. Cropping and Farming Systems. Agrobios.

Reddy SR. 2000. Principles of Crop Production. Kalyani.

Sankaran S & Mudaliar TVS. 1997. Principles of Agronomy. The Bangalore Printing & Publ. Co.

Singh SS. 2006. Principles and Practices of Agronomy. Kalyani. Tisdale SL,

Nelson WL, Beaton JD & Havlin JL. 1997. Soil Fertility and Fertilizers. Prentice Hall.

#### **Web Sources**

- <https://sites.google.com/site/completeagriculturejkyadav/agronomy/distinguish-between-cropping-system-and-farming-system>
- <https://www.agriculturewale.com/cropping-pattern-cropping-system/>
- [https://agribsc.kkwagh.edu.in/uploads/department\\_course/Cropping\\_system.pdf](https://agribsc.kkwagh.edu.in/uploads/department_course/Cropping_system.pdf)

**Course Title: Modern Concepts in Crop Productions**  
**Course Code: MAR114**

2	0	0	2
---	---	---	---

### **Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Acquire the knowledge about crop growth analysis
2. Attain the knowledge about quantitative agro-biological principles
3. Get knowledge about crop yield equation and physiology of grain yield in cereals
4. Acquire knowledge about the concept of ideal plant type and environmental stress
5. Learn about the knowledge about the resources conservation technology residue management- recycling and precision agriculture

### **Course Contents**

#### **UNIT-I**

**Hours-7**

Crop growth analysis in relation to environment. Agro-ecological zones of India. Quantitative agro-biological principles and inverse yield nitrogen law.

#### **UNIT-II**

**Hours-8**

Mitscherlich yield equation, its interpretation and applicability, Baule unit. Effect of lodging in cereals. Physiology of grain yield in cereals. Optimization of plant population and planting geometry in relation to different resources

#### **UNIT-III**

**Hours-8**

Concept of ideal plant type and crop modeling for desired crop yield. Scientific principles of crop production and crop response production functions. Concept of soil plant relations. Yield and environmental stress. Integrated farming systems.

#### **UNIT-IV**

**Hours-7**

Resource conservation technology including modern concept of tillage, dry farming. Determining the nutrient needs for yield potentiality of crop plants. Crop residue management-recycling and its effective utilization. Remote sensing for yield forecasting. Precision agriculture.

#### **Transaction Mode**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

#### **Suggested Readings**

Balasubramaniyan P & Palaniappan SP. 2001. Principles and Practices of Agronomy. Agrobios.

Fageria NK. 1992. Maximizing Crop Yields. Marcel Dekker.

Havlin JL, Beaton JD, Tisdale SL & Nelson WL. 2006. Soil Fertility and



Fertilizers. 7th Ed. Prentice Hall.

Paroda R.S. 2003. Sustaining our Food Security. Konark Publ. 14

Reddy SR. 2000. Principles of Crop Production. Kalyani Publ.

Sankaran S & Mudaliar TVS. 1997. Principles of Agronomy. The Bangalore Printing & Publ.

Singh SS. 2006. Principles and Practices of Agronomy. Kalyani.

**Course Title: Crop production in Problem Soils and Water**

**Course Code: MAR117**

L	T	P	C
2	0	0	2

**Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Have knowledge regarding basic concept of problematic soils
2. Learn about the knowledge regarding the diagnosis and reclamation of saline - alkaline soils
3. Attain the knowledge regarding the diagnosis and reclamation of acidic soils
4. Learn regarding the management of sandy, clayey, compact and waterlogged soils
5. Acquire knowledge about the diagnosis and management of poor quality irrigation water

**Course Contents**

**UNIT-I**

**Hours-7**

Area, distribution, origin and basic concepts of problematic soils. Morphological features and characterization of salt-affected soils.

**UNIT-II**

**Hours-8**

Management of salt- affected soils. Salt tolerance of crops - mechanism and ratings. Monitoring of soil salinity in the field. Management principles for sandy, clayey, red lateritic and dry land soils.

**UNIT-III**

**Hours-8**

Acid soils – nature, sources and management. Effect on plant growth. Lime requirement of acid soils. Biological sickness of soils and its management. Quality of irrigation water, management of brackish water.

**UNIT-IV**

**Hours-7**

Salt balance under irrigation. Characterization of brackish waters, area and extent. Agronomic practices in relation to problematic soils. Cropping pattern for utilizing poor quality ground waters.

**Transaction Mode**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

### **Suggested Readings**

Introductory Soil Science by D.K. Das.

Principles of Agronomy by S. R. Reddy

Principles Of Agronomy by Reddy & Reddy

### **Web Sources**

- <https://www.agriexam.com/introduction-to-soil-science-book-pdf>
- <https://cdnsciencepub.com/doi/10.1139/cjss-2018-0006>
- <https://www.agrimoon.com/wp-content/uploads/Introduction-to-Soil-Science.pdf>

**Course Title: Lab - Crop productions in Problem Soils and Water**

**Course Code: MAR118**

L	T	P	C
0	0	2	1

### **Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Have knowledge regarding the characterization of acid, acid sulphate, salt -affected and calcareous soils.
2. Attain knowledge about the determination of cations (Na<sup>+</sup>, K<sup>+</sup>, Ca<sup>++</sup> and Mg<sup>++</sup>) in ground water and soil samples,
3. Learn about the development regarding the determination of anions (Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, CO<sub>3</sub><sup>2-</sup> and HCO<sub>3</sub><sup>-</sup>) in ground water and soil
4. Acquire the knowledge about the determination of lime and gypsum requirement of acid and sodic soil
5. Learn regarding the management of sandy, clayey, compact and waterlogged soils

### **Course Contents**

Characterization of acid, acid sulfate, salt- affected and calcareous soils. Determination of cations (Na<sup>+</sup>, K<sup>+</sup>, Ca<sup>+</sup>, and Mg<sup>++</sup>) in ground water and soil samples. Determination of anions (Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, CO<sub>3</sub><sup>2-</sup> and HCO<sub>3</sub><sup>-</sup>) in ground waters and soil samples. Lime and gypsum requirement of acid and sodic soil.

**Suggested Readings**

Introductory Soil Science by D.K. Das.

Principles of Agronomy by S. R. Reddy

Principles Of Agronomy by Reddy & Reddy

**Course Title: Plant Physiology**

**Course Code: MAR119**

L	T	P	C
2	0	0	2

**Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Get knowledge about the various plant water relations
2. Learn about the mineral nutrition in plants
3. Understand the mechanism of various metabolic processes in plants
4. Know the basic knowledge about growth and development in plants
5. Learn about skills and techniques related to plant physiology so that they can design their own experiments

**Course Contents****UNIT-I****Hours-3**

Photosynthesis, pigments, Co<sub>2</sub> fixation and reduction. Carbohydrate synthesis in C<sub>3</sub>, C<sub>4</sub> and CAM plants.

**UNIT-II****Hours-8**

Translocation of metabolites. Photo respiration. Environmental and agricultural aspects of photosynthetic efficiency, source- sink relationship and productivity. Respiration. Concept of growth, differentiation and pattern formation. Factor affecting growth and general aspects of development.

**UNIT-III****Hours-9**

Harmones and growth regulators -auxins , gibberellins, cytokinins, ethylene and ABA. Other inhibitors. Retardants. Polyamines. Aliphatic alcohols. Brassins. Harmonal regulation of growth & development. Photoperiodism. Flowering hormones, Vernalization. Abscission.. Aging. Senescence.

**UNIT-IV****Hours-10**

Physiology of seed and fruit development. Seed germination. Seed and bud dormancy. Plant water relationship. Osmotic potential, water potential. Pressure potential and their relationship. Plasmolysis. Imbibitions. Absorption and translocation of water. Stomata, stomata mechanism. Factor affecting water loss. Physiological role of nutrients.

**Transaction Mode**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

**Suggested Readings**

Plant Physiology and Development by Eduardo Zeiger and Lincoln Taiz.

Physicochemical and Environmental Plant Physiology by Park Nobel.

Fundamentals of Plant Physiology by V.K. Jain.

**Web Sources**

- <https://www.sciencedirect.com/book/9780123741431/physicochemical-and-environmental-plant-physiology>
- <https://besjournals.onlinelibrary.wiley.com/doi/full/10.1046/j.1365-2664.1999.00459-5.x>
- <https://go.gale.com/ps/i.do?id=GALE%7CA63605079&sid=googleScholar&v=2.1&it=r&linkaccess=abs&issn=0011183X&p=AONE&sw=w&userGroupName=anon%7E8b5a362f>

**Course Title: Lab - Plant Physiology**

**Course Code: MAR120**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Understand the mechanism of various metabolic processes in plants
2. Acquire basic knowledge about growth and development in plants
3. Equip students with skills and techniques related to plant physiology so that they can design their own experiments
4. Know the basic knowledge about growth and development in plants
5. Equip students with skills and techniques related to plant physiology so that they can design their own experiments

### Course Contents

Experiments related to photosynthesis. Chlorophyll and other pigment determination. Experiments related to respiration, Osmosis, Imbibition, Plasmolysis. Measurements of  $\mu_w$  and  $\mu_s$ . Membrane permeability. Transpiration experiments. catalase, peroxidase and nitrate reductase activities as indicators of Nutrient status of crop. Experiment on growth measurements. Experiment on quality of light on seed germination. Breaking of dormancy. Experiment on photo-periodism. Experiment on hormonal regulation and development.

### Suggested Readings

Plant Physiology and Development by Eduardo Zeiger and Lincoln Taiz.

Physicochemical and Environmental Plant Physiology by Park Nobel.

Fundamentals of Plant Physiology by V.K. Jain.

### Course Title: Agricultural Statistics

Course Code: MAR121

L	T	P	C
3	0	0	3

### Learning Outcomes:

After successful completion of this course, the students will be able to:

1. Organize, manage and present data, analyze statistical data graphically using frequency distributions and cumulative frequency distributions
2. Analyze statistical data using measures of central tendency, dispersion and location
3. Use the basic probability rules, including additive and multiplicative laws, using the terms, independent and mutually exclusive events
4. Translate real-world problems into probability models and derive the probability density function of transformation of random variables
5. Calculate probabilities, and derive the marginal and conditional distributions of bivariate random variables

### Course Contents

#### UNIT-I

**Hours-11**

Frequency distribution, standard error and deviation, correlation and regression analyses, co-efficient of variation

#### UNIT-II

**Hours-12**

Hypothesis testing. Concept of p-value. Tests of significance-t, F and chi-square ( $X^2$ ); Data transformation and missing plot techniques;

#### UNIT-III

**Hours-13**

Design of experiments and their basic principles, completely randomized,

randomized block, split plot, strip-plot, factorial and simple confounding designs

**UNIT-IV**

**Hours-9**

Efficiency of designs; Methods of statistical analysis for cropping systems including intercropping; Pooled analysis.

**Suggested Readings**

Panse, V.G. and Sukhatme, P.V. 1954. *Statistical methods for agricultural workers*. pp. 361.

Gupta, S.C. and Kapoor, V.K. 2014. *Fundamentals of Mathematical Statistics*. Sultan Chand & Sons, New Delhi.pp. 230.

Snedecor, G.W. and Cochran, W.G. 1989. *Statistical Methods*, 8th Edition. Wiley-Blackwell. Pp.524.

Rangaswamy, R. 2016. *Textbook of Agricultural Statistics*.New Age International (P) Ltd. New Delhi. pp. 531.

Web Sources

- <https://www.cabdirect.org/cabdirect/abstract/19561604178>
- <https://agris.fao.org/agrissearch/search.do?recordID=US201300351448>
- [https://www.scirp.org/\(S\(351jmbntvnsjt1aadkozje\)\)/reference/referencespapers.aspx?referenceid=869408](https://www.scirp.org/(S(351jmbntvnsjt1aadkozje))/reference/referencespapers.aspx?referenceid=869408)

**Course Title: Lab- Agricultural Statistics**

**Course Code: MAR122**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**Learning Outcomes:**

1. After successful completion of this course, the students will be able to:
2. Statistical principles apply in all the areas of experimental work and they have a very important role in agriculture.
3. It is required at the national level and farm level for agriculture policy making, decision making, agriculture development and estimates agriculture and national income.

4. Statistics in agriculture are great importance in variety of area. One of the most important is to ascertain the volume of crop that needs to be produced based on output and demand of previous year.
5. It is helpful in land utilization and irrigation including the net area sown gross cultivated area, current follow, cultivable waste
6. Know how to analyze statistical data graphically using frequency distributions and cumulative frequency distributions

### **Course Contents**

Correlation analysis. Regression analysis (exponential, power function, quadratic, multi- variate, selection of variables, validation of models, ANOVA and testing of hypothesis). Tests of significance (Z-test, t-test, F-test and Chi-square test). Analysis of variance. Completely randomized design. Randomized block and latin square designs. Missing plot and analysis of covariance. 23, 24 and 33 simple and confounded experiments. Split plot designs. Factorial in split plot designs.

#### **Suggested Readings**

Panse, V.G. and Sukhatme, P.V. 1954. Statistical methods for agricultural workers. pp. 361.

Gupta, S.C. and Kapoor, V.K. 2014. *Fundamentals of Mathematical Statistics.* Sultan Chand & Sons, New Delhi, pp. 230.

Snedecor, G.W. and Cochran, W.G. 1989. *Statistical Methods,* 8th Edition. Wiley-Blackwell. Pp.524.

Rangaswamy, R. 2016. *Textbook of Agricultural Statistics.*New Age International (P) Ltd. New Delhi. pp. 531.

**Course Title: Seminar-I**

**Course Code: MAR123**

L	T	P	C
0	0	2	1

#### **Learning Outcomes:**

On successful completion of this course, the students will able to:

1. Show competence in identifying relevant information, defining and explaining topics under discussion
2. Present the classical and innovative work related to plant pathology subject.

3. Reach across diverse disciplines to apply theories, methods and knowledge bases from multiple fields to a single question or problem
4. Judge when to speak and how much to say, speak clearly and audibly in a manner appropriate to the subject
5. To ask appropriate questions, use evidence to support claims, respond to a range of questions

**Course Content**

Seminar topic will be suggested by faculty

**Course Title: Seminar-II**

**Course Code: MAR123A**

L	T	P	C
0	0	2	1

**Learning Outcomes:**

On successful completion of this course, the students will able to:

1. Show competence in identifying relevant information, defining and explaining topics under discussion
2. Present the classical and innovative work related to plant pathology subject.
3. Reach across diverse disciplines to apply theories, methods and knowledge bases from multiple fields to a single question or problem
4. Judge when to speak and how much to say, speak clearly and audibly in a manner appropriate to the subject
5. To ask appropriate questions, use evidence to support claims, respond to a range of questions

**Course Content**

Seminar topic will be suggested by faculty

**Course Title: Fundamental of Computer Application Lab**

**Course Code: MAR124**

L	T	P	C
0	0	2	1

**Learning Outcomes:**

On successful completion of this course, the students will able to:



1. Learn and understand about basics of MS-Word, Excel, preparation of Graphs
2. Read, understand, and interpret material on technology. They will have an appreciation for some of the ideas, issues, and problems involved in writing about technology and in workplace writing.
3. Understand the operating systems, peripheral devices, networking, multimedia and internet
4. Familiarize with basic sources and methods of research and documentation on topics in technology, including on-line research.
5. Students will be able to synthesize and integrate material from primary and secondary sources with their own ideas in research papers.

### **Course Content**

Ms-word: creating a document, saving and editing, use of options from tool bars, format, insert and tools(spelling and grammar), alignment of text, creating a table, merging cells, column and row width. Ms-excel: entering expressions through the formula tool bar and use of inbuilt functions, sum, average, max, min. Creating graphs and saving with and without data in Ms-excel. Ms-access: creating database, structuring with different types of fields. Ms-power point: preparation of slides on power point. Internet Browsing: browsing a web page and creating of E-Mail ID. Agri. net (ARIS).

### **Suggested Readings:**

Salaria, R.S. 2017. *Computer Fundamentals*. Daryaganj, New Delhi. pp. 486.  
 Manish, S. and Bhatt, A. 2016. *Computers in Agriculture: Fundamentals and Applications*. New India Publishing Agency. New Delhi. pp. 190.  
 Manjunath, B.E. 2010. *Computer Basics*. Vasan Publications, Bengaluru, Karnataka. pp. 356.

**Course Title: Lab - Library and Information Services**  
**Course Code: MAR125**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Identify library services and availability of resources in order to develop a realistic overall plan for research.
2. Use general information resources to increase familiarity with the topic and disciplinary vocabulary.

3. Define the research topic, question or thesis to achieve a manageable focus appropriate to the assignment criteria, available resources, and evidence needed to support thesis.
4. Identify keywords, synonyms and related terms in order to flexibly search information resources.
5. Learn about how to search the research citations and research papers.

### **Course Contents**

Introduction to Library and its services; five laws of library science; type of documents; classification and cataloguing; organization of documents; sources of information primary, secondary and tertiary; current awareness and SDI services; tracing information from reference sources; library survey; preparation of bibliography; use of Online Public Access Catalogue; use of CD-ROM databases and other computerized library services, CeRA, J-Gate; use of Internet including search engines and its resources; e-resources.

#### **Transaction Mode**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

#### **Suggested Readings**

Gita, S. 2012. *Library and Information Services*. LAP Lambert Academic Publishing, USA. pp. 76.

Kishore, A. 2021. *A Conceptual approach to library and information science A complete self study guide*. 2<sup>nd</sup> edition. AKB Publication. Jaipur. pp. 250.

Pandey, D.K. 2004. *Library and Information Science*. Atlantic Publishers & Distributors. New Delhi. pp. 272.

**Course Title: Lab - Technical Writing and Communication Skills**

**Course Code: MAR126**

L	T	P	C
0	0	2	1

#### **Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Understand and know how to follow the stages of the writing process (prewriting/writing/rewriting) and apply them to technical and workplace writing tasks.
2. Produce a set of documents related to technology and writing in the or place and will have improved their ability to write clearly and accurately.
3. Understand the basic components of definitions, descriptions, process explanations, and other common forms of technical writing.
4. Familiar with basic technical writing concepts and terms, such as audience analysis, jargon, format, visuals, and presentation.
5. Learn about how to do writing of abstracts, summaries and what are citations et

### Course Contents

Various forms of scientific writings: thesis, technical papers, review, manuals etc., various parts of thesis and research communications: title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion; writing of abstracts, summaries, précis, citations etc. commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; paginations, numbering of tables and illustrations; writing of numbers and dates in scientific write-ups; editing and proof reading; writing a review article, access methods.

### Transaction Mode

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

### Suggested Readings

Day, R.A. and Gastel, B. 2011. *How to Write and Publish a Scientific Paper*, 7th Edition. GreenwoodPress, United States. pp. 300.

Laplante, P.A. 2011. *Technical Writing: A Practical Guide for Engineers and Scientists*. CRC Press, London. pp. 250.

Greenlaw, R. 2012. *Technical Writing, Presentational Skills and Online Communication: Professional Tools and Insights*. Idea Group, U.S. pp. 247.

**Course Title: Master's Research**  
**Course Code: MAR127**

L	T	P	C
0	0	0	24

**Learning Outcomes:**

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

1. Conduct an investigation and solve scientific problems using a range of methods, and apply appropriate and/or theoretical techniques
2. Negotiate, plan, design and execute a research-based project,
3. Analyse data and provide a written report or thesis on the methodology and outcomes in an appropriate format
4. Learn the methodology of planning, layout, data recording, analysis, interpretation and report writing of plant pathology experiments
5. Familiarize with indexing databases, citation databases: web of science, scopus etc.

**Course Title: Soil Fertility and Fertilizer Use**  
**Course Code: MAR128**

L	T	P	C
2	0	0	2

**Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Acquire the knowledge regarding the concept of soil fertility and soil Productivity
2. Get the knowledge regarding the concept of nutrients sources
3. Attain knowledge regarding the concept of transformation of nutrients (NPK)
4. Learn about the concept of availability of micro nutrients and their transformation
5. Know the concept of site specific nutrient management concept of soil fertility evaluation and soil quality

**Course Contents**

**UNIT-I**

**Hours-7**

Soil fertility and soil productivity. Nutrient sources – fertilizers and manures. Soil N – sources and N transformations.

**UNIT-II**

**Hours-8**

Biological nitrogen fixation. Nitrogenous fertilizers - their fate in soils and enhancing N use efficiency. Soil P - forms, reactions in soils and factors

affecting availability. Management of P fertilizers. Potassium- forms, mechanism of fixation, Q/I relationships.

**UNIT-III**

**Hours-7**

Management of K fertilizers. Sulphur, Ca and Mg – source, forms, fertilizers and their behavior in soils and management. Micronutrients- critical limits in soils and plants, factors affecting their availability, sources and management. Common soil test methods for fertilizer recommendations.

**UNIT-IV**

**Hours-8**

Site-specific and plant need based nutrient management. Concept of balanced nutrition and integrated nutrient management. Blanket fertilizer recommendations- usefulness and limitations. Soil fertility evaluation. Soil quality in relation to sustainable agriculture.

**Transaction Mode**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

**Suggested Readings**

Brady NC & Weil R.R 2002. The Nature and Properties of Soils. 13th Ed. Pearson Edu.

Fageria NK, Baligar VC & Jones CA. 1991. Growth and Mineral Nutrition of Field Crops. Marcel Dekker.

Havlin JL, Beaton JD, Tisdale SL & Nelson WL. 2006. Soil Fertility and Fertilizers. 7th Ed. Prentice Hall.

Prasad R & Power JF. 1997. Soil Fertility Management for Sustainable Agriculture. CRC Press.

Yawalkar KS, Agrawal JP & Bokde S. 2000. Manures and Fertilizers. Agri-Horti Publ.

**Web Sources**

- [https://www.academia.edu/41667742/Pdf\\_The\\_Nature\\_and\\_Properties\\_of\\_Soils\\_15th\\_Edition\\_by\\_Ray\\_R\\_Weil\\_Nyle\\_C\\_Brady\\_Emeritus\\_Prof\\_esso](https://www.academia.edu/41667742/Pdf_The_Nature_and_Properties_of_Soils_15th_Edition_by_Ray_R_Weil_Nyle_C_Brady_Emeritus_Prof_esso)
- [https://epsc413.wustl.edu/TOC\\_Textbook.pdf](https://epsc413.wustl.edu/TOC_Textbook.pdf)
- <https://agris.fao.org/agrissearch/search.do?recordID=US199700266>

28

**Course Title: Lab - Soil Fertility and Fertilizer Use**  
**Course Code: MAR129**

0	0	2	1
---	---	---	---

### **Learning Outcomes:**

After successful completion of this course, the students will be able to:

1. Have knowledge regarding the laboratory and green house experiment are evaluation of indices of nutrient availability
2. Acquire knowledge about calculation of critical values of nutrients in soil and Plants
3. Determine the total and available nutrients in soils
4. Know about the skill development regarding analysis of nutrients in plants
5. Know the concept of site specific nutrient management concept of soil fertility evaluation and soil quality

### **Course Contents**

Laboratory and greenhouse experiments for evaluation of indices of nutrient availability and their critical values in soils and plants. Chemical analysis of soil for total and available nutrients. Analysis of plants for essential elements.

### **Suggested Readings**

Brady NC & Weil R.R 2002. The Nature and Properties of Soils. 13th Ed. Pearson Edu.

Fageria NK, Baligar VC & Jones CA. 1991. Growth and Mineral Nutrition of Field Crops. Marcel Dekker.

Havlin JL, Beaton JD, Tisdale SL & Nelson WL. 2006. Soil Fertility and Fertilizers. 7th Ed. Prentice Hall.

Prasad R & Power JF. 1997. Soil Fertility Management for Sustainable Agriculture. CRC Press.

Yawalkar KS, Agrawal JP & Bokde S. 2000. Manures and Fertilizers. Agri-Horti Publ.

**Course Title: Agronomy of medicinal, aromatic and under under-utilized crops**  
**Course Code: MAR130**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>

### **Learning Outcomes:**

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

1. Study about economic value of medicinal and aromatic plants at national and industrial level
2. Understand the botanical characteristics and export potential of medicinal and aromatic plants
3. Acquire knowledge of outstanding techniques for cultivation of medicinal and aromatic plants
4. Study the importance of value addition and quality standards in herbal products

### **Course Content**

#### **UNIT-I**

**7 Hours**

Importance of medicinal and aromatic plants in human health, national economy and related industries, classification of medicinal and aromatic plants according to botanical characteristics and their uses, export potential and indigenous technical knowledge.

#### **UNIT-II**

**7 Hours**

Climate and soil requirements; cultural practices; yield and important constituents of medicinal plants (Mulhati, Isabgol, Rauwolfia, Poppy, Aloe vera, Satavar, Stevia, Safed Musli, Kalmegh, Asaphoetida, Nux vomica, Rosadale etc).

#### **UNIT-III**

**8 Hours**

Climate and soil requirements; cultural practices; yield and important constituents of aromatic plants (Citronella, Palmarosa, Mentha, Basil, Lemon grass, Rose, Patchouli, Geranium).

#### **UNIT-IV**

**8 Hours**

Climate and soil requirements; cultural practices; yield of under-utilized crops (Rice bean, Lathyrus, Sesbania, Clusterbean, French bean, Fenugreek, Grain Amaranth, Coffee, Tea and Tobacco). Post harvest handling –drying, processing, grading, packing and storage, value addition and quality standards in herbal products.

#### **Transaction Mode**

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

#### **Suggested Readings:**

Chadha KL & Gupta R. 1995. Advances in Horticulture. Vol. II. Medicinal and Aromatic Plants. Malhotra Publ.

Das NR. 2007. Introduction to Crops of India. Scientific Publ.

Handa SS. 1984. Cultivation and Utilization of Medicinal Plants. RRL, CSIR, Jammu.

Hussain A. 1984. Essential Oil Plants and their Cultivation. CIMAP, Lucknow.

Hussain A. 1993. Medicinal Plants and their Cultivation. CIMAP, Lucknow.

ICAR 2006. Hand Book of Agriculture. ICAR, New Delhi.

Kumar N, Khader Md. Abdul, Rangaswami JBM & Irulappan 1997. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Oxford & IBH.

Prajapati ND, Purohit SS, Sharma AK & Kumar T. 2003. A Hand Book of Medicinal Plants: A Complete Source Book. Agrobios.

Sharma R. 2004. Agro-Techniques of Medicinal Plants. Daya Publ. House.

### Web Sources

- [https://www.scirp.org/\(S\(i43dyn45teexjx455qlt3d2q\)\)/reference/ReferencesPapers.aspx?ReferenceID=968307](https://www.scirp.org/(S(i43dyn45teexjx455qlt3d2q))/reference/ReferencesPapers.aspx?ReferenceID=968307)
- <https://agris.fao.org/agris-search/search.do?recordID=US201300007936>

**Course Title: Lab Agronomy of medicinal, aromatic and under-utilized crops**

**Course Code: MAR131**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### Learning Outcomes:

On successful completion of this course, the students will able to:

1. Study about economic value of medicinal and aromatic plants at national and industrial level
2. Understand the botanical characteristics and expert potential of medicinal and aromatic plants
3. Acquire knowledge of outstanding techniques for cultivation of medical and aromatic plants



4. Study the importance of value addition and quality standards in herbal products

### **Course Content**

Identification of crops based on morphological and seed characteristics. Raising of herbarium of medicinal, aromatic and under-utilized plants. Quality characters in medicinal and aromatic plants. Methods of analysis of essential oil and other chemicals of importance in medicinal and aromatic plants.

### **Suggested Readings:**

Chadha KL & Gupta R. 1995. Advances in Horticulture. Vol. II. Medicinal and Aromatic Plants. Malhotra Publ.

Das NR. 2007. Introduction to Crops of India. Scientific Publ.

Handa SS. 1984. Cultivation and Utilization of Medicinal Plants. RRL, CSIR, Jammu.

Hussain A. 1984. Essential Oil Plants and their Cultivation. CIMAP, Lucknow.

Hussain A. 1993. Medicinal Plants and their Cultivation. CIMAP, Lucknow.

ICAR 2006. Hand Book of Agriculture. ICAR, New Delhi.

Kumar N, Khader Md. Abdul, Rangaswami JBM & Irulappan 1997. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Oxford & IBH.

Prajapati ND, Purohit SS, Sharma AK & Kumar T. 2003. A Hand Book of Medicinal Plants: A Complete Source Book. Agrobios.

Sharma R. 2004. Agro-Techniques of Medicinal Plants. Daya Publ. House.