

GURU KASHI UNIVERSITY



**Master of Science in Agriculture
(Agronomy) (AGRON)
Session: 2025-26
Faculty of Agriculture**

Graduate Attributes of the Programme: -

Type of learning outcomes	The Learning Outcomes Descriptors
Graduates should be able to demonstrate the acquisition of:	
Learning outcomes that are specific to disciplinary areas of learning	Graduates will demonstrate comprehensive and in-depth understanding of agronomic principles, including soil science, crop physiology, sustainable agriculture, and modern crop management techniques
	Able to design, conduct, and critically analyze agronomic research using appropriate methodologies, statistical tools, and modern technologies to address real-world agricultural challenges.
	Acquire critical thinking and innovative approaches to develop sustainable and climate-resilient crop production strategies that enhance productivity while conserving resources.
	Able to communicate effectively scientific ideas, research findings, and technical knowledge to diverse stakeholders, and demonstrate ethical responsibility in professional agricultural practices and policy advocacy.
Generic learning outcomes	Demonstrate a commitment to continuous personal and professional development by adapting to new knowledge, technologies, and challenges in their field.
	Learn recognize and practice ethical behavior in research and professional activities, with sensitivity to societal needs, environmental sustainability, and equity.
	Get knowledge about the collaborate effectively in multidisciplinary and multicultural teams, and take leadership roles in professional, academic, or community settings.

Programme Learning outcomes: An Undergraduate Certificate is awarded to students who have demonstrated the achievement of the outcomes located at level 6:

Element of the Descriptor	Programme learning outcomes relating to Undergraduate Certificate
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Demonstrate comprehensive and advanced knowledge of agronomic principles, including soil health, crop physiology, climate-smart agriculture, and sustainable

	farming systems. Understand global and regional challenges in food security, climate change, and resource management and their impact on agronomic practices Critically analyze current research, trends, and scientific literature to deepen understanding and contribute to the field of agronomy.																		
General, technical and professional skills required to perform and accomplish tasks	Apply field-based and laboratory skills including soil and water testing, crop monitoring, pest management, and the use of agri-technologies such as precision farming tools. Demonstrate professionalism, including planning, project execution, documentation, and reporting in research or agricultural development contexts																		
Application of knowledge and skills	Integrate theoretical knowledge with practical agronomic skills to solve real-world problems in crop production, resource conservation, and sustainable agriculture.																		
Generic learning outcomes	Exhibit transferable skills such as critical thinking, communication, teamwork, and digital literacy applicable across disciplines and job roles																		
Constitutional, humanistic, ethical, and moral values	Demonstrate commitment to ethical research, social responsibility, environmental stewardship, and the principles of justice, equity, and inclusiveness in all professional actions																		
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Possess domain-specific competencies for careers in research, academia, agri-business, seed and fertilizer industries, government and non-government sectors.																		
Credit requirements	<table border="1"> <thead> <tr> <th colspan="2">Masters' Programme</th> </tr> </thead> <tbody> <tr> <td colspan="2">(i) Course work</td> </tr> <tr> <td>Major courses</td> <td>20</td> </tr> <tr> <td>Minor courses</td> <td>08</td> </tr> <tr> <td>Supporting courses</td> <td>06</td> </tr> <tr> <td>Common courses</td> <td>05</td> </tr> <tr> <td>Seminar</td> <td>01</td> </tr> <tr> <td>(ii) Thesis Research</td> <td>30</td> </tr> <tr> <td>Total</td> <td>70</td> </tr> </tbody> </table>	Masters' Programme		(i) Course work		Major courses	20	Minor courses	08	Supporting courses	06	Common courses	05	Seminar	01	(ii) Thesis Research	30	Total	70
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(ii) Thesis Research	30																		
Total	70																		
Entry requirements	A student holding a Bachelor's degree in Agriculture, subject to fulfilling the eligibility conditions specified by the University, shall be eligible for admission to the two-year M.Sc. Agronomy programme.																		

Program Structure

SEMESTER- I									
Course Code	Course Title	Type of Course	L	T	P	No. of Credits	Int.	Ext.	Total Marks
AGRON501	Agronomy of Oilseed, Fiber, Sugar and Important Medicinal and Aromatic Crops	Major	1	0	0	1	10	15	25
AGRON503	Dry Land Farming and Water Shed Management	Major	1	0	0	1	10	15	25
BIO501	Plant Physiology	Minor (CBCS) (Choose any one)	2	0	0	2	15	35	50
SOIL501	Soil Fertility and Fertilizer Use								
STAT501	Agricultural Statistics	Supporting	3	0	0	3	25	50	75
PGC501	Library and Information Services- Lab	Common	0	0	2	1	10	15	25
PGC502	Agricultural Research, Research Ethics and Rural Development Programmes	Common	1	0	0	1	10	15	25
AGRON502	Agronomy of Oilseed, Fiber, Sugar and Important Medicinal and Aromatic Crops- Lab	Major	0	0	2	1	10	15	25
AGRON504	Dry Land Farming and Water Shed Management-Lab	Major	0	0	2	1	10	15	25
BIO502	Plant Physiology- Lab	Minor (CBCS)	0	0	2	1	10	15	25

SOIL502	Soil Fertility and Fertilizer Use-Lab	(Choose any one)							
STAT502	Agricultural Statistics-Lab	Supporting	0	0	2	1	10	15	25
AGRON500	Masters Research	Research	-	-	-	5	S/ US	S/ US	S/US
Total						18			

SEMESTER-II									
Course Code	Course Title	Type of Course	L	T	P	No. of Credits	Int.	Ext.	Total Marks
AGRON551	Agronomy of Fodder and Forage/ Pasture Crops	Major	1	0	0	1	10	15	25
AGRON553	Irrigation Water Management	Major	2	0	0	2	15	35	50
AGRON555	Weed Management	Major	2	0	0	2	15	35	50
SOIL553	Crop production in Problem Soils and Water	Minor (CBCS) (Choose any one)	1	0	0	1	10	15	25
SOIL551	Soil Chemistry								
CA551	Fundamentals of Computer Applications-Lab	Supporting	0	0	4	2	15	35	50
AGRON552	Agronomy of Fodder and Forage/Pasture Crops-Lab	Major	0	0	2	1	10	15	25
AGRON554	Irrigation Water Management-Lab	Major	0	0	2	1	10	15	25
AGRON556	Weed Management-Lab	Major	0	0	2	1	10	15	25
SOIL554	Crop production in Problem Soils and Water-Lab	Minor (CBCS) (Choose any one)	0	0	2	1	10	15	25
SOIL552	Soil Chemistry-Lab								
AGRON557	Seminar	Seminar	-	-	-	1	10	15	25
PGC551	Basic Concepts in Laboratory Techniques-Lab	Common	0	0	2	1	10	15	25
AGRON500	Masters Research	Research	-	-	-	5	S/US	S/US	S/US
Total						19			

SEMESTER-III									
Course Code	Course Title	Type of Course	L	T	P	No. of Credits	Int	Ext.	Total Marks
AGRON601	Modern Concepts in Crop Productions	Major	3	0	0	3	25	50	75
SOIL603	Soil Physics	Minor (CBCS) (Choose any one)							
SOIL601	Soil Mineralogy, Genesis and Classification		2	0	0	2	15	35	50
PGC600	Technical Writing and Communication Skills-Lab	Common	0	0	2	1	10	15	25
SOIL604	Soil Physics- Lab	Minor (CBCS) (Choose any one)							
SOIL602	Soil Mineralogy, Genesis and Classification -Lab		0	0	2	1	10	15	25
AGRON500	Masters Research	Research	-	-	-	10	S/US	S/US	S/US
Total						17			

SEMESTER-IV									
Course Code	Course Title	Type of Course	L	T	P	No. of Credits	Int.	Ext.	Total Marks
AGRON651	Agronomy of Major Cereal and Pulse crops	Major	1	0	0	1	10	15	25
SOIL651	Soil Biology and Biochemistry	Major	2	0	0	2	15	35	50
PGC651	Intellectual Property And its management in Agriculture	Common	1	0	0	1	10	15	25
AGRON652	Agronomy of Major Cereal and Pulse crops- Lab	Major	0	0	2	1	10	15	25
SOIL652	Soil Biology and Biochemistry - Lab	Major	0	0	2	1	10	15	25
AGRON500	Masters Research	Research	-	-	-	10	S/US	S/US	S/US
Total						16			
Grand Total						70			

CBCS- Choice based credit system

Course Title: Agronomy of Oilseed, Fiber, Sugar and Important Medicinal and Aromatic Crops	L	T	P	Cr.
Course Code: AGRON501	1	0	0	1

Total Hours-15

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	L	T	P	Cr.
Course Code: AGRON502	0	0	2	1

Total Hours: 30**Course content**

1. Study about the Planning and layout of field experiments.
2. Cultivation of sugarcane crop and estimation of its quality parameters.
3. Intercultural operations in different crops;
4. Study about Cotton seed treatment;
5. Working out growth indices of prominent intercropping systems;
6. Judging of physiological maturity in different crops and working out harvest index;
7. Working out cost of cultivation of different crops;
8. Estimation of crop yield on the basis of yield attributes;
9. Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities;
10. Determination of oil content in oilseeds and computation of oil yield;
11. Estimation of quality of fiber of different fiber crops;
12. Study of seed production techniques in various crops;
13. Identification of crops based on morphological and seed characteristics;
14. Raising of herbarium of medicinal, aromatic and under-utilized plants.
15. Visit of field experiments.

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 Publisher, New Delhi.
- 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 Publisher, New Delhi.*

Web Sources

- <https://www.scientificpubonline.com/bookdetailintroduction-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	Cr.
Course Code: AGRON503	1	0	0	1

Total Hours-15**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, tilth, 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	L	T	P	Cr.
Course Code: AGRON504	0	0	2	1

Total hours: 30**Course Contents**

- Study about the Seed treatment.
- To study about the seed germination and crop establishment in relation to soil moisture contents
- Effect of moisture stress 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,
- Study about 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,degradation%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	Cr.
Course Code: BIO501	2	0	0	2

Total hours: 30**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. Alliphatic 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	L	T	P	Cr.
Course Code: BIO502	0	0	2	1

Total hours: 30**Course Contents**

1. Study about the photosynthesis in plants.
2. Determination of Chlorophyll and other pigment from plant leaf.
3. Study about the respiration, Osmosis, Imbibition, Plasmolysis. Measurements of μw and μs .
4. Study about the Membrane permeability.
5. Study about the Transpiration rates in plants.
6. To study about the catalase, peroxidase and nitrate reductase activities as indicators of Nutrient status of crop.
7. Measurement of plants growth.
8. Quality of light on seed germination.
9. Studies on Breaking of dormancy.
10. Studies on photo-periodism.
11. Hormonal regulation and development studies in plants.

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=ONE&sw=w&userGroupName=anon%7E8b5a362f>

Course Title: Soil Fertility and Fertilizer Use	L	T	P	Cr.
Course Code: SOIL501	2	0	0	2

Total Hours: 30**Course 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.

Course Title: Lab - Soil Fertility and Fertilizer Use	L	T	P	Cr.
Course Code: SOIL502	0	0	2	1

Total Hours: 30**Course Contents**

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

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. 2004. 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. 2005. 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_Professo

https://epsc413.wustl.edu/TOC_Textbook.pdf

<https://agris.fao.org/agrissearch/search.do?recordID=US19970026628>

Course Title: Agricultural Statistics	L	T	P	Cr.
Course Code: STAT501	3	0	0	3

Total Hours-45**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	L	T	P	Cr.
Course Code: STAT502	0	0	2	1

Total hours: 30**Course Contents**

1. Correlation analysis.
2. Regression analysis (exponential, power function, quadratic, multi-variate, selection of variables, validation of models, ANOVA and testing of hypothesis).
3. Tests of significance (Z-test, t-test, F-test and Chi-square test).
4. Analysis of variance.
5. Completely randomized design.
6. Randomized block
7. Latin square designs.
8. Missing plot and analysis of covariance.
9. 23, 24 and 33 simple and confounded experiments.
10. Split plot designs.
11. 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/cabdirectabstract/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	L	T	P	Cr.
Course Code: PGC501	0	0	2	1

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 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

1. Introduction to Library and its services;
2. Five laws of library science;
3. Type of documents;
4. Classification and cataloguing;
5. Organization of documents;
6. Sources of information primary, secondary and tertiary;
7. Current awareness and SDI services;
8. Tracing information from reference sources;
9. Library survey; preparation of bibliography;
10. Use of Online Public Access Catalogue; use of CD-ROM databases and other Computerized library services,
11. CeRA, J- Gate;
12. 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	L	T	P	Cr.
Course Code: PGC502	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

Course content**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 Organizations. 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

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

Semester-2

Course Title: Agronomy of Fodder and Forage/ Pasture Crops	L	T	P	Cr.
Course Code: AGRON551	1	0	0	1

Total Hours-15**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	L	T	P	Cr.
Course Code: AGRON552	0	0	2	1

Total hours: 30**Course Contents**

1. Farm operations in raising fodder crops;
2. Canopy measurement,
3. Yield Estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose etc. of various fodder and forage crops;
4. Quality estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose etc. of various fodder and forage crops;
5. Anti-quality components like HCN in sorghum and such factors in other crops;
6. Hay making and economics of their preparation
7. 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 & Dabadghao 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	L	T	P	Cr.
Course Code: AGRON553	2	0	0	2

Total Hours-30**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	L	T	P	Cr.
Course Code: AGRON554	0	0	2	1

Total hours: 30**Course Contents**

1. Measurement of soil water potential by using tensiometer, Neutron probe, pressure plate and membrane apparatus.
2. Soil-moisture characteristics curve.
3. Water flow measurements using different devices.
4. Determination of irrigation requirements.
5. Calculation of irrigation efficiency and crop coefficient.
6. Determination of infiltration rate.
7. Determination of saturated/ unsaturated hydraulic conductivity.
Determination of Consumptive use,
8. 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://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: Weed Management	L	T	P	Cr.
Course Code: AGRON555	2	0	0	2

Total Hours-30**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	L	T	P	Cr.
Course Code: AGRON556	0	0	2	1

Total hours: 30**Course Contents**

1. Identification of important crops weed.
2. Preparation of a weed herbarium.
3. Weed survey in crops and cropping systems.
4. Crop-weed competition studies.
5. To study the Weed indices.
6. Preparation of spray solutions of herbicides for high and low-volume sprayers.
7. Study about the Use of various types of spray pumps and nozzles and calculation of swath width.
8. Economics of weed control.
9. Herbicide residue analysis in plant and soil.
10. Bioassay of herbicide residue.
11. 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	Cr.
Course Code: SOIL553	1	0	0	1

Total Hours-15**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	L	T	P	Cr.
Course Code: SOIL554	0	0	2	1

Total hours: 30**Course Contents**

1. Characterization of acid soils
2. Characterization of acid sulfate soils
3. Characterization of salt- affected soils
4. Characterization of calcareous soils.
5. Determination of cations (Na⁺, K⁺, Ca⁺, and Mg⁺⁺) in ground water
6. Determination of cations (Na⁺, K⁺, Ca⁺, and Mg⁺⁺) in soil samples.
7. Determination of anions (Cl⁻, SO₄²⁻, CO₃²⁻ and HCO₃⁻) in ground waters and soil samples.
8. Lime requirement of acid and sodic soil
9. 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 Chemistry	L	T	P	Cr.
Course Code: SOIL551	1	0	0	1

Total Hours-15**Course Outcomes:**

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

1. Understand Chemical (elemental) composition of the earth's crust, soils, rocks and minerals.
2. Acquaint knowledge about inorganic and organic Soil colloids and their concept .
3. About sorption properties of soil colloids and Soil organic matter fractionation .
4. About adsorption desorption behavior of soil .

Course Contents**UNIT-I****Hours-4**

Chemical (elemental) composition of the earth's crust, soils, rocks and minerals. Elements of equilibrium thermodynamics, chemical equilibria, electrochemistry and chemical kinetics.

UNIT-II**Hours-3**

Soil colloids- inorganic and organic colloids - origin of charge, concept of point of zero-charge (PZC) and its dependence on variable-charge soil components, surface charge characteristics of soils. Diffuse double layer theories of soil colloids, zeta potential, stability, coagulation/flocculation and peptization of soil colloids. Electrometric properties of soil colloids, sorption properties of soil colloids. Soil organic matter - fractionation of soil organic matter and different fractions. Characterization of OM. Clay- organic interactions.

UNIT-III**Hours-4**

on exchange processes in soil. Cation exchange- theories based on law of massaction (Kerr-Vanselow, Gapon equations, hysteresis, Jenny's concept), adsorption isotherms, Donnan-membrane equilibrium concept, clay-membrane electrodes and ionic activity measurement. Thermodynamics. Statistical mechanics. Anion and ligand exchange -inner sphere and outer-sphere surface complex formation. Fixation of oxyanions, hysteresis in sorption-desorption of oxy-anions and anions. Shift of PZC on ligand exchange, AEC, CEC. Experimental methods to study ion exchange phenomena and practical implications in plant nutrition.

UNIT-IV**Hours-4**

Potassium, phosphate and ammonium fixation in soils covering specific and non-specific sorption. Precipitation-dissolution equilibria. Concept of quantity/intensity (Q/I) relationship. Step and constant-rate K. Management aspects. Chemistry of acid soils. Active and potential acidity. Lime potential, chemistry of acid soils, sub-soil acidity. Chemistry of salt-affected soils and amendments; soil pH, E_{Ce}, ESP, SAR and important relations; soil management and amendments. Chemistry and electrochemistry of submerged soils, geochemistry of micronutrients, environmental soil chemistry.

Course Title: Lab - Soil Chemistry	L	T	P	Cr.
Course Code: SOIL552	0	0	2	1

Total hours: 30**Course contents**

1. Preparation of saturation extract,
2. measurement of pH, EC, CO, HCO, Ca, Mg, K and Na,
3. Determination of CEC and AEC of soils,
4. Analysis of equilibrium soil solution for pH, EC, Eh by the use of Eh-pH meter and conductivity meter,
5. Determination of point of zero-charge and associated surface charge characteristics by the serial potentiometric titration method,
6. Extraction of humic substances, Potentiometric and conductometric titration of soil humic and fulvic acids, (E4/E6) ratio of soil humic and fulvic acids by visible spectrophotometric studies and the $\Delta(E4/E6)$ values at two pH values,
7. Adsorption-desorption of phosphate/sulphate by soil using simple adsorption isotherm,
8. Construction of adsorption envelope of soils by using phosphate/fluoride/sulphate and ascertaining the mechanism of the ligand exchange process involved,
9. Determination of titratable acidity of an acid soil by BaCl₂-TEA method,
10. Determination of Q/I relationship of potassium,
11. Determination of lime requirement of an acid soil by buffer method,
12. Determination of gypsum requirement of an alkali soil.

Suggested Readings

- Purcell, J. M., & Varnes, J. C. (2006). *Principles of Environmental Chemistry*. Pearson Education.
- Biederbick, J. L. B., & Bles, L. P. J. M. (2010). *The Chemistry of Soils*. Springer Science & Business Media.
- Parsons, K. M. (2014). *Soil and Environmental Chemistry: An Integrative Approach*. Elsevier.
- Whittington, W. J. (2007). *Soil Chemistry and Fertilization*. Springer.
- Plaster, E. (2012). *Soil Science and Management*. Delmar Cengage Learning.

Web Sources

- https://onlinelibrary.wiley.com/doi/full/10.1002/9781119300762.wst_s0025#:~:text=Soil%20chemistry%20is%20the%20branch,plant%20and%20animal%20in%20nature).

- https://en.wikipedia.org/wiki/Soil_chemistry
- <https://agritech.tnau.ac.in/agriculture/pdf/Principles%20of%20Soil%20Chemistry,%20Fourth%20Edition%20by%20Tan,%20Kim%20H.pdf>

Course Title: Lab -Fundamental of Computer Application	L	T	P	Cr.
Course Code: CA551	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 Read, understand, and interpret material on technology.
2. Understand the operating systems, peripheral devices, networking, multimedia and internet
3. Familiarize with basic sources and methods of research and documentation on topics in technology, including on-line research.
4. Students will be able to synthesize and integrate material from primary and secondary sources with their own ideas in research papers.

Course Content

1. 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.
2. Ms-excel: entering expressions through the formula tool bar and use of inbuilt functions, sum, average, max, min.
3. Creating graphs and saving with and without data in Ms-excel.
4. Ms-access: creating database, structuring with different types of fields.
5. Ms-power point: preparation of slides on power point.
6. 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	L	T	P	Cr.
Course Code: PGC551	0	0	2	1

Total Hours-30**Course Outcomes:**

On successful completion of this course, the students will be 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

1. Safety measures while in Lab
2. Handling of chemical substances
3. Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vials; washing, drying and sterilization of glassware
4. Drying of solvents/chemicals Weighing and preparation of solutions of different strengths and their dilution
5. Handling techniques of solutions; Preparation of different agro-chemical doses in field and pot applications
6. Preparation of solutions of acids, Neutralization of acid and bases
7. Preparation of buffers of different strengths and pH values
8. Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sand bath, water bath, oil bath
9. Electric wiring and earthing.
10. Preparation of media and methods of sterilization
11. Seed viability testing, testing of pollen viability
12. Tissue culture of crop plants;
13. 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	L	T	P	Cr.
Course Code: AGRON557	-	-	2	1

Total hours-30**Course Outcomes:**

On successful completion of this course, the students will be 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	Cr.
Course Code: AGRON601	3	0	0	3

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

- *Balasubramaniyan P & Palaniappan SP. 2021. Principles and Practices of Agronomy. Agrobios.*
- *Fageria NK. 2020. 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. 2021. Sustaining our Food Security. Konark Publ.*
- *Reddy SR. 2020. Principles of Crop Production. Kalyani Publ.*
- *Sankaran S & Mudaliar TVS. 2019. Principles of Agronomy. The Bangalore Printing & Publ.*
- *Singh SS. 2020. Principles and Practices of Agronomy. Kalyani.*

Course Title: Soil Mineralogy, Genesis and Classification	L	T	P	Cr.
Course Code: SOIL601	2	0	0	2

Total Hours-30**Course 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**

Fundamentals of crystallography, space lattice, coordination theory, isomorphism and polymorphism.

UNIT-II**Hours-8**

Classification, structure, chemical composition and properties of clay minerals. Genesis and transformation of crystalline and non-crystalline clay minerals. Identification techniques, amorphous soil constituents and other non-crystalline silicate minerals and their identification. Clay minerals in Indian soils, role of clay minerals in plant nutrition, interaction of clay with humus, pesticides and heavy metals.

UNIT-III**Hours-7**

Factors of soil formation. Soil formation models. Soil forming processes, weathering of rocks and mineral transformations. Soil profile. Weathering sequences of minerals with special reference to Indian soils.

UNIT-IV**Hours-8**

Concept of soil individual. Soil classification systems–historical developments and modern systems of soil classification with special emphasis on soil taxonomy. Soil classification. Soil mineralogy and soil maps–usefulness.

Course Title: Lab-Soil Mineralogy, Genesis and Classification	L	T	P	Cr.
Course Code: SOIL602	0	0	2	1

Total hours: 30

Course Contents

1. Separation of sand, silt and clay fraction from soil.
2. Determination of specific surface area and CEC of clay.
3. Identification and quantification of minerals in soil fractions.
4. Morphological properties of soil profile in different land forms.
5. Classification of soils using soil taxonomy.

Transaction Mode

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

Suggested Readings

- Buol, D. P., Southard, R. J., Graham, R. C., & McKenzie, A. P. (2011). *Soil Genesis and Classification*. Wiley-Blackwell.
- Sparks, K. H. (2003). *Introduction to Soil Chemistry: Analysis and Chemistry of Soils*. Wiley-Interscience.
- Miller, M. G. (2002). *Soil Mineralogy and the Application of Soil Classification*. Academic Press.
- Rao, K. S. (2009). *Soil and Water Chemistry: An Integrative Approach*. Wiley-Blackwell.
- Davis, R. B., & Moore, E. P. F. (2002). *Soil Formation*. Cambridge University Press.
- Brady, N. C., & Weil, R. R. (2016). *The Nature and Properties of Soils*. Pearson Education.
- McKenzie, A. P., & Buol, D. P. (2017). *Soil Genesis and Classification in the Context of Changing Climates*. CRC Press.

Web Sources

- <https://rlbcau.ac.in/pdf/PGCourse/Soil%20Science/APS%20504.pdf>
- <https://csauk.ac.in/wp-content/uploads/2022/10/PG-Earth-structure-and-composition.pdf>
- <https://download.e-bookshelf.de/download/0000/7983/31/L-G-0000798331-0035549403.pdf>

Course Title: Soil Physics	L	T	P	Cr.
Course Code: SOIL603	2	0	0	2

Total Hours-30**Course Outcomes:**

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

1. Acquire the knowledge regarding the concept of soil physics
2. Get the knowledge regarding physical properties of soil and impact on soil productivity.
3. Attain knowledge regarding the effect of properties on Soil structure - genesis, types, characterization and management soil structure
4. Learn about the concept of Soil water: content and potential. Soil water retention, soil-water constants and measurement.
5. Know the concept of Modes of energy transfer in soils;, soil temperature in relation to plant growth and temperature management

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

Basic principles of physics applied to soils, soil as a three phase system. Soil texture, textural classes, mechanical analysis, specific surface. Soil consistence, dispersion and workability of soils; soil compaction and consolidation. Soil strength; swelling and shrinkage - basic concepts. Alleviation of soil physical constraints for crop production. Soil erosion and edibility.

UNIT-II**Hours-8**

Soil structure - genesis, types, characterization and management soil structure. Soil aggregation, aggregate stability. Soil tilth, characteristics of good soil tilth. Soil crusting - mechanism, factors affecting and evaluation. Soil conditioners. Puddling, its effect on soil physical properties; clod formation.

Soil water: content and potential. Soil water retention, soil-water constants, measurement of soil water content, energy state of soil water, soil water potential. Soil-moisture characteristic curve, hysteresis, measurement of soil-moisture potential.

UNIT-III**Hours-7**

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

UNIT-IV**Hours-8**

Composition of soil air, renewal of soil air - convective flow and diffusion, measurement of soil aeration, aeration requirement for plant growth, soil air management.

Modes of energy transfer in soils; energy balance, thermal properties of soil; measurement of soil temperature, soil temperature in relation to plant growth, soil temperature management

Course Title: Lab- Soil Physics	L	T	P	Cr.
Course Code: SOIL604	0	0	2	1

Total hours: 30**Course Content**

1. Determination of B.D, P.D and mass volume relationship of soil.
2. Mechanical analysis by hydrometer and international pipette method.
3. Measurement of Atterberg limits.
4. Aggregate analysis - dry and wet.
5. Measurement of soil-water content by different methods.
6. Measurement of soil-water potential by using tensiometer and gypsum blocks.
7. Determination of soil-moisture characteristics curve and computation of pore-size, distribution.
8. Determination of hydraulic conductivity under saturated and unsaturated conditions.
9. Determination of infiltration rate of soil.
10. Determination of aeration porosity and oxygen diffusion rate.
11. Soil temperature measurements by different methods.
12. Estimation of water balance components in bare and cropped fields.

Transaction Mode

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

Suggested Readings

- Hillel, D. (2004). Introduction to Environmental Soil Physics. Academic Press.
- Minitab, M. J. (2009). Measurement of Soil Oxygen Diffusion in the Root Zone. *Soil Science Society of America Journal*, 47(5), 843-849.
- Lal, R., & Stewart, B. A. (2023). Soil Physics: A Handy Guide. CRC Press.
- Prasad, M. S. T. S. R. S., & Gupta, R. K. (2022). Fundamentals of Soil Physics. Wiley-Blackwell.

Web Sources

- <https://indico.ictp.it/event/a0124/material/1/6.pdf>
- https://geo.libretexts.org/Bookshelves/Soil_Science/Digging_into_Canadian_Soils%3A_An_Introduction_to_Soil_Science/01%3A_Digging_In/1.04%3A_Soil_Physics
- <https://www.eolss.net/sample-chapters/c10/e5-24-01-01.pdf>
- <https://www.iaea.org/sites/default/files/publications/magazines/bul>

[letin/bull25-3/25305184546.pdf](#)

- [https://www.agrophysics.in/admin/adminjournalpdf/20190516115521993431154/journal-187797629.pdf](#)
- [https://www.osti.gov/etdeweb/servlets/purl/20946956](#)

Course Title: Lab - Technical Writing and Communication Skills	L	T	P	Cr.
Course Code: PGC600	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

1. Various forms of scientific writings: thesis, technical papers, review, manuals etc.,
2. Various parts of thesis and research communications: title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion;
3. Writing of abstracts, summaries, précis, citations etc. commonly used abbreviations in the thesis and research communications;
4. Illustrations, photographs and drawings with suitable captions; paginations, numbering of tables and illustrations;
5. 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	Cr.
Course Code: AGRON651	1	0	0	1

Total Hours-15**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	L	T	P	Cr.
Course Code: AGRON652	0	0	2	1

Total Hours-30**Course Content**

1. Phenological studies at different growth stages of crop.
2. Estimation of crop yield on the basis of yield attributes.
3. Formulation of cropping schemes for various farm sizes.
4. Calculation of cropping and rotational intensities.
5. Working out growth indices of prominent intercropping systems of different crops.
6. Estimation of protein content in pulses.
7. Planning and layout of field experiments.
8. Intercultural operations in different crops.
9. Determination of cost of cultivation of different crops.
10. Working out harvest index of various crops.
11. Study of seed production techniques in various crops.
12. Visit of field experiments.

Transaction Mode

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

Suggested Readings

- Hunsigi G & Krishna KR. 2022. *Science of Field Crop Production*. Oxford & IBH.
- Jeswani LM & Baldev B. 2020. *Advances in Pulse Production Technology*. ICAR.
- 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: Soil Biology and Biochemistry	L	T	P	Cr.
Course Code: SOIL651	2	0	0	2

Total Hours-30**Course Outcomes:**

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

1. Understand Types of organisms in different soils, Soil microbial biomass, microbial interactions .
2. Attain knowledge about Microbial transformation of different nutrients.
3. Get familiar with use of organic waste
4. Know about the preparation of farmyard manure, animal manures, rural and urban composts and vermi-compost and bio-fertilizers.
5. Learn about the role of soil organisms in pedogenesis.

Course Contents**UNIT-I****Hours-8**

Soil biota, soil microbial ecology, types of organisms in different soils. Soil microbial biomass, microbial interactions, un-culturable soil biota. Microbiology and biochemistry of root-soil interface. Phyllosphere, soil enzymes, origin, activities and importance. Soil characteristics influencing growth and activity of microflora. Root rhizosphere and PGPR.

UNIT-II**Hours-7**

Microbial transformations of nitrogen, phosphorus, sulphur, iron and manganese in soil. Biochemical composition and biodegradation of soil organic matter and crop residues, microbiology and biochemistry of decomposition of carbonaceous and proteinaceous materials. Cycles of important organic nutrients. Organic wastes and their use for production of biogas and manures. Biotic factors in soil development. Microbial toxins in the soil.

UNIT-III**Hours-8**

Preparation and preservation of farmyard manure, animal manures, rural and urban composts and vermi-compost. Bio-fertilizers–definition, classification, specifications, method of production and role in crop production. FCO specifications and quality control of bio-fertilizers.

UNIT-IV**Hours-7**

Biological indicators of soil quality. Bioremediation of contaminated soils. Microbial transformations of heavy metals in soil. Role of soil organisms in pedogenesis–important mechanisms and controlling factors. Soil genomics and bioprospecting. Soil sickness due to biological agents. Xenobiotics. Antibiotic production in soil.

Course Title: Lab- Soil Biology and Biochemistry	L	T	P	Cr.
Course Code: SOIL652	0	0	2	1

Total Hours-30**Course Content**

1. Determination of soil microbial population.
2. Soil microbial biomass carbon.
3. Elemental composition, fractionation of organic matter and functional groups.
4. Decomposition of organic matter in soil.
5. Soil enzymes.
6. Measurement of important soil microbial processes such as ammonification, nitrification,
7. Measurement of N₂ fixation, S oxidation, P solubilization and mineralization of other micronutrients.

Transaction Mode

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

Suggested Readings:

- *de Bruijn, F. J. (2022). Soil Microorganisms and Plant Growth. Wiley-Blackwell*
- *Somasegaran, J. S. C. M. W. M. M. (2022). Soil Microbial Ecology and Biochemistry: A Global Perspective. Springer.*
- *Henson, W. H., & Leppard, R. J. M. (2023). Microbial Diversity and Ecology in Agroecosystems. Elsevier.*
- *Hwang, D. H., & Baughman, K. M. (2021). Biology of Soil: Microorganisms in Soil Ecosystems.*
- *Wiley-Blackwell. Rousk, I. G., & Brookes, P. C. (2022). Microbial Ecology in Soils: From the Lab to the Field. Springer.*

Web Sources

- <https://rlbcau.ac.in/pdf/PGCourse/Soil%20Science/APS%20506.pdf>
- <https://repository.rothamsted.ac.uk/item/992v9/long-term-effects-of-lime-and-phosphorus-application-on-soil-extractable-olsen-phosphorus-differ-between-two-arable-uk-soils>
- <https://repository.rothamsted.ac.uk/item/9846q/effects-of-soil-incorporation-depth-of-biodiesel-co-product-bcp-additions-on-n-leaching-losses-and-on-genes-involved-in-soil-nitrogen-cycling-in-an-acidic-chinese-tea-soil>

Course Title: Intellectual Property and its Management in Agriculture	L	T	P	Cr.
Course Code: PGC651	1	0	0	1

Total Hours-15**Course Outcomes:**

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

- *Erbisch FH and Maredia K.1998. Intellectual Property Rights in AgriculturalBiotechnology. CABI.*
- *Ganguli P. 2001. Intellectual Property Rights: Unleashing KnowledgeEconomy.McGraw-Hill.*
- *Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC andAesthetic Technologies*

Course Title: Master's Research	L	T	P	Cr.
Course Code: AGRON500	0	0	0	30

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.