

GURU KASHI UNIVERSITY



M.Sc. Agronomy

Session : 2024-25

Department of Agronomy

Graduate Attributes:

The graduates will be able to develop proficiency in various methods of different types of field crops cultivation and resource utilization problems. Inculcate 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 standards for export of farm produce.

Programme Outcomes (POs)

After completion of programme, the students will be able to:

- 1.** 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.** Understand 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 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 followed for various 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, Herbicide residue

Course Structure of M.Sc. Agronomy

Course Code	Course Name	Type of Course	L	T	P	Credit
SEMESTER - 1st						
MAR103	Agronomy of Oilseed, Fiber, Sugar and Important Medicinal and Aromatic Crops	Major	1	0	0	1
MAR107	Dry Land Farming and Water Shed Management	Major	1	0	0	1
MAR119	Plant Physiology	Minor (CBCS)	2	0	0	2
MAR132	Soil erosion and conservation					
MAR121	Agricultural Statistics	Supporting	3	0	0	3
MAR125	Library and Information Services- Lab	Common	0	0	2	1
MAR134	Agricultural Research, Research Ethics and Rural Development Programmes	Common	1	0	0	1
MAR104	Agronomy of Oilseed, Fiber, Sugar and Important Medicinal and Aromatic Crops-Lab	Major	0	0	2	1
MAR108	Dry Land Farming and Water Shed Management-Lab	Major	0	0	2	1
MAR120	Plant Physiology-Lab	Minor	0	0	2	1
MAR133	Soil erosion and conservation-Lab	Minor				
MAR122	Agricultural Statistics-Lab	Supporting	0	0	2	1
MAR100	Master Research	Thesis research	-		10	NC
Total						13
SEMESTER-2nd						
MAR201	Agronomy of Fodder and Forage/ Pasture Crops	Major	1	0	0	1
MAR202	Irrigation Water Management	Major	2	0	0	2
MAR203	Weed Management	Major	2	0	0	2
MAR204	Crop production in Problem Soils and Water	Minor (CBCS)	1	0	0	1
MAR205	Soil, water and air pollution					
MAR206	Fundamentals of Computer Applications-Lab	Supporting		-	4	2
MAR207	Agronomy of Fodder and Forage/ Pasture Crops-Lab	Major	0	0	2	1
MAR208	Irrigation Water Management-Lab	Major	0	0	2	1

M.Sc. Agronomy (MAR24)

MAR209	Weed Management-Lab	Major	0	0	2	1
MAR210	Crop production in Problem Soils and Water-Lab	Minor (CBCS)	0	0	2	1
MAR211	Soil, water and air pollution-Lab	Seminar	N A	N A	2	1
MAR212	Seminar-I					
MAR213	Basic Concepts in Laboratory Techniques-Lab	Common	0	0	2	1
MAR100	Master Research	Thesis research	-		10	NC
Total						14
SEMESTER-3rd						
MAR301	Modern Concepts in Crop Productions	Major	3	0	0	3
MAR307	Principles of Plant Physiology I: Plant Water Relations and Mineral Nutrition	Minor (CBCS)	2	0	0	2
MAR303	Soil microbiology					
MAR304	Technical Writing and Communication Skills-Lab	Common	0	0	2	1
MAR308	Principles of Plant Physiology I: Plant Water Relations and Mineral Nutrition - Lab	Minor (CBCS)	0	0	2	1
MAR306	Soil microbiology-Lab					
MAR100	Master Research	Thesis Research	-		20	NC
Total						7
SEMESTER-4th						
MAR401	Agronomy of Major Cereal and Pulse crops	Major	1	0	0	1
MAR404	Principles and practices of Soil Fertility and Nutrient Management	Major	2	0	0	2
MAR402	Intellectual Property And its management in Agriculture	Common	1	0	0	1
MAR403	Agronomy of Major Cereal and Pulse crops- Lab	Major	0	0	2	1
MAR405	Principles and practices of Soil Fertility and Nutrient Management- Lab	Major	0	0	2	1
MAR100	Master Research	Thesis Research	-		20	NC
Total						6
MAR100	Master Research	Thesis Research	0	0	0	30
Grand Total						40+30=70

CBCS- Choice based credit system and NC- Non credit

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. End-Term Exam: [20 Marks]

D. 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 Oilseed, Fiber, Sugar and Important Medicinal and Aromatic Crops

Course Code: MAR103

L	T	P	C
1	0	2	2

Total Hours-45

Course 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-4

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, soybean,), fiber crops (Cotton, jute, sunn hemp) and sugar crops- sugarcane.

UNIT-II

Hours-3

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-4

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

UNIT-IV

Hours- 4

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

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

Course content

- 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.

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- Das NR. 2020. *Introduction to Crops of India*. Scientific Publ.
- Das PC. 2019. *Oilseed Crops of India*. Kalyani.
- Lakshmikantam N. 2021. *Technology in Sugarcane Growing*. 2ndEd. Oxford & IBH.
- Prasad, Rajendra. 2020. *Text Book of Field Crop Production*. ICAR.
- Singh C, Singh P & Singh R. 2021. *Modern Techniques of Raising Field Crops*. Oxford & IBH.
- Singh SS. 2020. *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: Dry Land Farming and Water Shed Management

L	T	P	C
1	0	2	2

Course Code: MAR107

Total Hours-45

Course 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

Hours-3

Definition, concept and characteristics of dry land farming. Dry land versus rainfed farming. Significance and dimensions of dry land farming in Indian agriculture. Soil and climatic parameters with special emphasis on rainfall characteristics.

UNIT-II

Hours-4

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. Anti-transpirants, soil and crop management techniques, seeding and efficient fertilizer use. Fertilizer placement top dressing and foliage application.

UNIT-III

Hours-4

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, contingent plan for aberrant weather conditions.

UNIT-IV

Hours-4

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).

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

Course Code: MAR: 108

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.
- Visit to dryland farming unit at farmer's field.

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- Dhopte, A.M. 2020. *Agro technology for Dry land Farming*. Scientific Publ.
- Dhruv Narayana, V.V. 2022. *Soil and Water Conservation Research in India*. ICAR.
- Rao, S.C. and Ryan, J. 2022. *Challenges and Strategies of Dryland Agriculture*. Scientific Publishers.
- Singh, P. and Maliwal, P.L. 2021. *Technologies for Food Security and Sustainable Agriculture*. Agrotech Publishing Company.
- Singh, R.P. 2020. *Improved Agronomic Practices for Dryland Crops*. CRIDA.
- Singh, R.P. 2018. *Sustainable Development of Dryland Agriculture in India*. Scientific Publ.
- Venkateshwarlu, J. 2019. *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,degradati on%20and%20decreased%20crop%20yields.>
- https://agritech.tnau.ac.in/agriculture/agri_majorareas_dryland_drylandtechnologies.html
- <https://prepp.in/news/e-492-dry-land-farming-agriculture-notes>

Course Title: Plant Physiology

L	T	P	C
2	0	2	3

Course Code: MAR119**Total Hours-60****Course 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-7

Photosynthesis, pigments, CO₂ fixation and reduction. Carbohydrate synthesis in C₃, C₄ and CAM plants. Translocation of metabolites. Photo respiration. Factor affecting water loss. Physiological role of nutrients.

UNIT-II

Hours-7

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-8

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

UNIT-IV

Hours-8

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.

Course Title: Lab - Plant Physiology

Course Code: MAR120

Course Contents

- Experiments related to photosynthesis.
- Chlorophyll and other pigment determination.
- Experiments related to respiration, Osmosis, Imbibition, Plasmolysis. Measurements of μw and μs .
- 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.

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Plant Physiology and Development* by Eduardo Zeiger and Lincoln Taiz. 2021.
- *Physicochemical and Environmental Plant Physiology* by Park Nobel. 2022.
- *Fundamentals of Plant Physiology* by V.K. Jain. 2020.

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: Soil erosion and conservation
Course Code: MAR132

L	T	P	C
2	0	2	3

Total Hours-60**Course Outcomes:**

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

1. To enable students to understand various types of soil erosion
2. To enable students to know about the measures to be taken for controlling soil erosion to conserve soil and water.
3. Learn about the planning for soil conservation
4. Know the basic knowledge about watershed management

Course Contents

UNIT-I	8
History, distribution, identification and description of soil erosion problems in India. Forms of soil erosion; effects of soil erosion and factors affecting soil erosion; types and mechanisms of water erosion; raindrops and soil erosion; rainfall erosivity - estimation as EI30 index and kinetic energy;	
UNIT-II	8
Factors affecting water erosion; empirical and quantitative estimation of water erosion; methods of measurement and prediction of runoff; soil losses in relation to soil properties and precipitation. Wind erosion- types, mechanism and factors affecting wind erosion; extent of problem in the country.	
UNIT-III	7
Principles of erosion control; erosion control measures – agronomical and engineering; erosion control structures - their design and layout. Soil conservation planning; land capability classification; soil conservation in special problem areas such as hilly, arid and semi-arid regions, waterlogged and wet lands.	
UNIT-VI	7
Watershed management - concept, objectives and approach; water harvesting and recycling; flood control in watershed management; socioeconomic aspects of watershed management; case studies in respect to monitoring and evaluation of watersheds; use of remote sensing in assessment and planning of watersheds.	

Course Title: Lab - Soil erosion and conservation
Course Code: MAR133
Course content

- Determination of different soil erodibility indices - suspension percentage, dispersion ratio, erosion ratio, clay ratio, clay/moisture equivalent ratio, percolation ratio, raindrop erodibility index

- Computation of kinetic energy of falling rain drops
- Computation of rainfall erosivity index (EI30) using rain gauge data
- Visits to a watersheds

Suggested Readings

- Biswas TD & Narayanasamy G. (Eds.) 2020. *Soil Management in Relation to Land Degradation and Environment*. Bull. Indian Society of Soil Science No. 17.
- Doran JW & Jones AJ. 2021. *Methods of Assessing Soil Quality*. Soil Science Society of America, Spl Publ. No. 49, Madison, USA.
- Gurmial Singh, Venkataramanan C, Sastry G & Joshi BP. 2021. *Manual of Soil and Water Conservation Practices*. Oxford & IBH.

Course Title: Agricultural Statistics

L	T	P	C
3	0	2	4

Course Code: MAR121

Total Hours-60

Course 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 (X²); Data transformation and missing plot techniques;

UNIT-III

Hours-11

Design of experiments and their basic principles, completely randomized, randomized block, split plot, strip-plot, factorial and simple confounding designs

UNIT-IV

Hours-11

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

Course Title: Lab- Agricultural Statistics

Course Code: MAR122

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
- 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.

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- Panse, V.G. and Sukhatme, P.V. 2021. *Statistical methods for agricultural workers*.
- Gupta, S.C. and Kapoor, V.K. 2022. *Fundamentals of Mathematical Statistics*. Sultan Chand & Sons, New Delhi.
- Snecdecor, G.W. and Cochran, W.G. 2021. *Statistical Methods, 8th Edition*. Wiley-Blackwell.
- Rangaswamy, R. 2019. *Textbook of Agricultural Statistics*. New Age International (P) Ltd. New Delhi.

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 - Library and Information Services Course Code: MAR125

Total Hours-30

Course 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

L	T	P	C
0	0	2	1

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. 2020. *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.2nd edition*. AKB Publication. Jaipur. pp. 250.
- Pandey, D.K. 2020. *Library and Information Science*. Atlantic Publishers & Distributors. New Delhi. pp. 272.

Course Title: Agricultural Research, Research Ethics and Rural Development Programmes

Course Code: MAR134

L	T	P	C
1	0	0	1

Total Hours-15

Course Outcomes:

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

1. To enlighten the students about the organization and functioning of agricultural research systems at national and international levels
2. To aware the students about research ethics, and rural development programmes and policies of Government.
3. Acquire knowledge on Concept and connotations of rural development
4. Constraints in implementation of rural policies and programmes

UNIT-I

Hours-3

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the

environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research(CGIAR):

UNIT-II**Hours-4**

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics. International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels;

UNIT-III**Hours-4**

International fellowships for scientific mobility. Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme.

UNIT-IV**Hours-4**

Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Reading

1. Bhalla GS & Singh G. 2001. Indian Agriculture-Four Decades of Development. Sage Publ.
2. Punia MS. Manual on International Research and Research Ethics.CCS, Haryana Agricultural University, Hisar.
3. Rao BSV.2007. Rural Development Strategies and Role of Institutions-Issues, Innovations and Initiatives. Mittal Publ.
4. Singh K.1998. Rural Development -Principles, Policies and Management. Sage Publ.

Semester-2**Course Title: Agronomy of Fodder and Forage/ Pasture Crops****Course Code: MAR201**

L	T	P	C
1	0	2	2

Total Hours-45

Course 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 quality fodder.
5. Get knowledge about the seed production techniques of fodder crops.

Course Contents

UNIT-I

Hours-4

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

UNIT-II

Hours-4

Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important forage crops like, napier grass, panicum, 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-3

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

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

Course Code: MAR: 207

Course Contents

- Farm operations in raising fodder crops;
- Canopy measurement,
- Yield Estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose etc. of various fodder and forage crops;
- 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 making and economics of their preparation
- Silage making and economics of their preparation.

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- Chatterjee BN. 2022. *Forage Crop Production - Principles and Practices*. Oxford & IBH.
- Das NR. 2021. *Introduction to Crops of India*. Scientific Publ.

- Narayanan TR & Dabardghao PM. 2020. *Forage Crops of India*. ICAR.
- Singh P & Srivastava AK. 2021. *Forage Production Technology*. IGFRI, Jhansi.
- Singh C, Singh P & Singh R. 2019. *Modern Techniques of Raising Field Crops*. Oxford & IBH.
- Tejwani KG. 2018. *Agroforestry in India*. Oxford & IBH

Course Title: Irrigation Water Management

Course Code: MAR202

L	T	P	C
2	0	2	3

Total Hours-60

Course 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

Hours-7

History of irrigation in India; Major irrigation projects in India; Water resources development. Concepts of irrigation scheduling, Different approaches of irrigation scheduling. Drainage requirement of crops, methods of field drainage, their layout and spacing.

UNIT-II

Hours-8

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, soil and plant relation, transpiration, soil-water-plant relationships and water absorption by plants.

UNIT-III

Hours-8

Plant response to water stress. Methods of irrigation viz. surface methods, overhead methods, subsurface irrigation, drip irrigation, sprinkler 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

Hours-7

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;

Course Title: Lab- Irrigation Water Management

Course Code: MAR208

Course Contents

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

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Reading

- *Paliwal, K.V. 2021. Irrigation with Saline Water. WTC, IARI, New Delhi.*
- *Panda, S. C. 2020. Principles and Practices of Water Management. Agrobios.*
- *Prihar, S. S. and Sandhu.B.S.2021. Irrigation of Field Crops - Principles and practices, ICAR, New Delhi.*
- *Sankara Reddi, G.H. and Yellamanda Reddy, T. 2020. Efficient Use of Irrigation Water. Kalyani , Ludhiana.*
- *Singh, P. and Maliwal, P. L. 2019. Technologies for Food Security and Sustainable Agriculture. Agrotech Publ.*

Web Sources

- <https://saiplatform.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: Weed Management

Course Code: MAR203

L	T	P	C
2	0	2	3

Total Hours-60

Course 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-7

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-8

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, herbicide interaction and crops herbicide rotations.

UNIT-IV

Hours-7

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

Course Title: Lab - Weed Management

Course Code: MAR209

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.

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- Aldrich RJ & Kramer RJ. 2020. *Principles in Weed Management*. Panima Publ. Ashton FM & Crafts AS. 2021. *Mode of Action of Herbicides*. 2nd Ed. Wiley Inter Science.
- Gupta OP. 2020. *Weed Management – Principles and Practices*. Agrobios. Mandal RC. 2021. *Weed, Weedicides and Weed Control - Principles and Practices*. Agro Botanical Publ.
- Rao VS. 2022. *Principles of Weed Science*. Oxford & IBH.
- Subramanian S, Ali AM & Kumar RJ. 2021. *All About Weed Control*.

- Kalyani. Zimdahl RL. 2019. *Fundamentals of Weed Science. 2nd Ed. Academic Press.*

Web Sources

- 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: Crop production in Problem Soils and Water

L	T	P	C
1	0	2	2

Course Code: MAR204**Total Hours-45****Course 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-3**

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

UNIT-II**Hours-4**

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-4**

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, principles and management of brackish water.

UNIT-IV**Hours-4**

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.

Course Title: Lab - Crop productions in Problem Soils and Water**Course Code: MAR210****Course Contents**

- Characterization of acid soils
- Characterization of acid sulfate soils
- Characterization of salt- affected soils

- Characterization of calcareous soils.
- Determination of cations (Na⁺, K⁺, Ca⁺, and Mg⁺⁺) in ground water
- Determination of cations (Na⁺, K⁺, Ca⁺, and Mg⁺⁺) in soil samples.
- Determination of anions (Cl⁻, SO₄²⁻, CO₃²⁻ and HCO₃⁻) in ground waters and soil samples.
- Lime requirement of acid and sodic soil
- Gypsum requirement of acid and sodic soil.

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Introductory Soil Science by D.K. Das. 2021.*
- *Principles of Agronomy by S. R. Reddy. 2022.*
- *Principles Of Agronomy by Reddy & Reddy. 2020.*

Web Sources

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

Course Title: Soil, water and air pollution
Course Code: MAR205

L	T	P	C
1	0	2	2

Total Hours-45

Course Outcomes:

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

1. To make the students aware of the problems of soil, water and air pollution associated with use of soils for crop production
2. To Learn about the Sewage and industrial effluents – their composition and effect on soil health and plant growth and human beings
3. Attain the knowledge regarding the Pollution of water resources due to leaching of nutrients and pesticides from soil
4. Learn regarding the management of soil and water pollution

Course Contents

UNIT-I

Hours-4

Soil, water and air pollution problems associated with agriculture, nature and extent. Nature and sources of pollutants – agricultural, industrial, urban wastes, fertilizers and pesticides, acid rains, oil spills etc.; air, water and soil pollutants - their CPC standards and effect on plants, animals and human beings.

UNIT-II

Hours-3

Sewage and industrial effluents – their composition and effect on soil properties/health, and plant growth and human beings; soil as sink for waste disposal. Pesticides – their classification, behavior in soil and effect on soil microorganisms.

UNIT-III**Hours-4**

Toxic elements – their sources, behavior in soils, effect on nutrients availability, effect on plant and human health. Pollution of water resources due to leaching of nutrients and pesticides from soil.

UNIT-IV**Hours-4**

Remediation/amelioration of contaminated soil and water; remote sensing applications in monitoring and management of soil and water pollution. Emission of greenhouse gases – carbon dioxide, methane and nitrous oxide.

Course Title: Lab- Soil, water and air pollution**Course Code: MAR211**

- Sampling of sewage waters, sewage sludge, solid/liquid industrial wastes, polluted soils and plants
- Estimation of dissolved and suspended solids, chemical oxygen demand (COD), biological demand (BOD), nitrate and ammoniacal nitrogen and phosphorus, heavy metal content in effluents
- Heavy metals in contaminated soils and plants
- Management of contaminants in soil and plants to safeguard food safety
- Air sampling and determination of particulate matter and oxides of sulphur
- Visit to various industrial sites to study the impact of pollutants on soil and Plants

Suggested Readings

- Lal R, Kimble J, Levine E & Stewart BA. 2020. *Soil Management and Greenhouse Effect*. CRC Press.
- Middlebrooks EJ. 2021. *Industrial Pollution Control. Vol. I. Agro-Industries*. John Wiley Interscience. Ross SM. *Toxic Metals in Soil Plant Systems*.
- John Wiley & Sons. Vesilund PA & Pierce 2022. *Environmental Pollution and Control*. Ann Arbor Science Publ.

Course Title: Lab -Fundamental of Computer Application**Course Code: MAR206****Course Content**

L	T	P	C
0	0	4	2

Total Hours-60**Course 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).

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *Salaria, R.S. 2020. Computer Fundamentals. Daryaganj, New Delhi. pp. 486.*
- *Manish, S. and Bhatt, A. 2021. Computers in Agriculture: Fundamentals and Applications. New India Publishing Agency. New Delhi. pp. 190.*
- *Manjunath, B.E. 2022. Computer Basics. Vasan Publications, Bengaluru, Karnataka. pp. 356.*

Course Title: Lab – Basic Concepts in Laboratory Techniques

Course Code: MAR213

L	T	P	C
0	0	2	1

Total Hours-30

Course Outcomes:

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

1. To acquaint the students about the basics of commonly used techniques in laboratory.
2. Preparation of solutions of acids
3. Get knowledge on Drying of solvents/chemicals
4. Electric wiring and earthing

Course Content

- Safety measures while in Lab
- Handling of chemical substances
- Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets; washing, drying and sterilization of glassware
- Drying of solvents/chemicals

- Weighing and preparation of solutions of different strengths and their dilution
- Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications
- Preparation of solutions of acids
- Neutralisation of acid and bases
- Preparation of buffers of different strengths and pH values
- Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath
- Electric wiring and earthing. Preparation of media and methods of sterilization
- Seed viability testing, testing of pollen viability
- Tissue culture of crop plants; Description of flowering plants in botanical terms in relation to taxonomy

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Reading

Furr AK. 2000. CRCH and Book of Laboratory Safety. CRC Press.

Gabb MH & Lat chem. WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.

Course Title: Seminar-I

Course Code: MAR212

L	T	P	C
-	-	2	1

Course 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

Semester-3

Course Title: Modern Concepts in Crop Productions

L	T	P	C
3	0	0	3

Course Code: MAR301**Total Hours-45****Course 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 resource conservation technologies, 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. Mitscherlich yield equation, its interpretation and applicability, Baule unit.

UNIT-II**Hours-11**

Effect of lodging in cereals. Physiology of grain yield in cereals. Optimization of plant population and planting geometry in relation to different resources, Precision agriculture.

UNIT-III**Hours-13**

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-14**

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.

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- Balasubramanian P & Palaniappan SP. 2021. *Principles and Practices of Agronomy. Agrobios.*
- Fageria NK. 2020. *Maximizing Crop Yields. Marcel Dekker.*
- Hawlin JL, Beaton JD, Tisdale SL & Nelson WL. 2006. *Soil Fertility and Fertilizers. 7th Ed. Prentice Hall.*
- Paroda R.S. 2021. *Sustaining our Food Security. Konark Publ.*
- Reddy SR. 2020. *Principles of Crop Production. Kalyani Publ.*
- Sankaran S & Mudaliar TV. 2019. *Principles of Agronomy. The Bangalore Printing & Publ.*
- Singh SS. 2020. *Principles and Practices of Agronomy. Kalyani.*

Course Title: Principles of Plant Physiology I - Plant Water Relations and Mineral Nutrition

L	T	P	C
2	0	2	3

Course Code: MAR307**Total Hours-60****Course Outcomes:**

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

1. Acquire the knowledge regarding the Nutrient Elements and their Importance
2. Get the knowledge regarding the Concept of osmosis and diffusion
3. Attain knowledge regarding the Root structure and functions
4. Learn about the Role of mineral nutrients in plant's metabolism

Course Contents**UNIT-I****Hours-7**

Soil and Plant Water Relations. Water Absorption and Translocation. Transpiration and Evaporative Cooling. Water Productivity and Water Use Efficiency. Moisture Stress and Plant Growth. Nutrient Elements and their Importance. Water and its importance; Molecular structure of water; Properties and functions of water.

UNIT-II**Hours-8**

Concept of water potential; Plant cell and soil water potential and their components; Methods to determine cell and soil water potential; Concept of osmosis and diffusion. Soil physical properties and water availability in different soils Water holding capacity and approaches to improve WHC; Concept of FC and PWP.

UNIT-III**Hours-7**

Water Absorption and Translocation. Root structure and functions; Root architecture and relevance in water mining; Mechanism of water absorption and translocation; Theories explaining water absorption and translocation; Aquaporins. Mycorrhizal association and its relevance in water mining.

UNIT-IV**Hours-8**

Moisture Stress and Plant Growth Physiology of water stress in plants. Nutrient Elements and Their Importance. Role of mineral nutrients in plant's metabolism; Essential elements and their classification. Concept of Foliar Nutrition Foliar nutrition; significance and factors affecting total uptake of minerals; Foliar nutrient droplet size for effective entry; role of wetting agents in entry of nutrients.

Course Title: Lab - Principles of Plant Physiology I - Plant Water Relations and Mineral Nutrition

Course Code: MAR308**Course Contents**

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

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- Brady NC & Weil R.R 2021. *The Nature and Properties of Soils. 13th Ed. Pearson Edu.*
- Fageria NK, Baligar VC & Jones CA. 2022. *Growth and Mineral Nutrition of Field Crops. Marcel Dekker.*
- Havlin JL, Beaton JD, Tisdale SL & Nelson WL. 2022. *Soil Fertility and Fertilizers. 7th Ed. Prentice Hall.*
- Prasad R & Power JF. 2020. *Soil Fertility Management for Sustainable Agriculture. CRC Press.*
- Yawalkar KS, Agrawal JP & Bokde S. 2021. *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_Professo
- https://epsc413.wustl.edu/TOC_Textbook.pdf
- <https://agris.fao.org/agrissearch/search.do?recordID=US19970026628>

Course Title: Soil Microbiology
Course Code: MAR303

L	T	P	C
2	0	2	3

Total Hours-60

Course Outcomes:

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

1. Acquire the knowledge regarding the basics of microbiology related to soil including biogeochemical cycles
2. Get the knowledge regarding the plant growth promoting rhizobacteria
3. Attain knowledge regarding the microbial interactions in soil and other soil activities
4. Learn about the Biodegradation of pesticides, Organic wastes and their use for production of biogas and manures

Course Contents

UNIT-I

Soil biota, Soil microbial ecology, types of organisms in different soils; Soil microbial biomass; Microbial interactions: unculturable soil biota.

Hours-7

UNIT-II

Microbiology and biochemistry of root - soil interface; phyllosphere, Biofertilizers, soil enzyme activities and importance.

Hours-8

UNIT-III

Microbial transformations of nitrogen, phosphorus, sulphur, iron and manganese in soil. Biochemical composition and biodegradation of soil organic matter and crop residues.

Hours-7

UNIT-IV**Hours-8**

Biodegradation of pesticides, Organic wastes and their use for production of biogas and manures: Biotic factors in soil development.

Course Title: Lab-Soil Microbiology**Course Code: MAR306****Course Content**

- Determination of soil microbial population; Soil microbial biomass; Decomposition studies in soil, Soil enzymes;
- Measurement of important soil microbial processes such as ammonification, nitrification.
- N₂ fixation, S oxidation, P solubilization and mineralization of other micro-nutrients;
- Study of rhizosphere effect.

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Martin Alexander 2021. Soil Microbiology. John Wiley.*
- *Paul EA. 2020. Soil Microbiology, Ecology and Biochemistry. 3rd ed. Academic Press.*

Course Title: Lab - Technical Writing and Communication Skills**Course Code: MAR304****Course Content**

L	T	P	C
0	0	2	1

Total Hours-30**Course 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.

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, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Day, R.A. and Gastel, B. 2021. How to Write and Publish a Scientific Paper, 7th Edition. Greenwood Press, United States.*
- *Laplante, P.A. 2022. Technical Writing: A Practical Guide for Engineers and Scientists. CRC Press, London.*
- *Greenlaw, R. 2022. Technical Writing, Presentational Skills and Online Communication: Professional Tools and Insights. Idea Group, U.S.*

Semester-4

Course Title: Agronomy of Major Cereal and Pulse crops

L	T	P	C
1	0	2	2

Course Code: MAR401

Total Hours-45

Course 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-4

Origin, modern 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, millets

UNIT-II

Hours-3

Origin, modern 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-4

Origin, modern 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 pulse crops- *Pigeonpea, mungbean, urdbean*

UNIT-IV

Hours-4

Origin, modern 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, Field pea and lentil*

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

Course Code: MAR403

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.
- 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.

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings

- *Das NR. 2019. Introduction to Crops of India. Scientific Publ.*

- Hunsigi G & Krishna KR. 2022. *Science of Field Crop Production*. Oxford & IBH.
- Jeswani LM & Baldev B. 2020. *Advances in Pulse Production Technology*. ICAR.
- Khare D & Bhale MS. 2021. *Seed Technology*. Scientific Publ.
- Kumar Ranjeet & Singh NP. 2022. *Maize Production in India: Golden Grain in Transition*. IARI, New Delhi.
- Pal M, Deka J & Rai RK. 2019. *Fundamentals of Cereal Crop Production*. Tata McGraw Hill.
- Prasad, Rajendra. 2022. *Text Book of Field Crop Production*. ICAR.
- Singh C, Singh P & Singh R. 2020. *Modern Techniques of Raising Field Crops*. Oxford & IBH.

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

Course Title: Principles and practices of soil fertility and nutrient management

Course Code: MAR404

L	T	P	C
2	0	2	3

Total Hours-60

Course Outcomes:

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

1. To impart knowledge of fertilizers and manures as sources of plant nutrients and apprise about the integrated approach of plant nutrition and sustainability of soil fertility.
2. Basic knowledge on soil fertility and management
3. Acquaint knowledge on preparation of manures
4. Time and methods of manures and fertilizers application

UNIT-I

Hours-8

Soil fertility and productivity - factors affecting; features of good soil management; problems of supply and availability of nutrients; relation between nutrient supply and crop growth; organic farming –basic concepts and definitions. Criteria of essentiality of nutrients; Essential plant nutrients–their functions.

UNIT-II

Hours-7

Nutrient deficiency symptoms; transformation and dynamics of major plant nutrients. Preparation and use of farm yard manure, compost, green manures, vermicompost, bio-fertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management. Soil less cultivation.

UNIT-III

Hours-8

Commercial fertilizers; composition, relative fertilizer value and cost; crop response to different nutrients, residual effects and fertilizer use efficiency; agronomic, chemical and physiological, fertilizer mixtures and grades; methods of increasing fertilizer use efficiency; nutrient interactions.

UNIT-IV**Hours-7**

Time and methods of manures and fertilizers application; foliar application and its concept; relative performance of organic and inorganic nutrients; economics of fertilizer use; integrated nutrient management; use of vermin-compost and residue wastes in crops.

Course Title: Lab- Principles and practices of soil fertility and nutrient management

Course Code: MAR405

Course Content

- Determination of soil pH
- Determination of soil EC
- Determination of soil organic C
- Determination of available N in soil
- Determination of available P in soil
- Determination of available K in soil
- Determination of available S in soil
- Determination of total N in soil
- Determination of total N in plant
- Determination of total P in plant
- Determination of total K in plant
- Determination of total S in plant
- Computation of optimum and economic yield

Course Title: Intellectual Property and its Management in Agriculture

Course Code: MAR402

L	T	P	C
1	0	0	1

Total Hours-15

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

to:

1. Equip students and stakeholders with
2. Know about Intellectual Property Rights (IPR) related protection systems
3. Make use of IPR as a tool for wealth and value creation in a knowledge-based economy.
4. International Treaty on Plant Genetic Resources for Food and Agriculture

Course Content

Unit-I**3 hours**

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs.

Unit-II**4 hours**

Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks.

Unit-III**4 hours**

Protection of plant varieties and farmers' rights and biodiversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection.

Unit-IV**4 hours**

National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

Transaction Mode

Lecture, Seminar, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested readings:

1. *Erbisch FH and Maredia K. 1998. Intellectual Property Rights in Agricultural Biotechnology. CABI.*
2. *Ganguli P. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill.*
3. *Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC and Aesthetic Technologies*

Course Title: Master's Research**Course Code: MAR100**

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Course 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. Analyze 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.