



M.Sc. (Ag.) Agronomy

PROGRAM SYLLABUS (EMBEDDED WITH COs)

School of Agriculture,

ITM University, Gwalior, Madhya Pradesh 474001

SYLLABUS

WITH

EMBEDDED

COURSE OUTCOMES (COs)

Semester-I

Course Code: AGRON-501	Course Name: Modern Concepts in Crop Production	Semester: I
-------------------------------	--	--------------------

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
4	4	0	0		4		M.Sc. (Ag.) Agronomy
Curriculum level					Basic, recent and Innovative	Student specific course outcome	Higher Education Research Entrepreneurship

Objective:

- Basics of crop growth in relation to environment and sustainability
- Knowledge and concept of different techniques of crop production
- Basic concepts of crop modelling for maximizing crop yield

Course outcomes: After completion of the course, a student will be able to:

CO-1	Crop production techniques and crop growth in relation to environment
CO-2	Zero and minimum tillage: their basics and application
CO-3	Precision agriculture and Precision farming, their concepts and application
CO-4	Biotic and a biotic stresses; concept of ideal plant type
CO-5	Basics and application crop production under protective agriculture

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cropping and farming systems, Assignment Quiz Seminars with open discussions Group discussions or debate

Assessment tools	
AT1-1	Mid-term Exams and end term exam

AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Teaching Pedagogy	Assessment tools
Course Contents	Unit – I Crop growth analysis in relation to environment; geo-ecological zones of India.	Classroom teaching with AV aids	Assignment,
	Unit – II Quantitative agro-biological principles and inverse yield nitrogen law; Mitscherlich yield equation, its interpretation and applicability; Baule unit.	Flipped classes teaching model, Discussions, Field demonstration (ABL)	Assignment, Unannounced test Mid and End Term Examinations
	Unit – III Effect of lodging in cereals; physiology of grain yield in cereals; optimization of plant population and planting geometry in relation to different resources, concept of ideal plant type and crop modeling for desired crop yield.	Lecture method/ Presentation Field demonstration (ABL)	Skill test , Quiz. end term examinations
	Unit – IV Scientific principles of crop production; crop response production functions; concept of soil plant relations; yield and environmental stress, use of growth hormones and regulators for better adaptation in stressed condition.	Collaborative learning, Lecture method, ABL	Group discussions or debate, Assignment, Extempore, End Term Examinations
	Unit-V IFS, organic farming, and resource conservation technology including modern concept of tillage; dry farming; determining the nutrient needs for yield potentiality of crop plants, concept of balance nutrition and INM; precision agriculture. Soil less cultivation, Aeroponic, Hydroponic, Robotic and terrace farming. Use of GIS, GPS and remote sensing, precision farming and protected agriculture.	Flipped classes teaching model, Discussions and Presentation, ABL	Seminar Presentation , Unannounced test, End term examination

Practical Exercise*	List of practicals (field/lab exercises)	Assessment tools
Nil		

Resources:	LCD, OHP, Black Board, Agronomy lab and tools, field for demonstration, Polyhouse, Net house and Different types of devices.
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	<ol style="list-style-type: none"> 1. Preparation of cropping scheme and their analysis 2. Crop modelling for desired crop yield. 3. IFS, organic farming and tools of precision farming
Suggested reading:	<p>A. Textbooks:</p> <ol style="list-style-type: none"> 1. Reddy SR. 2000. Principles of Crop Production. Kalyani Publication. 2. Prasad R and Power JF. 1997. <i>Soil Fertility Management for Sustainable Agriculture</i>. CRC Press. 3. Panda, SC. Modern Concepts and Advances Principles in Crop Production. AGROBIOS <p>B. Reference books:</p> <ol style="list-style-type: none"> 1. Balasubramaniyan, P. and Palaniappan S.P. 2001. Principles and Practices of Agronomy. Agrobios. 2. Arya, RN. Principle of Crop Production and Crops.
Suggested e-resources (Websites/e-books)	<ol style="list-style-type: none"> 1. https://www.amazon.in/MODERN-CONCEPTS-ADVANCES-PRINCIPLES-PRODUCTION/dp/8177544357 2. https://www.researchgate.net/publication/309211395_Modern_Concepts_in_Crop_Production 3. https://www.researchgate.net/publication/370624967_Modern_Concepts_in_Agriculture

Course Code: AGRON-502	Course Name: Principles and practices of soil fertility and nutrient management	Semester: I
-------------------------------	--	--------------------

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1		4		M.Sc. (Ag.) Agronomy
Curriculum level					Basic, recent and Innovative	Student specific course outcome	Higher Education Research Entrepreneurship

Objective: 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.

Course outcomes: After completion of the course, a student will be able to:

CO-1	To gain basic knowledge of soil fertility and productivity
CO-2	To study Importance or Significance of soil macronutrient and micronutrients
CO-3	To Assess and develop importance of soil physical and chemical properties
CO-4	To study about soil pollution and mitigation process
CO-5	To study about soil pollution and mitigation process

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cropping and farming systems, ===== Assignment Quiz Seminars with open discussions Group discussions or debate

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate

AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Teaching Pedagogy	Assessment tools
Course Contents	Unit I 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.	Classroom teaching with AV aids	Assignment, Quiz, Mid-term examinations
	Unit II Criteria of essentiality of nutrients; Essential plant nutrients - their functions, nutrient deficiency symptoms; transformation and dynamics of major plant nutrients.	Flipped classes teaching model, Discussions, Field demonstration (ABL)	Assignment, Unannounced test, Mid and End Term Examinations
	Unit III Preparation and use of farmyard manure, compost, green manures, vermicompost, biofertilizers and other organic concentrates their composition, availability and crop responses; recycling of organic wastes and residue management. Soil less cultivation.	Lecture method/ Presentation, Field demonstration (ABL)	Skill test, Quiz, end term examinations
	Unit IV 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.	Collaborative learning, Lecture method, ABL	Group discussions or debate, Assignment, Extempore, End Term Examinations
	Unit V 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 vermincompost and residue wastes in crops.	Flipped classes teaching model, Discussions and Presentation, ABL	Seminar Presentation, Unannounced test, End term examination
Practical Exercise* (Min-8)	List of practicals (field/lab exercises)		Assessment tools
	<ul style="list-style-type: none"> • Determination of soil pH • Determination of soil EC • Determination of soil organic C • Determination of available N, P, K and S of soil • Determination of total N, P, K and S of soil • Determination of total N, P, K, S in plant • Computation of optimum and economic yield 		Spot Identification Practical Activity Practical Record Attendance Viva voce

Resources:	Agronomy lab and tools, LCD, OHP, Black Board, organic farm for demonstration.
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	<ol style="list-style-type: none"> 4. Commercial fertilizers; composition and its types 5. Recycling of organic wastes and residue management. 6. Essential plant nutrients - their functions, nutrient deficiency symptoms
Suggested reading:	<p>A. Textbooks:</p> <ol style="list-style-type: none"> 4. Brady NC and Weil RR. 2002. The Nature and Properties of Soils. 13th Ed. Pearson Education 2. Fundamentals of soil science by D.K. Das <p>B. Reference books:</p> <ol style="list-style-type: none"> 3. Yawalkar KS, Agrawal JP and Bokde S. 2000. Manures and Fertilizers. Agri-Horti Publ. 4. Havlin JL, Beaton JD, Tisdale SL and Nelson WL. 2006. <i>Soil Fertility and Fertilizers</i>. 7th Ed. Prentice Hall
Suggested e-resources (Websites/e-books)	<ol style="list-style-type: none"> 4. https://www.researchgate.net/publication/309211815 Principles and Practices of Soil Fertility and Nutrient Management 5. https://ncof.dacnet.nic.in/PrinciplesOrganicFarming

Course Code: SST-501	Course Name: Seed Physiology	Semester: I
-----------------------------	-------------------------------------	--------------------

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1				4		M.Sc. (Ag.) GPB
Curriculum level							Basic, recent and Innovative	Student specific course outcome	<ul style="list-style-type: none"> • Higher Education • Research • Placement

Objective: To provide an insight into physiological processes governing seed quality and its survival.

Course outcomes: Through this course students will be able to:

CO-1	Understand the basic principle of seed production, quality seeds.
CO-2	Describe the concept of seed development, maturation, chemical composition and seed viability and vigour test.
CO-3	Demonstrate methods and techniques of quality control during seed production
CO-4	Classify the seed germination techniques and role of phytohormones.
CO-5	Recommend the method of induce and breaking dormancy for long term storage seed.

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Midterm Exams
AT1-2	Seminar Presentation and Report
AT1-3	Industrial Visit Report
AT1-4	Quiz
AT1-5	Poster
AT1-6	Activity Based Learning
AT1-7	Flip Class
AT1-8	Review writing
AT1-9	Identification

Prerequisites	Module wise details	Assessment tools
Course Contents	Unit – 1 Physiology of seed development and maturation; chemical composition, synthesis and accumulation of seed reserves, induction of desiccation tolerance, hormonal regulation of seed development.	Quiz GD Poster Presentation Case study
	Unit – 2 Seed germination; factors affecting germination; role of embryonic axis; growth hormones and enzyme activities, effect of age, size and position of seed on germination. Physiological processes during seed germination.	Mid term exam ABL activities Open book

	<p>Unit – 3 Seed respiration, breakdown of stored reserves in seeds, mobilization and interconversion pathways. Seed dormancy- types, significance, mechanism, endogenous and exogenous factors regulating dormancy, role of phytochrome and PGR, genetic control of dormancy.</p>	Report Presentation Power Point Presentation Assignments
	<p>Unit – 4 Seed viability and longevity, pre and post-harvest factors affecting seed viability ; seed ageing ; physiology of seed deterioration ; lipid peroxidation and other viability theories; means to prolong seed viability; mechanism of desiccation sensitivity and recalcitrance with respect to seed longevity.</p>	Assignments Seminars Report Writing Quiz
	<p>Unit-5 Seed vigour and its concept, vigour test methods, factors affecting seed vigour, physiological basis of seed vigour in relation to crop performance and yield. Seed invigoration and its physiological and molecular control.</p>	End term exam Flip Class Industrial Visit
Practical Exercise*	Course Modules	Assessment tools
	<ol style="list-style-type: none"> 1. Proximate analysis of chemical composition of seed 2. Methods of testing viability; kinetics of seed imbibition and solute leakage 3. Seed germination and dormancy breaking methods 4. Seed invigoration and priming treatments. 5. Accelerated ageing and controlled deterioration tests 6. Enzymatic activities and respiration during germination and effect of accelerated ageing 7. Vigour testing methods 	Practical Activity Practical Record Viva voce Spot Identification
References	<ol style="list-style-type: none"> 1. Agrawal PK & Dadlani M. (Eds.). 1992. <i>Techniques in Seed Science and Technology</i>. South Asian Publ. 2. Baskin CC & Baskin JM. 1998. <i>Seeds: Ecology, Biogeography and Evolution of Dormancy and Germination</i>. Academic Press. 3. Basra AS. 2006. <i>Handbook of Seed Science and Technology</i>. Food Product Press. 4. Bench ALR & Sanchez RA. 2004. <i>Handbook of Seed Physiology</i>. Food Product Press. 5. Bewley JD & Black M. 1982. <i>Physiology and Biochemistry of Seeds in Relation to Germination</i>. Vols. I, II. Springer Verlag. 6. Bewley JD & Black M. 1985. <i>Seed: Physiology of Seed Development and Germination</i>. Plenum Press. 7. Copeland LO & Mc Donald MB. 1995. <i>Principles of Seed Science and Technology</i>. 3rd Ed. Chapman & Hall. 8. Khan AA. 1977. <i>Physiology and Biochemistry of Seed Dormancy and Germination</i>. North Holland Co. 9. Kigel J & Galili G. (Eds.). <i>Seed Development and Germination</i>. Marcel Dekker. 10. Murray DR. 1984. <i>Seed Physiology</i>. Vols. I, II. Academic Press. 	

	Sadasivam S & Manickam A. 1996. <i>Biochemical Methods</i> . 2nd Ed. New Age.
Resources:	LCD, OHP, Black Board, Laboratory.
Assignment/ Tutorial:	Students are required to submit one assignment and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignment	
	<ol style="list-style-type: none"> 1. Physiology of seed development and maturation 2. Hormonal regulation of seed development 3. Physiological processes during seed germination 4. Breakdown of stored reserves in seeds 5. Significance, mechanism and genetic control of Seed dormancy 6. Seed viability, longevity and seed deterioration 7. Seed vigour and Seed invigoration.

Course Code: STAT511

Course Name: Statistical Methods for Applied Sciences

Semester: I

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
4	3	0	1		5		M.Sc. Agri. & Horti.
Curriculum level					Information based Critical thinking based Research based	Student specific course outcome	Placement Research Higher education

Objective: To understand different statistical concepts and its utility in agriculture research and get hands-on end-to-end solution of statistical techniques using calculator/MSExcel/R

Course outcomes: Through this course students will be able to:

CO-1	Describe the understanding of basic concept of statistics and probability in the field of agriculture
CO-2	Explain the concept of probability distributions and various statistical tools used for agricultural data analysis
CO-3	Calculate the various statistical parameters of given data samples using parametric and non-parametric tests
CO-4	Investigate the multivariate analysis using different software

CO-5	Evaluate the use of various statistical software used for agricultural dataset test/analysis
------	--

Teaching Pedagogy:

T1	Classroom Lectures Activity based learning PowerPoint Presentations
T2	ABL activities Assignments Unannounced Test Quiz

Assessment tools	
AT1-1	Midterm Exams and end term exam
AT1-2	Quiz
AT1-3	Activity Based Learning
AT1-4	Assignments
AT1-5	Viva voce examination
AT1-6	Unannounced Test

Prerequisites	Module wise details	Assessment tools
Course Content	<p style="text-align: center;">Unit-1</p> Classification, tabulation and graphical representation of data. Descriptive statistics (including Box-plot and Scattergrams). Probability Theory, Statistics and Exploratory Data Analysis. Random variable and mathematical expectation.	Classroom teaching ABL
	<p style="text-align: center;">Unit-2</p> Discrete and continuous probability distributions: Binomial, Poisson, Normal distribution, Beta and Gamma distributions and their applications. Concept of sampling distribution: chi-square, t and F distributions. Tests of significance based on t and F distributions.	Assignment Unannounced test Mid Term examination
	<p style="text-align: center;">Unit-3</p> Introduction to the theory of estimation and confidence-intervals. Correlation and regression. Simple and multiple linear regression model, estimation of parameters, predicted values and residuals, correlation, partial correlation coefficient, multiple correlation coefficient, rank correlation, test of significance of correlation coefficient and regression coefficients.	Quiz Assignment
	<p style="text-align: center;">Unit-4</p> Non-parametric tests - sign, Wilcoxon, Mann-Whitney U-test, Wald Wolfowitz run test, Run test for the randomness of a sequence. Median test, Kruskal-Wallis test,	ABL Assignment Quiz

	Friedmantwo-wayANOVAbyranks.Kendall's coefficientofconcordance.	
	Unit-V Introduction to multivariate analytical tools- Hotelling's T2 Tests of hypothesisabout the mean vector of a multinormal population. Cluster analysis, principalcomponentanalysisandFactoranalysis.	End termexaminatio nABL VivaVoce

Practical	Course Modules	Assessment tools
Exercise*(Min-8)	<ol style="list-style-type: none"> 1. Tabulation and graphical presentation of data. 2. Fitting of distributions ~ Binomial, Poisson and Normal. 3. Large sample tests, testing of hypothesis based on exact sampling distributions ~ chi square, t and F. 4. Confidence interval estimation and point estimation of parameters of binomial, Poisson and Normal distribution. 5. Correlation and regression analysis. 6. Application of dimensionality reduction technique PCA. 7. Nonparametric tests. 	Practical Activity Practical Record Viva voce
Resources:	LCD, White Board, Computer Lab.	
Assignment/Tutorial:	Students are required to submit one assignment and attend quiz as a part of their continuous evaluation system.	

List of Assignments	<ol style="list-style-type: none"> 1. Example of Binomial and Poisson distribution fitting 2. Example of Principal Component analysis 3. Example of Path Analysis
Suggested reading:	<p>A. Textbooks:</p> <ol style="list-style-type: none"> 1. Gupta, S.C. and Kapoor, V.K. 2014. Fundamentals of Mathematical Statistics. Sultan Chand and sons. New Delhi 2. Gupta, V., 2002. <i>Comdex Computer Kit</i>. Dream Tech Press, New Delhi. 3. Chandel SRS. 1999. A handbook of Agricultural Statistics. Achal Prakashan 4. Anderson TW. 1958. An Introduction to Multivariate Statistical Analysis. John Wiley. 5. Dillon WR & Goldstein M. 1984. Multivariate Analysis- Methods and Applications. John Wiley. 6. Goon AM, Gupta MK & Dasgupta B. 1977. An Outline of Statistical Theory. Vol. I. The World Press. 7. Goon AM, Gupta MK & Dasgupta B. 1983. Fundamentals of Statistics. Vol. I. The World Press. <p>Reference books:</p> <ol style="list-style-type: none"> 1) Rangaswamy, R. 1995. <i>A Text Book of Agricultural Statistics</i>. New Age International Publishing Limited, Hyderabad. <p>Gupta, S.C. and Kapoor, V.K. 2014. Fundamentals of Mathematical Statistics. Sultan Chand and sons. New Delhi</p>
Suggested e-resources (Websites/e-books)	<ol style="list-style-type: none"> 1. https://sscners.icar.gov.in/socialsci/8Multivariate%20Analysis%20Using%20SAS.pdf 2. https://iasri.icar.gov.in/wp-content/uploads/2021/10/Reference-Manual-FINAL.pdf

Course Code: PGS-501	Course Name: Library and Information Services	Semester: I
-----------------------------	--	--------------------

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
1	0	0	1		2		Common to all PG Programs
Curriculum level					<ul style="list-style-type: none"> • Information based • Skill development based • Research based 	Student specific course outcome	<ul style="list-style-type: none"> • Skill enhancement • Research • Higher education

Objective: To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines, etc.) of information search.

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe about the information and knowledge resources
CO-2	Carry out literature survey
CO-3	Apply the modern tools (Internet, OPAC, search engines, etc.) of information search
CO-4	Equip the students/scholars with skills to trace information from libraries efficiently
CO-5	Formulate information search strategies

Teaching Pedagogy:

T1	Classroom Lectures Web-based Practicals Student Seminars/ Presentations/Workshop
T2	ABL activities Library based study Web surfing for collection of information

Assessment tools	
AT1-1	Cataloguing
AT1-2	Student Seminars/ Presentations/Workshop Report
AT1-3	Drafting a technical program for scientific search of information
AT1-4	Indexing of journal/Literature Survey
AT1-5	Database information

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	<ol style="list-style-type: none"> 1. Introduction to library and its services; 2. Role of libraries in education, research and technology transfer; Classification systems and organization of library; 3. Sources of information- Primary Sources, 	Cataloguing Drafting a technical

	<ol style="list-style-type: none"> 4. Secondary Sources and Tertiary Sources; 5. Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; 6. Literature survey; Citation techniques/ Preparation of bibliography; 7. Use of CD-ROM Databases, 8. Online Public Access Catalogue and other computerized library services; 9. Use of Internet including search engines and its resources; 10. eResources access methods. 	<p>program Student Seminars/ Presentations/ Workshop Report/ Indexing of journal/ Literature Survey</p>
Resources:	LCD, Black/White Board, Library	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	<ol style="list-style-type: none"> 1. Application of SCOPUS for scientific profile and scientific writing 2. Application of WoS for scientific profile and scientific writing 3. Application of reference management tools like Mendeley, EndNote, Paperpile etc. for scientific writing 	
Suggested reading:	<p>A. Text and Reference books:</p> <ol style="list-style-type: none"> 1. James HS. 1994. Handbook for Technical Writing. NTC Business Books. 2. Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press. 3. Sethi J & Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India. 4. Wren PC & Martin H. 2006. High School English Grammar and Composition. S. Chand & Co. 	
Suggested e-resources (Websites/e-books)	<ol style="list-style-type: none"> 1. https://www.scopus.com/sources.uri?zone=TopNavBar&origin=searchbasic 2. https://mjl.clarivate.com/home 	

	Agriculture	
--	-------------	--

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
1	1	0	0		1		Common to all PG Program
Curriculum level					Basic and applied	Student specific course outcome	Higher Education Placement Research

Objective: The main objective of this course is to equip students and stakeholders with knowledge of Intellectual Property Rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge based economy.

Course outcomes: After completion of course, the student will be able to:

CO-1	Define various aspects of IPR.
CO-2	Elaborate scope of various types of IPRs in agriculture.
CO-3	Understand the significance of various national and international initiatives for biodiversity protection.
CO-4	Apply the approach of IPRs for protection.
CO-5	Equip the students/scholars with skills to apply for IPR.

Teaching Pedagogy:

T1	Classroom Lectures Web-based information Student Seminars/ Presentations/Workshop
T2	ABL activities IPR based activities Patent and copy right application

Assessment tools	
AT1-1	ABL
AT1-2	Student Seminars/ Presentations/Workshop Report
AT1-3	Drafting a technical program for IPR
AT1-4	Collection and conservation of biodiversity in campus
AT1-5	Applying for Copy right or patent

Prerequisites	Unit wise contents details	Assessment tools

Course Contents	UNIT-I: History of IPR: Historical perspectives and need for the introduction of Intellectual Property Right regime. TRIPs and various provisions in TRIPs Agreement.	ABL Drafting a technical program
	UNIT II: Introduction to IPR: Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs. Indian Legislations for the protection of various types of Intellectual Properties.	ABL Drafting a technical program
	UNIT III: Fundamentals of IPRs: Fundamentals of patents, copyrights. Geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection.	Collection and conservation of germplasm/ Applying for Copy right or patent
	UNIT IV: Protection of IPR: Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection.	Student Seminars/ Presentations/Workshop Report/ Applying for Copy right or patent
	UNIT V: National and International initiatives: 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.	Student Seminars/ Presentations/Workshop Report

Resources:	LCD, Black/White Board
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	<ol style="list-style-type: none"> 1. The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000 2. PPV and FR Act 2001, and Rules 2003 3. The Biological Diversity Act, 2002
Suggested reading:	A. Text and Reference books: <ol style="list-style-type: none"> 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. 4. Ministry of Agriculture, Government of India. 2004. State of Indian Farmer. Vol. V. Technology Generation and IPR Issues. Academic Foundation. 5. Rothschild M and Scott N. (Ed.). 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI. 6. Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya Publ. House.
Suggested e-resources (Websites/e-books)	<ol style="list-style-type: none"> 1. https://www.meity.gov.in/writereaddata/files/National_IPR_Policy.pdf 2. https://icar.org.in/sites/default/files/ICAR%20Guidelines%20for%20IPM%20and%20Technology%20Transfer_2018-1.pdf

Semester-II

Course Code: AGRON 503	Course Name: Principles and practices of weed management	Semester: II
-------------------------------	---	---------------------

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1		4		M.Sc. (Ag), Agronomy
Curriculum level					Basic, applied and Innovative	Student specific course outcome	

Objective: To familiarize the students about the weeds, herbicides and methodology of weed control

Course outcomes: Through this course students will be able to:

CO-1	The knowledge on weed biology and survey of weeds in varied ecosystem.
CO-2	Basic concept, introductory idea and classification of herbicides and its application methods and knowing about mode and mechanism of action of herbicides.
CO-3	Chemistry and nature of herbicides and its movement, degradation in soil and plant system, mechanism of herbicide resistance
CO-4	Effective cultural, mechanical, biological, and chemical methods for managing weeds in different cropping system, crops and water weed
CO-5	Integrated weed management practices for different ecosystems

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate

	Quiz
--	------

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Teaching Pedagogy	Assessment tools
Course Contents	Unit – I Weed biology and ecology, crop-weed competition including allelopathy; principles and methods of weed control and classification; weed indices.	Socratic method, Presentation	Assignment, Quiz, Mid-term examinations
	Unit – II Herbicides introduction and history of their development; classification based on chemical, physiological application and selectivity; mode and mechanism of action of herbicides.	Flipped classes teaching model, Discussions, Field demonstration (ABL)	Assignment, Unannounced test, Mid and End Term Examinations
	Unit – III Herbicide structure - activity relationship; factors affecting the efficiency of herbicides; herbicide formulations, herbicide mixtures; herbicide resistance and management; weed control through bio-herbicides, myco-herbicides and allelochemicals; Degradation of herbicides in soil and plants; herbicide resistance in weeds and crops; herbicide rotation.	Lecture method/ Presentation, Field demonstration (ABL)	Skill test, Quiz, end term examinations
	Unit – IV Weed management in major crops and cropping systems; parasitic weeds; weed shifts in cropping systems; aquatic and perennial weed control.	Collaborative learning, Lecture method, ABL	Group discussions or debate, Assignment, Extempore, End Term Examinations

	<p>Unit-V Integrated weed management; cost: benefit analysis of weed management.</p>	<p>Flipped classes teaching model, Discussions and Presentation, ABL</p>	<p>Seminar Presentation , Unannounced test, End term examination</p>
--	---	--	--

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	<ol style="list-style-type: none"> 1. Identification of important weeds of different crops 2. Preparation of a weed herbarium 3. Weed survey in crops and cropping systems 4. Crop-weed competition studies 5. Preparation of spray solutions of herbicides for high and low-volume sprayers 6. Use of various types of spray pumps and nozzles and calculation of swath width 7. Economics of weed control 8. Herbicide resistance analysis in plant and soil 9. Bioassay of herbicide resistance 10. Calculation of herbicidal requirement 	<p>Spot Identification Practical Activity Practical Record Attendance Viva voce</p>
Resources:	LCD, Black Board, Agronomy lab and tools and field for demonstration, Polyhouse, Net house.	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments		
Suggested reading:	<p>A. Textbooks:</p> <ol style="list-style-type: none"> 1. Das TK. 2008. Weed Science: Basics and Applications, Jain Brothers (New Delhi). 2. Walia US. 2006. Weed Management, Kalyani. 3. Kewat, M.L. and Sharma, R.S. (2007). A Practical Manual for Weed Control, College of Agriculture, JNVV, Jabalpur publication 	
Suggested e-resources (Websites/e-books)	<ol style="list-style-type: none"> 1. http://www.agrimoon.com 2. http://www.agriinfo.in 3. http://www.agriglance.com 4. http://agritech.tnau.ac.in 	

Course Code: AGRON 504	Course Name: Principles and practices of water management	Semester: II
-------------------------------	--	---------------------

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1		4		M.Sc. (Ag), Agronomy
Curriculum level					Basic, applied and Innovative	Student specific course outcome	

Objective: To teach the principles of water management and practices to enhance the water productivity

Course outcomes: Through this course students will be able to:

CO-1	Know the different irrigation projects, importance of water for crop production and different water resources of world and India
CO-2	Water absorption, movement in soil and plant and stress condition of the crop
CO-3	The principles involved in estimating water requirement, various methods of irrigation scheduling and approaches
CO-4	Water management in crop and cropping systems and economize the water and known quality of water and its management
CO-5	Understand the effect of excess water on plant growth, drainage requirements of crop, layout and special irrigability of lands

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate

	Quiz
--	------

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Teaching Pedagogy	Assessment tools
Course Contents	Unit – I Water and its role in plants; water resources of India, major irrigation projects, extent of area and crops irrigated in India and different states.	Socratic method, Presentation	Assignment, Quiz, Mid-term examinations
	Unit – II Soil water movement in soil and plants; transpiration; soil-water-plant relationships; water absorption by plants; plant response to water stress, crop plant adaptation to moisture stress condition.	Flipped classes teaching model, Discussions, Field demonstration (ABL)	Assignment, Unannounced test Mid and End Term Examinations
	Unit – III Soil, plant and meteorological factors determining water needs of crops; scheduling, depth and methods of irrigation; micro-irrigation system; ferti-gation management of water in controlled environments and poly-houses.	Lecture method/ Presentation Field demonstration (ABL)	Skill test, Quiz. end term examinations
	Unit – IV Water management of the crops and cropping systems; quality of irrigation water and management of saline water for irrigation; water use efficiency.	Collaborative learning, Lecture method, ABL	Group discussions or debate, Assignment, Extempore, End Term Examinations
	Unit-V Excess of soil water and plant growth; water management in problem soils; drainage requirement of crops and methods of field drainage, their layout and spacing.	Flipped classes teaching model, Discussions and Presentation, ABL	Seminar Presentation, Unannounced test, End term examination

Practical Exercise* (Min-8)	List of practical's (field/lab exercises)	Assessment tools
	<ol style="list-style-type: none"> 1. Measurement of soil water potential by using tensiometer, and pressure plate and membrane apparatus 2. Soil-moisture characteristics curves 3. Water flow measurements using different devices 4. Determination of irrigation requirements 5. Calculation of irrigation efficiency 6. Determination of infiltration rate 7. Determination of saturated/unsaturated hydraulic conductivity 	<p>Spot Identification Practical Activity Practical Record Attendance Viva voce</p>
Resources:	LCD, Black Board, Agronomy lab and tools and field for demonstration, Polyhouse, Net house.	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments		
Suggested reading:	<p>A. Textbooks:</p> <ol style="list-style-type: none"> 1. Paliwal KV. 1972. <i>Irrigation with Saline Water</i>. IARI Monograph, New Delhi. 2. Panda SC. 2003. <i>Principles and Practices of Water Management</i>. Agrobios. 3. Reddy SR. 2000. <i>Principles of Crop Production</i>. Kalyani. 4. Singh Pratap&Maliwal PL. 2005. <i>Technologies for Food Security and Sustainable Agriculture</i>. Agrotech Publ. <p>B. Reference books:</p> <ol style="list-style-type: none"> 5. 	
Suggested e-resources (Websites/e-books)		

Course Code: AGRON 506				Course Name: Agronomy of Major Cereals and Pulses				Semester: II			
Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)		
3	2	0	1				4		M.Sc. (Ag.) Agronomy		
Curriculum level							Basic and applied	Student specific course outcome	Higher Education Placement Research		

Objective: To impart knowledge of crop husbandry of cereals and pulse crops.

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the basic concepts and principles of production technology and postharvest handling and processing and seed production technology of different cereals and pulses.
CO-2	Compare the different cultivation practices, seed production and processing technologies with their economic viability and sustainability.
CO-3	Utilize various principles and concepts of crop production to enhance productivity and maximise the return per unit area and time.
CO-4	Analyse the impact of various intercultural operation on yield, quality and storage in different cereals and pulses.
CO-5	Assess the sustainability of various crop production technologies for commercial crop production and quality seed production with better cost benefit ratio.

Teaching Pedagogy:

T1	Classroom teaching with AV aids Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid-term Exams and end term exam

AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	PPT Presentation

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	Unit I: Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of Rabi cereals.	Quiz Mid-term Exams
	Unit II: Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of Kharif cereals.	group discussion, Unannounced test Mid-term Exams
	Unit III: Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of Rabi pulses.	assignment and class discussion, Mid-term Exams and end term exam
	Unit IV: Origin and history, area and production, classification, improved varieties, adaptability, climate, soil, water and cultural requirements, nutrition, quality components, handling and processing of the produce for maximum production of Kharif pulses.	Extempore, Mid-term Exams and end term exam
	Unit V: Seed production technology of cereals and pulse crops, cost of cultivation analysis in different crops.	PPT Presentation, Mid-term Exams and end term exam

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	<ul style="list-style-type: none"> Phenological studies at different growth stages of crop Estimation of crop yield on the basis of yield attributes Formulation of cropping schemes for various farm sizes and calculation of cropping and rotational intensities Working out growth indices (CGR, RGR, NAR, LAI, LAD, LAR, LWR, SLA, SLW etc) Assessment of land use and yield advantage (Rotational intensity, Cropping intensity, Diversity Index, Sustainable Yield Index Crop Equivalent Yield, Land Equivalent ration, Aggressiveness, Relative 	Spot Identification Practical Activity Practical Record Attendance Skill test

	<p>Crowding Coefficient, Competition Ratio and ATER etc)</p> <ul style="list-style-type: none"> • Estimation of protein content in pulses • Planning and layout of field experiments • Judging of physiological maturity in different crops • 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 selected crops • Visit of field experiments on cultural, fertilizer, weed control and water management aspects • Visit to nearby villages for identification of constraints in crop production 	Viva voce
Resources:	LCD, OHP, Black Board, Agronomy lab and tools and field for demonstration	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	<ol style="list-style-type: none"> 1. Modern seed production technologies of rice, of maize and Pigeon pea 2. Detail description of improved varieties of different cereals and pulses 3. Cost of cultivation analysis of rice in traditional and SRI system. 	
Suggested reading:	<p>A. Text and Reference books:</p> <ul style="list-style-type: none"> • Das NR. 2007. Introduction to Crops of India. Scientific Publ. • Hunsigi G and Krishna KR. 1998. Science of Field Crop Production. Oxford & IBH. • Jeswani LM and Baldev B. 1997. Advances in Pulse Production Technology. ICAR. • Khare D and Bhale MS. 2000. Seed Technology. Scientific Publ. • Kumar Ranjeet and Singh NP. 2003. Maize Production in India: Golden Grain in Transition. IARI, New Delhi. • Pal M, Deka J and Rai RK. 1996. Fundamentals of Cereal Crop Production. Tata McGraw Hill. • Prasad Rajendra. 2002. Text Book of Field Crop Production. ICAR. • Singh C, Singh P and Singh R. 2003. Modern Techniques of Raising Field Crops. Oxford & IBH. • Singh SS. 1998. Crop Management. Kalyani. • Yadav DS. 1992. Pulse Crops. Kalyani. 	
Suggested e-resources (Websites/e-books)	<ol style="list-style-type: none"> 1. http://www.iiwm.res.in/pdf/Bulletin_69.pdf 2. https://icar-nrri.in/wp-content/uploads/2019/08/11.-NRRI-Research-Bulletin-9.pdf 3. http://oar.icrisat.org/11078/1/Pigeonpea%20hybrid%20%26%20Seed%20Production.pdf 4. file:///C:/Users/vinod/Downloads/978-981-19-5888-5.pdf 	

Course Code: SOILS-502					Course Name: Soil fertility and fertilizer use				Semester: II		
Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)				
3	2	0	1		4		M.Sc. (Soil Science)				
Curriculum level					Basic and applied		Student specific course outcome	Higher Education Placement Research			

Objective: To impart knowledge about soil fertility and its control, and to understand the role of fertilizers and manures in supplying nutrients to plants so as to achieve high fertilizer use efficiency.

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe essential plant nutrients, its functions and deficiency symptoms.
CO-2	Discuss sources, forms, roles and transformation of nitrogen in soil.
CO-3	Demonstrate the methods of fertilizer recommendation and application
CO-4	Analyse the role of phosphatic fertilizer, behavior and their management
CO-5	Justify the significance for presence of potassium and sulphur in soil.

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Two Midterm Exams
AT1-2	Seminar Presentation and Report
AT1-3	Industrial Visit Report
AT1-4	Quiz
AT1-5	Poster
AT1-6	Activity Based Learning
AT1-7	Flip Class
AT1-8	Review writing

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	Unit-I: Soil fertility and soil productivity; nutrient sources – fertilizers and manures; essential plant nutrients - functions and deficiency symptoms.	How can classroom teaching through chalk-board or power point be assessment tool?
	Unit-II: Soil and fertilizer nitrogen – sources, forms, immobilization and mineralization, nitrification, denitrification; biological nitrogen fixation - types, mechanism, microorganisms and factors affecting; nitrogenous fertilizers and their fate in soils; management of fertilizer nitrogen in lowland and upland conditions for high fertilizer use efficiency.	ABL, assignments, seminars and Quiz are assessment tools. Flip Classes can be a assessment tools only if it is evaluated
	Unit-III: Soil and fertilizer phosphorus - forms, immobilization, mineralization, reactions in acid and alkali soils; factors affecting phosphorus availability in soils; phosphatic fertilizers - behavior in soils and management under field conditions.	Class room teaching (Chalk-board) and Power Point Presentations are not the assessment tools
	Unit-IV: Potassium - forms, equilibrium in soils and its agricultural significance; mechanism of potassium fixation; management of potassium fertilizers under field conditions. Sulphur - source, forms, fertilizers and their behavior in soils; calcium and magnesium– factors affecting their availability in soils; management of sulphur, calcium and magnesium fertilizers.	Assignments Flip Class/ Seminars Quiz
	Unit-V: Micronutrients – critical limits in soils and plants; factors affecting their availability and correction of their deficiencies in plants; role of chelates in nutrient availability. Common soil test methods for fertilizer recommendations; quantity–intensity relationships; soil test crop response correlations and response functions.	Assignments Flip Class/ Seminars Quiz
	Unit-VI: Fertilizer use efficiency; blanket fertilizer recommendations – usefulness and limitations; site-specific nutrient management; plant need based nutrient management; integrated nutrient management. Soil fertility evaluation - biological methods, soil, plant and tissue tests; soil quality in relation to sustainable agriculture.	Assignments Flip Class/ Seminars Quiz

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Principles of colorimetry 2. Flame-photometry and atomic absorption spectroscopy 3. Chemical analysis of soil for total and available nutrients	Activity based learning can be given to

	4. Analysis of plants for essential elements	implement application aspect
Resources:	LCD, OHP, Black Board, Laboratory.	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	<ol style="list-style-type: none"> 1. Mobility and deficiency Symptoms of Plant Nutrients 2. Site-specific nutrient management 3. Integrated nutrient management 4. Write the principle and procedure to determine Available nitrogen in soil 5. Write the principle and procedure to determine Available Phosphorus in Alkaline soil (Olsen method) 6. Write the principle and procedure to determine Available Potassium in soil 	
Suggested reading:	<p>A. Text and Reference books:</p> <ol style="list-style-type: none"> 1. Brady NC & Weil RR. 2002. The Nature and Properties of Soils. 13th Ed. Pearson Edu. 2. Kabata-Pendias A & Pendias H. 1992. Trace Elements in Soils and Plants. CRC Press. 3. Kannaiyan S, Kumar K & Govindarajan K. 2004. Biofertilizers Technology. Scientific Publ. 4. Leigh JG. 2002. Nitrogen Fixation at the Millennium. Elsevier. 5. Mengel K & Kirkby EA. 1982. Principles of Plant Nutrition. International Potash Institute, Switzerland. 6. Mortvedt JJ, Shuman LM, Cox FR & Welch RM. 1991. Micronutrients in Agriculture. 2nd Ed. SSSA, Madison. 7. Pierzinsky GM, Sims TJ & Vance JF. 2002. Soils and Environmental Quality. 2nd Ed. CRC Press. 8. Stevenson FJ & Cole MA. 1999. Cycles of Soil: Carbon, Nitrogen, Phosphorus, Sulphur, Micronutrients. John Wiley & Sons. 9. Tisdale SL, Nelson SL, Beaton JD & Havlin JL. 1999. Soil Fertility and Fertilizers. 5th Ed. Prentice Hall of India. 10. Troeh FR & Thompson LM. 2005. Soils and Soil Fertility. Blackwell. 	
Suggested e-resources (Websites/e-books)	<ol style="list-style-type: none"> 1. https://krishi.icar.gov.in/jspui/bitstream/123456789/19624/1/Book%20chepter%207%20july%202018.pdf 2. https://krishi.icar.gov.in/jspui/bitstream/123456789/35535/2/12.pdf 3. https://www.mdpi.com/2223-7747/9/8/1011 	

CourseCode:STAT-512	CourseName:Experimental Designs	Semester:II
----------------------------	--	--------------------

Credits	L	T	P	Marks			Contact Hours(per week)	Independent Study Hour(per week)	Section(Group)
3	2	0	1				4		M.Sc.(Agri.)
Curriculumlevel							Information basedCritical thinking basedResearchbased	Student specificcourseoutcome	PlacemntResearch Highereducation

Objective: To educate about concepts of Design of Experiments so as to enable them to understand the concepts involved in planning, designing their experiments and analysis of experimental data.

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the basic concept of designing of field experiment
CO-2	Compare the different experimental designs used in agriculture field experiments
CO-3	Demonstrate the analysis of covariance in basic designs and confounding in factorial experiments
CO-4	Analyse the result of various statistical designs along give scientific interpretation
CO-5	Assess the suitability of different Software for the statistical analysis of different designs for different sets of experimental conditions

Teaching Pedagogy:

T1	Class room Lectures Activity based learning PowerPoint Presentations
T2	ABL activities Assignments Unannounced test Quiz

Assessment tools	
AT1-1	One Midterm Exam
AT1-2	Quiz
AT1-3	Activity Based Learning
AT1-4	Assignments
AT1-5	Viva

	voceexamination
AT1-5	Unannouncedtest

Prerequisites	Unitwisecontentsde tails	Assessmenttools
CourseContents	Unit –1 Needfordesigningofexperiments,characteristicsofagooddesign.Data Transformation,Basic principlesofdesigns-randomization,replicationandlocal control.	Classroomtea ching ABL
	Unit–2 Uniformitytrials,sizeandshape ofplotsandblocks;Analysisofvariance;completely randomized design, randomized block design and Latin square design.	AssignmentU nannounced testMid Termexamina tion
	Unit –3 Factorial experiments, (symmetrical as well as asymmetrical). Orthogonalityandpartitioningofdegreesof freedom,Confoundinginsymmetricalfactorialexperiments,Factorialexperimentswith controltreatment.	Quiz Assignment
	Unit –4 Split plot and strip plot designs; Analysis of covariance and missing plottechniques in randomized block and Latin square designs; Transformations,crossoverdesigns,balancedincompleteblockdesign,resolvable design andtheir applications ~ Lattice design, alpha design - concepts, randomizationprocedure,analysisandinterpretationofresults.Responsesurfaces. Experimentswithmixtures.	ABL Assignment Quiz
	Unit –5 Bioassays- directandindirect,indirectassaysbasedonquantaldoseresponse,parallellineandslop eratioassayspotencyestimation.	End termexaminati on ABL VivaVoce

PracticalExercise*(Min-8)	Listofpracticals	Assessmenttools
----------------------------	------------------	-----------------

	<ol style="list-style-type: none"> 1. Analysis of data obtained from CRD 2. Analysis of data obtained from RBD 3. Analysis of data obtained from LSD 4. Analysis of factorial experiments without and with confounding 5. Analysis of Split plot Design 6. Analysis of Strip plot design 7. Transformation of data 8. Uniformity Trial data analysis 	<p>Practical Activity Practical Record Vivavoc e</p>
--	--	--

Resources:	LCD, Black/White Board, Computer Lab
Assignment/Tutorial:	Students are required to submit one assignment and attend quiz as a part of their continuous evaluation system..
List of Assignments	1. Examples of different designs
Suggested reading:	<p>A. Textbooks:</p> <ol style="list-style-type: none"> 1. Dean AM & Voss D. 1999. Design and Analysis of Experiments. Springer. 2. Federer WT. 1985. Experimental Designs. MacMillan. 3. Fisher RA. 1953. Design and Analysis of Experiments. Oliver & Boyd. 4. Pearce SC. 1983. The Agricultural Field Experiment: A Statistical Examination of Theory and Practice. John Wiley. <p>B. Reference Book:</p> <ol style="list-style-type: none"> 1. Gupta, S. C. and Kapoor, V. K. 2007. Fundamentals of Applied Statistics. Sultan Chand and sons. New Delhi 2. Nigam AK & Gupta VK. 1979. Handbook on Analysis of Agricultural Experiments. IA SRIPubl. 3. Rangaswamy, R. 1995. <i>A Text Book of Agricultural Statistics</i>. New Age International Publishing Limited, Hyderabad.
Suggested e-reading:	<ol style="list-style-type: none"> 1. http://apps.iasri.res.in/ebook/EBADAT/2-Basic%20Statistical%20Techniques/9-Fundamentals%20of%20Designsf.pdf 2. http://apps.iasri.res.in/ebook/EBADAT/2-Basic%20Statistical%20Techniques/17-factoriallectf.pdf

Course Code: PGS-504	Course Name: BASIC CONCEPTS IN LABORATORY TECHNIQUES	Semester: II
-----------------------------	---	---------------------

Credits	L	T	P	Marks			Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
1	0	0	1				2		Common to all PG Programs
Curriculum level							<ul style="list-style-type: none"> • Information based • Research based • Skill Development based 	Student specific course outcome	<ul style="list-style-type: none"> • Research • Higher education • Skill enhancement

Objective: To acquaint the students about the basics of commonly used techniques in laboratory.

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the basic concepts and working principles of common laboratory instruments and techniques
CO-2	Explain the SOPs of various equipments and techniques used in different laboratories
CO-3	Demonstrate the analysis of physiochemical, molecular analysis using different equipments and techniques and solve problems with trouble shooting.
CO-4	Examine the results of various lab analysis with scientific explanation
CO-5	Assess the precision level of laboratory instruments and techniques and find the suitable methods for performing the different lab analyses

Teaching Pedagogy:

T1	Classroom teaching with AV aids Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions

	Group discussions or debate Quiz
--	-------------------------------------

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	PPT Presentation

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	<ul style="list-style-type: none"> 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, sandbath, waterbath, oilbath; 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. 	Lab manuals Lab management skills Activity Based Learning (ABL) Experimental set up Oral Viva-voce examination Preparation of chemicals
Resources:	Bio-chemistry Laboratory, Departmental laboratories	

Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	1. Principle of working of different lab instruments 2. Sterilization techniques 3. Tissue culture Media composition and preparation
Suggested reading:	A. Text and Reference books: 1. Furr AK. 2000. CRC Hand Book of Laboratory Safety. CRC Press. Gabb MH and Latchem WE. 1968. A Handbook of Laboratory Solutions. Chemical Publ. Co.
Suggested e-resources (Websites/e-books)	1. https://faculty.ksu.edu.sa/sites/default/files/1_identification_of_the_common_laboratory_glassware_pipettes_and_equipment .pdf 2. https://ncert.nic.in/ncerts/l/kelm202.pdf 3. https://5.imimg.com/data5/BW/FG/MY-7710909/glass-reaction-cum-distillation-unit.pdf 4. https://www.borosil.com/site/assets/files/2618/labglassware_catalogue_2021.pdf

In accordance with
ICAR BSMA Committee, 2021



July, 2023 BOS
M.Sc. Ag. (Agronomy)

Semester-III

CourseCode:AGRON- 507	CourseName:Agromony of oilseed, fibre and sugar crops	Semester:III
------------------------------	--	---------------------

Credits	L	T	P	Marks	Contact Hours(perweek)	Independent StudyHour(perweek)	Section(Group)
3	2	0	1		4		M.Sc. (Ag),Agronomy
Curriculumlevel					Information basedCritical thinking basedResearch based	Student specificcourse outcome	PlacementResearch Highereducation

Objective:To impart in-depth knowledge about the conservation of agriculture for sustainable crop production.

Courseoutcomes:After successful completion of the course, the students are expected to

CO-1	Acquire the knowledge about the origin, geographical distribution, economic importance, Soil and climatic requirements, varieties, cultural practices and yield of oilseed crops (<i>Rabi</i> and <i>kharif</i>), fibre crop and sugar crop.
CO-2	Acquire the knowledge about the constraints of oilseed crops (<i>Rabi</i> and <i>kharif</i>), fibre crop and sugar crop production.
CO-3	Able to identify the different improved varieties of oilseed crops (<i>Rabi</i> and <i>kharif</i>), fibre crop and sugar crop and its associated weeds, disease and pest
CO-4	Utilized the theoretical and practical knowledge of production technology to maximise the production of oilseed crops (<i>Rabi</i> and <i>kharif</i>), fibre crop and sugar crop.

TeachingPedagogy:

T1	Class room Lectures Laboratory/ Field Practicals Student Seminars/ Presentations
T2	ABL activities Field Tours/ Demonstrations/Assignments

Assessmenttools

AT1-1	Mid termExamsand end termexam
AT1-2	SeminarPresentation
AT1-3	Quiz
AT1-4	Poster

AT1-5	ActivityBasedLearning
AT1-6	Vivavoceexamination
AT1-7	Reportwriting
AT1-8	Fieldtrial
AT1-9	SpotIdentification

Prerequisites	Modulewisedetails	Assessmenttools
Cou rseC onte	Unit- 1 <i>Rabi</i> oilseeds – Rapeseed and mustard, Linseed and Niger	Presentation
	Unit- 2 <i>Kharif</i> oilseeds - Groundnut, Sesame, Castor, Sunflower, Soybean and Safflower	MidTermexamination Reportwriting
	Unit- 3 Fiber crops - Cotton, Jute, Ramie and Mesta.	Lecture method/ Presentation Field demonstration (ABL)
	Unit- 4 Sugar crops – Sugar-beet and Sugarcane	Collaborative learning, Lecture method, ABL
	Unit- 5 Economic considerations in CA, adoption and constraints, CA: The future of agriculture	ABL End term examination Viva Voce

Practical Exercise*(Min-8)	CourseModules	Assessmenttools
	7. Survey and surveillance 8. Collection of Soil and Root Samples 9. Extraction of Nematodes from Soil Samples 10. Extraction of Nematode from Plant Material 11. Handling and Use of Microscopes 12. Counting and Picking of Nematodes 13. Preparation of Fixatives and their Recipes/Compositions 14. Preparation of Temporary and Permanent Mounts 15. Morphology of a Typical Plant Parasitic Nematode	PracticalActivityPra cticalRecordVivavo cefield Identification
Resources:	LCD,OHP,BlackBoard,MolecularBiologyLaboratory.	

Assignment/Tutorial:	Students are required to submit one assignment and deliver one powerpoint presentation as a part of their continuous evaluation system.
List of Assignments	1. Regional aspect of oilseed crops production in Madhya Pradesh, India. Role of micro nutrient in oilseeds crops.
Suggested reading:	1. Shagun, and Jhala, V.S. 2022. Agronomy of Oilseed, Fibre and Sugar Crops. Amiga Press 2. Das, N.R. 2017. Practical Manual on Basic Agronomy (With Theory) 2nd Revised Ed. Scientific Publishers 3. Singh, C. 1983. Modern Techniques of Raising Field Crops. Oxford & IBH 4. U. S. Walia, S.S. Kler, D.S. Singh, D. , 1986. ICAR, Science of Agronomy. Scientific Publishers (India) 5. Joshi, M. 2015. Textbook of field crops. PHI Learning Kamburova, V.S. and Kim, S.K. 2018. Fundamentals of Agronomy. Scitus Academics LLC
Suggested e-resources (Websites /e-books)	1. https://courseware.cutm.ac.in/wp-content/uploads/2020/06/CPT-II-Lecture-Notes.pdf 2. https://www.amigapress.co.in/product/agronomy-of-oilseed-fibre-and-sugar-crops/

Course Code: AGRON-508	Course Name: Agronomy of medicinal, aromatic & underutilized crops	Semester: III
-------------------------------	---	----------------------

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1		4		M.Sc. (Ag), Agronomy
Curriculum level					Basic, applied and Innovative	Student specific course outcome	Higher Education Placement Research Entrepreneurship

Objective: To acquaint students about different medicinal, aromatic and underutilized field crops, their package of practices and processing.

Course outcomes: Through this course students will be able to:

CO-1	Identify the different medicinal and aromatic and underutilized field crops along with their respective uses, chemical constituents and importance.
CO-2	Describe the basic concepts of production technology and postharvest management of medicinal and aromatic crops and principles of landscaping used for planning and layout of fields.
CO-3	Demonstrate various intercultural operations and postharvest practices used in medicinal and aromatic crops.
CO-4	Analyse the opportunities and challenges in production, postharvest value addition and marketing of medicinal and aromatic crops.
CO-5	Assess the economic feasibility of different medicinal, aromatic crops and underutilized crops cultivation under different agro-climatic conditions and Judge the various methods used in postharvest value addition

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate

	Quiz
--	------

Assessment tools	
AT1-1	Mid-term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Teaching Pedagogy	Assessment tools
Course Contents	Unit – 1 Importance of medicinal and aromatic plants in human health, national economy and related industries, classification of medicinal and aromatic plants according to botanical characteristics and their uses, export potential and indigenous technical knowledge.	Socratic method, Presentation	Assignment, Quiz, Mid-term examinations
	Unit – II Climate and soil requirements; cultural practices; yield and important constituents of medicinal plants (Mulhati, Isabgol, Rauwolfia, Poppy, Aloe vera, Satavar, Stevia, SafedMusli, Kalmegh, Asaphoetida, Nuxvomica, Rosadle, etc).	Flipped classes teaching model, Discussions, Field demonstration (ABL)	Assignment, Unannounced test Mid and End Term Examinations
	Unit – III Climate and soil requirements; cultural practices; yield and important constituents of aromatic plants (Citronella, Palmarosa, Mentha, Basil, Lemon grass, Rose, Patchouli, Geranium).	Lecture method/ Presentation Field demonstration (ABL)	Skill test, Quiz. end term examinations
	Unit – IV Climate and soil requirements; cultural practices; yield of under-utilized crops (Rice bean, Lathyrus, Sesbania,	Collaborative learning, Lecture method, ABL	Group discussions or debate, Assignment, Extempore, End Term

	Clusterbean, French bean, Fenugreek, Grain Amaranth, Coffee, Tea and Tobacco).		Examinations
	Unit-V Post-harvest handling –drawing, processing, grading, packing and storage, value addition and quality standards in herbal products.	Flipped classes teaching model, Discussions and Presentation, ABL	Seminar Presentation , Unannounced test, End term examination

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	<ol style="list-style-type: none"> 1. Identification of crops based on morphological and seed characteristics. 2. Raising of herbarium of medicinal, aromatic and under-utilized plants. 3. Quality characters in medicinal and aromatic plants. 4. Methods of analysis of essential oil and other chemicals of importance in medicinal and aromatic plants. 	Spot Identification Practical Activity Practical Record Attendance Viva voce
Resources:	LCD, OHP, Black Board, Horticulture lab and tools, Gardens, and field for demonstration, Polyhouse, Net house, Processing unit/post-harvest lab	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	<ol style="list-style-type: none"> 16. Preparation of plant identification database for the assign plant species along with identification name plate with In-built barcode 17. Varietal health of ornamental and MAP crops. 18. Value addition process of assign crop 	
Suggested reading:	A. Textbooks: <ol style="list-style-type: none"> 5. N. Kumar. 2018. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Scientific International Pvt. Ltd., New Delhi. 6. H.C. Srivastava. 2014. Medicinal and Aromatic Plants. ICAR, New Delhi. B. Reference books: <ol style="list-style-type: none"> 6. Chadha, K.L. 2019. Handbook of Horticulture (Vol-I & II). ICAR, New Delhi. 	
Suggested e-resources (Websites/e-books)	<ol style="list-style-type: none"> 1. http://naac.gov.in/images/docs/campus/Ornamental%20plants%20at%20NAAC.pdf 2. http://agricoop.gov.in/Documents/Horticulture%20Statistics%20at%20a%20Glance-2018.pdf 3. http://agricoop.gov.in/en/StatHortEst#gsc.tab=0 3. https://agriexchange.apeda.gov.in/index/genReport_combined.aspx#content 	

Course Code: AGRON-509	Course Name: Agronomy of Fodder and Forage Crops	Semester: III
-------------------------------	---	----------------------

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1		4		M.Sc. (Ag), Agronomy
Curriculum level					Basic, applied and Innovative	Student specific course outcome	Higher Education Placement Research Entrepreneurship

Objective: To teach the crop husbandry of different forage and fodder crops, round the year system along with their processing techniques.

Course outcomes: Through this course students will be able to:

CO-1	Define the meaning of fodder and forage crops as related to livestock production. Identify the common pasture and forage crops in your locality.
CO-2	Describe the basic concepts of production technology and quality aspects including anti-quality factors of important forage crops Napier grass, Panicum, Lasiurus, Cenchrus, etc.
CO-3	Year-round fodder production and management, preservation and utilization of forage and pasture crops. Illustrate the various methods of conserving pasture for livestock feeding
CO-4	Principles and methods of hay and silage making; chemical and biochemical changes, nutrient losses and factors affecting quality of hay and silage; use of physical and chemical enrichments and biological methods for improving nutrition; value addition of poor quality fodder. Fodder production through hydroponics. Azolla cultivation.
CO-5	Economics of forage cultivation uses and seed production techniques of important fodder crops.

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
----	---

T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz
----	--

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Teaching Pedagogy	Assessment tools
Course Contents	Unit – 1 Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important fodder crops like sorghum, maize, bajra, guar, cowpea, oats, barley, berseem, senji, lucerne, etc.	Socratic method, Presentation	Assignment, Quiz, Mid-term examinations
	Unit – II Adaptation, distribution, varietal improvement, agro-techniques and quality aspects including anti-quality factors of important forage crops/grasses/lime, Napier grass, Panicum, Lasiurus, Cenchrus, etc.	Flipped classes teaching model, Discussions, Field demonstration (ABL)	Assignment, Unannounced test Mid and End Term Examinations
	Year-round fodder production and management, preservation and utilization of forage and pasture crops	Lecture method/ Presentation Field demonstration (ABL)	Skill test, Quiz. end term examinations

	Unit – IV		
	Principles and methods of hay and silage making; chemical and biochemical changes, nutrient losses and factors affecting quality of hay and silage; use of physical and chemical enrichments and biological methods for improving nutrition; value addition of poor quality fodder. Fodder production through hydroponics. Azolla cultivation.	Collaborative learning, Lecture method, ABL	Group discussions or debate, Assignment, Extempore, End Term Examinations
	Unit-V Economics of forage cultivation uses and seed production techniques of important fodder crops.	Flipped classes teaching model, Discussions and Presentation, ABL	Seminar Presentation, Unannounced test, End term examination

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	<ol style="list-style-type: none"> 1. Practical training of farm operations in raising fodder crops. 2. Canopy measurement, yield, Leaf: Stem ratio and quality estimation, viz. crude protein, NDF, ADF, lignin, silica, cellulose and IVDMD, etc. of various fodder and forage crops. 3. Anti-quality components like HCN in sorghum and such factors in other crops. 4. Hay and silage making and economics of their preparation. 	Spot Identification Practical Activity Practical Record Attendance Viva voce
Resources:	LCD, OHP, Black Board, and field for demonstration, Processing unit	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	<ol style="list-style-type: none"> 1. Preparation of plant identification database for the assign plant species along with identification name plate with In-built barcode 2. Varietal health of forage and fodder crops. 3. Value addition process of assign crop 	
Suggested reading:	A. Textbooks: <ol style="list-style-type: none"> 1. Barnes, R.F., D.A. Miller, and C.J. Nelson. (1995). Forages, the Science of Grassland Agriculture. 5th Ed., Vols. 1 and 2, Iowa State University Press, Ames, IA. 2. Bogdan, A.V. (1977). Tropical Pasture and Fodder Plants (Grasses and Legumes). B. Reference books: <ol style="list-style-type: none"> 1. Singh, A.K., Khan, M.A., Natraja S., Singh, K.M. 2013. Forage and fodder an Indian 	

	perspective. Daya Publishing house. New Delhi
Suggested e-resources (Websites/e-books)	<ol style="list-style-type: none">1. https://icar.gov.in/files/forage-and-grasses.pdf2. http://www.worldcat.org/title/agronomy-of-fodder-and-forage-crops/oclc/9956244253. https://books.google.com/books/about/Agronomy_of_Fodder_and_Forage_Crops.html?id=EBvorQEACAAJ4. https://content.kopykitab.com/ebooks/2013/11/2214/sample/sample_2214.pdf5. http://www.kvknamsai.org.in/pdf/Fodder%20manual.pdf

Course Code: AGRON-510	Course Name: Agrostology and Agro-Forestry	Semester: III
-------------------------------	---	----------------------

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1		4		M.Sc. (Ag), Agronomy
Curriculum level					Basic, applied and Innovative	Student specific course outcome	Higher Education Placement Research Entrepreneurship

Objective: To study about the grassland ecology and agroforestry system

Course outcomes: Through this course students will be able to:

CO-1	Identify the different agrostology, grassland ecology, pastures, agroforestry systems & its importance and scope.
CO-2	Describe the basic knowledge of agro forestry, forage crops and their utility and sustainable management of agrostology and agroforestry systems and its components viz. agri silviculture, silvi-pasture, agri-silvipasture, agri-horticulture, aqua-silviculture, alley cropping and energy plantation.
CO-3	Demonstrate various problems and its management of grasslands and agro-forestry systems viz. problems of seed germination, irrigation and manuring, associative influence in relation to above ground and underground interferences.
CO-4	Analyse the opportunities and challenges in production and managements of agrostology and agro-forestry systems.
CO-5	Assess the economic feasibility of different agrostology and agro-forestry systems

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of agrostology and agroforestry, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Teaching Pedagogy	Assessment tools
Course Contents	Unit – 1 Agrostology, definition and importance, grassland ecology – community, climax, dominant species, succession, biotype, ecological status of grasslands in India, grass cover of India, problems and management of grasslands.	Socratic method, Presentation	Assignment, Quiz, Mid-term examinations
	Unit – II Importance, classification (various criteria), scope, status and research needs of pastures, establishment, improvement and renovation of natural and cultivated pastures, common pasture grasses.	Flipped classes teaching model, Discussions, Field demonstration (ABL)	Assignment, Unannounced test Mid and End Term Examinations
	Unit – III Agroforestry: definition and importance, agroforestry systems, agrisilviculture, silvipasture, agrisilvipasture, agrihorticulture, aquasilviculture, alley cropping and energy plantation.	Lecture method/ Presentation Field demonstration (ABL)	Skill test, Quiz. end term examinations
	Unit – IV Crop production technology in agro-forestry and agrostology system, silvipastoral system: meaning and importance for wasteland development, selection of species, planting methods and problems of seed germination in agro-forestry systems, irrigation and manuring in agro-forestry systems, associative influence in relation to above ground and underground interferences, lopping and coppicing in agro-	Collaborative learning, Lecture method, ABL	Group discussions or debate, Assignment, Extempore, End Term Examinations

	forestry systems, social acceptability and economic viability, nutritive value of trees, tender operation, desirable tree characteristics.		
--	--	--	--

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	<ol style="list-style-type: none"> 4. Preparation of charts and maps of India showing different types of pastures and agro-forestry systems 5. Identification of seeds and plants of common grasses, legumes and trees of economic importance with reference to agro-forestry 6. Seed treatment for better germination of farm vegetation 7. Methods of propagation/ planting of grasses and trees in silvi-pastoral system 8. Fertilizer application in strip and silvi-pastoral systems 9. After-care of plantation 10. Estimation of protein content in loppings of important fodder trees 11. Estimation of calorie value of wood of important fuel trees 12. Estimation of total biomass and fuel wood 13. Economics of agro-forestry 14. Visit to important agro-forestry research stations 	<p>Spot</p> <p>Identification</p> <p>Practical Activity</p> <p>Practical Record</p> <p>Attendance</p> <p>Viva voce</p>
Resources:	LCD, OHP, Black Board, Agronomy lab and field for demonstration.	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	<ol style="list-style-type: none"> 19. Preparation of herbarium 20. Prepare layout of silvi-pastoral systems for different agroclimatic zone of India 21. Role of Agro-forestry system for social acceptability and economic viability. 	
Suggested reading:	<ol style="list-style-type: none"> 1. Chatterjee BN and Das PK. 1989. Forage Crop Production. Principles and Practices. Oxford & IBH. 2. Dabadghao PM and Shankaranarayan KA. 1973. The Grass Cover in India. ICAR. 3. Dwivedi AP. 1992. Agroforestry- Principles and Practices. Oxford & IBH. 4. Indian Society of Agronomy. 1989. Agroforestry System in India. Research and Development, New Delhi. 5. Narayan TR and Dabadghao PM. 1972. Forage Crop of India. ICAR, New Delhi 	
Suggested e-resources (Websites/e-books)	<ol style="list-style-type: none"> 1. https://www.soilassociation.org/media/19141/the-agroforestry-handbook.pdf 2. http://www.nicraicar.in/nicrarevised/images/Books/Agroforestry%20Book%20ISBN%20%20978-93-80883-42-7.pdf 3. https://digitalcommons.humboldt.edu/cgi/viewcontent.cgi?article=1000&context=botany_jps 	

Course Code: AGRON-511	Course Name: Cropping Systems and Sustainable Agriculture	Semester: III
-------------------------------	--	----------------------

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
2	2	0	0		2		M.Sc. (Ag), AGRONOMY
Curriculum level					Basic, applied and Innovative	Student specific course outcome	Higher Education Placement Research Entrepreneurship

Objective: To acquaint the students about prevailing cropping systems in the country and practices to improve productivity.

Course outcomes: Through this course students will be able to:

CO-1	Identify the different Cropping systems, farming system and cropping pattern with their respective M.P. as well as north part of India, for sustainable resource management.
CO-2	Describe the basic concepts of different competition relations between farming and cropping system component on above and below ground interactions and allelopathic effects.
CO-3	Demonstrate various IFS model and sustainability approaches.
CO-4	Analyse the opportunities and challenges in farming system for sustainable management of natural resources
CO-5	Assess the economic feasibility of different farming system component viz. cropping system, crop diversification, organic farming etc

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities IFS Model demonstration Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Teaching Pedagogy	Assessment tools
Course Contents	Unit – 1 Cropping systems: definition, indices and its importance; physical resources, soil and water management in cropping systems; assessment of land use.	Socratic method, Presentation	Assignment, Quiz , Mid-term examinations
	Unit – II Concept of sustainability in cropping systems and farming systems, scope and objectives; production potential under monoculture cropping, multiple cropping, alley cropping, sequential cropping and intercropping, mechanism of yield advantage in intercropping systems.	Flipped classes teaching model, Discussions, Field demonstration (ABL)	Assignment, Unannounced test Mid and End Term Examinations
	Unit – III Above and below ground interactions and allelopathic effects; competition relations; multi-storied cropping and yield stability in intercropping, role of non-monetary inputs and low cost technologies; research need on sustainable agriculture.	Lecture method/ Presentation Field demonstration (ABL)	Skill test , Quiz. end term examinations
	Unit – IV Crop diversification for sustainability; role of organic matter in maintenance of soil fertility; crop residue management; fertilizer use efficiency and concept of fertilizer use in intensive cropping system. Advanced nutritional tools for big data analysis and interpretation.	Collaborative learning, Lecture method, ABL	Group discussions or debate, Assignment, Extempore, End Term Examinations

	Unit-V Plant ideotypes for drylands; plant growth regulators and their role in sustainability.	Flipped classes teaching model, Discussions and Presentation, ABL	Seminar Presentation, Unannounced test, End term examination
	Unit-VI Artificial Intelligence- Concept and application.	Lecture method/ Presentation	Skill test, Quiz. end term examinations

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	NIL	NIL
Resources:	Classroom teaching with AV aids, group discussion, assignment.	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	22. Crop diversification for sustainability 23. Concept of sustainability in cropping systems and farming systems. 24. Role of Artificial Intelligence in present climate change scenario	
Suggested reading:	1. Panda SC. 2017. Cropping Systems and Sustainable Agriculture. Agrobios (India) 2. Panda SC. 2018. Cropping and Farming Systems. Agrobios. 3. Palaniappan SP and Sivaraman K. 1996. Cropping Systems in the Tropics; Principles and Management. New Age. 4. Panda SC. 2003. Cropping and Farming Systems. Agrobios. 5. Reddy SR. 2000. Principles of Crop Production. Kalyani. 6. Sankaran S and Mudaliar TVS. 1997. Principles of Agronomy. The Bangalore Printing & Publ. Co. 7. Singh SS. 2006. Principles and Practices of Agronomy. Kalyani. 8. Tisdale SL, Nelson WL, Beaton JD and Havlin JL. 1997. Soil Fertility and Fertilizers. Prentice Hall.	
Suggested e-resources (Websites/e-books)	1. https://iifsr.icar.gov.in/icar-iifsr/pdf/Bulletin%20%28Dr.%20J.P.%20Singh%29.pdf 2. https://iifsr.icar.gov.in/icar-iifsr/wp-content/uploads/2022/08/OF_Bulletin_Final_2022.pdf 3. https://iifsr.icar.gov.in/icar-iifsr/prog_files/Bulletin_IFS_July_2020.pdf 4. https://www.manage.gov.in/publications/eBooks/organic%20farming.pdf 5. https://www.ceew.in/sites/default/files/CEEW-FOLU-Sustainable-Agriculture-in-India-2021-20Apr21.pdf	

Course Code: AGRON-512	Course Name: Dryland Farming and Watershed Management	Semester: III
-------------------------------	--	----------------------

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1		4		M.Sc. (Ag.) Agronomy
Curriculum level					Basic, applied and Innovative	Student specific course outcome	Higher Education Placement Research Entrepreneurship

Objective: To educate about the dryland farming and watershed management.

Course outcomes: Through this course students will be able to:

CO1	Discuss the fundamental knowledge of mapping arid and semi-arid regions
CO2	Understand the skills required for integrated dry farming technologies
CO3	Apply the knowledge on soil and moisture conservation approaches and contingent crop plan to evade risk in dry farming.
CO4	Analyse the types of droughts, characterization of environment for water availability
CO5	Assess practical knowledge on rain water harvesting techniques and watershed management principles.
CO6	Develop the IFS model for dry farming region

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning
AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Teaching Pedagogy	Assessment tools
Course Contents	Unit I Definition, concept and characteristics of dry land farming; dry land versus rainfed farming; significance and dimensions of dry land farming in Indian agriculture.	Socratic method, Presentation	Assignment, Quiz, Mid-term examinations
	Unit II Soil and climatic parameters with special emphasis on rainfall characteristics; constraints limiting crop production in dry land areas; types of drought, characterization of environment for water availability; crop planning for erratic and aberrant weather conditions.	Flipped classes teaching model, Discussions, Field demonstration (ABL)	Assignment, Unannounced test Mid and End Term Examinations
	Unit – III Stress physiology and resistance to drought, adaptation of crop plants to drought, drought management strategies; preparation of appropriate crop plans for dry land areas; mid contingent plan for aberrant weather conditions.	Lecture method/ Presentation Field demonstration (ABL)	Skill test, Quiz. end term examinations
	Unit IV Tillage, tillage, 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); antitranspirants; soil and crop management techniques, seeding and efficient fertilizer use	Collaborative learning, Lecture method, ABL	Group discussions or debate, Assignment, Extempore, End Term Examinations

	<p>Unit V Concept of watershed resource management, problems, approach and components.</p>	<p>Flipped classes teaching model, Discussions and Presentation, ABL</p>	<p>Seminar Presentation, Unannounced test, End term examination</p>
--	---	--	---

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	<ol style="list-style-type: none"> 1. Method of Seed Priming 2. Determination of moisture content of germination of important dryland crops 3. Determination of Relative Water Content and Saturation Deficit of Leaf 4. Moisture stress effects and recovery behaviour of important crops Estimation of Potential ET by Thornthwaite method 5. Estimation of Reference ET by Penman Monteith Method Classification of climate by Thornthwaite method (based on moisture index, humidity index and aridity index) 6. Classification of climate by Koppen Method 7. Estimation of water balance by Thornthwaite method 8. Estimation of water balance by FAO method 9. Assessment of drought 10. Estimation of length of growing period 11. Estimation of probability of rain and crop planning for different drought condition 12. Spray of anti-transpirants and their effect on crops 13. Water use efficiency 14. Visit to dryland research stations and watershed projects 	<p>Practical Activity Practical Record Attendance Viva voce</p>
Resources:	LCD, OHP, Black Board, Horticulture lab and tools, Gardens, and field for demonstration, Polyhouse, Net house, Processing unit/post-harvest lab	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	<ol style="list-style-type: none"> 25. To prepare assignment on Stress physiology and its management strategies. 26. To prepare report on visit to dryland research stations and watershed projects 	
Suggested reading:	<ol style="list-style-type: none"> 1) Reddy TY. 2018. Dryland Agriculture Principles and Practices, Kalyani publishers 2) Das NR. 2007. Tillage and Crop Production. Scientific Publ. 3) Dhopte AM. 2002. Agrotechnology for Dryland Farming. Scientific Publ. 4) Dhruv Narayan VV. 2002. Soil and Water Conservation Research in India. ICAR. 5) Gupta US. (Ed.). 1995. Production and Improvements of Crops for Drylands. Oxford & IBH. 6) Katyal JC and Farrington J. 1995. Research for Rainfed Farming. CRIDA. 7) Rao SC and Ryan J. 2007. Challenges and Strategies of Dryland Agriculture. Scientific Publ. 	

	<p>8) Singh P and Maliwal PL. 2005. Technologies for Food Security and Sustainable Agriculture. Agrotech Publ. Company.</p> <p>9) Singh RP. 1988. Improved Agronomic Practices for Dryland Crops. CRIDA.</p> <p>10) Singh RP. 2005. Sustainable Development of Dryland Agriculture in India. Scientific Publ. Singh SD. 1998. Arid Land Irrigation and Ecological Management. Scientific Publ.</p> <p>11) Venkateshwarlu J. 2004. Rainfed Agriculture in India. Research and Development Scenario. ICAR.</p>
<p>Suggested e-resources (Websites/e-books)</p>	<p>https://coabnau.in/uploads/1615893931_Agron6.10_Notes.pdf</p> <p>https://www.powershow.com/view/72660-OTUyY/Central_Research_Institute_for_Dryland_Agriculture_powerpoint_ppt_presentation</p> <p>https://www.researchgate.net/publication/335692243_1_Dryland_farming_An_Introduction</p> <p>https://www.icar-crida.res.in/</p> <p>http://agropedia.iitk.ac.in/content/watershed-management-dryland</p>

Course Code: AGRON-513	Course Name: Principles and Practices of Organic Farming	Semester: III
-------------------------------	---	----------------------

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1		4		M.Sc. (Ag.) Agronomy
Curriculum level					Basic, applied and Innovative	Student specific course outcome	Higher Education Placement Research Entrepreneurship

Objective: To educate about principles and practices of organic farming for sustainable crop production.

Course outcomes: Through this course students will be able to:

CO1	Describe organic farming including its relevance to India and global agriculture and future prospects
CO2	Explain soil fertility, nutrient cycle manures and soil biota (earthworms and vermicompost)
CO3	Apply the concepts of marketing and export potential, certification and labelling
CO4	Analyse the knowledge of cropping and farming systems for sustainable agriculture
CO5	Evaluate marketing and export potential, Socio-economic impact of Organic farming and national economy
CO6	Generate inspection, certification, labelling and accreditation procedures for an organic farm.

Teaching Pedagogy:

T1	Activity based learning using different tools Flipped classes teaching model Collaborative learning Socratic method of teaching. Power Point Presentations.
T2	ABL activities Field demonstration of cultivation practices, Assignment Unannounced test Seminars with open discussions Group discussions or debate Quiz

Assessment tools	
AT1-1	Mid term Exams and end term exam
AT1-2	Assignment
AT1-3	Unannounced test
AT1-4	Activity Based Learning

AT1-5	Group discussions or debate
AT1-6	Skill test
AT1-7	Quiz
AT1-8	Extempore (student needs to explain the instant given topic as a teacher to all other students)
AT1-9	Seminar Presentation

Prerequisites	Unit wise contents details	Teaching Pedagogy	Assessment tools
Course Contents	Unit I: Organic farming - concept and definition, its relevance to India and global agriculture and future prospects; principles of organic agriculture; organics and farming standards; organic farming and sustainable agriculture; selection and conversion of land, soil and water management - land use, conservation tillage; shelter zones, hedges, pasture management, agro-forestry	Lecture method/ Presentation Field demonstration (ABL)	Assignment, Quiz, Mid-term examinations
	Unit II: Organic farming and water use efficiency; soil fertility, nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermicompost, green manures, bio-fertilizers and biogas technology	Flipped classes teaching model, Discussions, Field demonstration (ABL)	Assignment, Unannounced test Mid and End Term Examinations
	Unit III: Farming systems, selection of crops and crop rotations, multiple and relay cropping systems, intercropping in relation to maintenance of soil productivity	Lecture method/ Presentation Field demonstration (ABL)	Skill test, Quiz, end term examinations
	Unit IV: Control of weeds, diseases and insect pest management, biological agents and pheromones, bio-pesticides.	Collaborative learning, Lecture method/ Presentation , ABL	Group discussions or debate, Assignment, Extempore, End Term Examinations
	Unit V: Socio-economic impacts; marketing and export potential: inspection, certification, labeling and accreditation procedures; organic farming and national economy	Flipped classes teaching model, Discussions and Presentation, ABL	Seminar Presentation, Unannounced test, End term examination

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	1. Method of making compost by aerobic method	

	<ol style="list-style-type: none"> 2. Method of making compost by anaerobic method 3. Method of making vermicompost 4. Identification and nursery raising of important agro-forestry trees and trees for shelter belts 5. Efficient use of biofertilizers, technique of treating legume seeds with Rhizobium cultures, use of Azotobacter, Azospirillum, and PSB cultures in field 6. Visit to a biogas plant 7. Visit to an organic farm 8. Quality standards, inspection, certification and labelling and accreditation procedures for farm produce from organic farms 	<p>Practical Activity</p> <p>Practical Record</p> <p>Attendance</p> <p>Viva voce</p>
Resources:	LCD, OHP, Black Board, Visit to research stations, organic farm, visit field demonstrations.	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	<ol style="list-style-type: none"> 27. To prepare assignment on Stress physiology and its management strategies. 28. To prepare report on visit to dryland research stations and watershed projects 	
Suggested reading:	<ol style="list-style-type: none"> 1. Ananthakrishnan TN. (Ed.). 1992. Emerging Trends in Biological Control of Phytophagous Insects. Oxford & IBH. 2. Gaur AC. 1982. A Manual of Rural Composting, FAO/UNDP Regional Project Document, FAO. 3. Joshi M. 2016. New Vistas of Organic Farming. Scientific Publishers 4. Lampin N. 1990. Organic Farming. Press Books, Ipswich, UK. 5. Palaniappan SP and Anandurai K. 1999. Organic Farming – Theory and Practice. Scientific Publ. 6. Rao BV Venkata. 1995. Small Farmer Focused Integrated Rural Development: Socio-economic Environment and Legal Perspective: Publ.3, ParisaraprajnaParishtana, Bangalore. 7. Reddy MV. (Ed.). 1995. Soil Organisms and Litter Decomposition in the Tropics. Oxford & IBH. 8. Sharma A. 2002. Hand Book of Organic Farming. Agrobios. 9. Singh SP. (Ed.). 1994. Technology for Production of Natural Enemies. PDBC, Bangalore. SubbaRao NS. 2002. Soil Microbiology. Oxford & IBH. 10. Trivedi RN. 1993. A Text Book of Environmental Sciences, Anmol Publ. 	
Suggested e-resources (Websites/e-books)	<p>https://www.canr.msu.edu/hrt/uploads/535/78622/Organic-Farming-hand-col-2006-10pgs.pdf</p> <p>https://coabnau.in/uploads/1587019407_Principlesoforganicfarming.pdf</p> <p>https://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Compilation_techniques_organic_agriculture_rev.pdf</p>	

Course Code: SOILS-509	Course Name: Remote Sensing and GIS Techniques for Soil, Water and Crop Studies	Semester: Iii
-------------------------------	--	----------------------

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
3	2	0	1		4		M.Sc. (Ag), SS
Curriculum level					<ul style="list-style-type: none"> • Information based • Critical thinking based • Research based 	Student specific course outcome	<ul style="list-style-type: none"> • Placement • Research • Higher education

Objective: This course is aimed at understanding the basic concepts of remote sensing, aerial photographs and imageries, and their interpretation; application of remote sensing in general and with special reference to soil, plants and yield forecasting; to impart knowledge about geo-statistical techniques with special reference to krigging, and GIS and applications in agriculture.

Course outcomes: After completion of course, the student will be able to:

CO-1	Describe the fundamental concept of remote sensing.
CO-2	Discuss the application of remote sensing in agriculture.
CO-3	Apply image processing techniques for identification of crop and soil issues.
CO-4	Examine the Crop stress and Yield forecast of different agricultural crops
CO-5	Determine the GIS techniques for solving complex agricultural problems.

Teaching Pedagogy:

T1	Class room teaching (chalk-board) Power Point Presentations
T2	ABL activities Assignments Flip Class/ Seminars Quiz

Assessment tools	
AT1-1	Two Midterm Exams
AT1-2	Seminar Presentation and Report
AT1-3	Industrial Visit Report
AT1-4	Quiz
AT1-5	Poster

AT1-6	Activity Based Learning
AT1-7	Flip Class
AT1-8	Review writing

Prerequisites	Unit wise contents details	Assessment tools
Course Contents	Unit-I: Introduction and history of remote sensing; sources, propagation of radiations in atmosphere; interactions with matter.	Class room teaching (chalk-board) Power Point Presentations
	Unit-II: Sensor systems - camera, microwave radiometers and scanners; fundamentals of aerial photographs and image processing and interpretations.	ABL activities Assignments Flip Class/ Seminars Quiz Industrial Visit
	Unit-III: Application of remote sensing techniques - land use soil surveys, crop stress and yield forecasting, prioritization in watershed and drought management, wasteland identification and management.	Class room teaching (chalk-board) Power Point Presentations
	Unit-IV: Significance and sources of the spatial and temporal variability in soils; variability in relation to size of sampling; classical and geo-statistical techniques of evolution of soil variability.	Assignments Flip Class/ Seminars Quiz
	Unit-V: Introduction to GIS and its application for spatial and non-spatial soil and land attributes.	Assignments Flip Class/ Seminars Quiz

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	<ol style="list-style-type: none"> 1. Familiarization with different remote sensing equipments and data products 2. Interpretation of aerial photographs and satellite data for mapping of land resources 3. Analysis of variability of different soil properties with classical and geostatistical techniques 4. Creation of data files in a database programme 5. Prioritization of watershed 6. Use of GIS for soil spatial simulation and analysis 7. Preparation of land use and land cover map 8. To enable the students to conduct soil survey and interpret soil survey reports in terms of land use planning 	Activity based learning can be given to implement application aspect

Resources:	LCD, OHP, Black Board, Laboratory.
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	<ol style="list-style-type: none">1. Remote sensing and its components2. Image processing and interpretation3. Prioritization of watershed.4. Radiation laws5. GIS and its components6. Application of Remote sensing in agriculture
Suggested reading:	A. Text and Reference books: <ol style="list-style-type: none">1. Brady NC & Weil RR. 2002. The Nature and Properties of Soils. 13th Ed. Pearson Edu.2. Elangovan K. 2006. GIS Fundamentals, Applications and Implementations. New India Publ. Agency.3. Lillesand TM & Kiefer RW. 1994. Remote Sensing and Image Interpretation. 3rd Ed. Wiley.4. Nielsen DR & Wendroth O. 2003. Spatial and Temporal Statistics. Catena Verlag GmbH.5. Star J & Esles J. 1990. Geographic Information System: An Introduction. Prentice Hall.
Suggested e-resources (Websites/e-books)	<ol style="list-style-type: none">1. https://www.intechopen.com/chapters/834172. https://www.mdpi.com/2072-4292/12/19/31363. https://www.ncfc.gov.in/publications/p3.pdf4. https://www.nrsc.gov.in/sites/default/files/pdf/ebooks/Chap_1_Agriculture.pdf

Course Code: PGS-502				Course Name: Technical Writing and Communications Skill				Semester: I	
Credits	L	T	P	Marks		Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)	
1	0	0	1			2		M.Sc. Agronomy	
Curriculum level						<ul style="list-style-type: none"> • Information based • Skill development based • Research based 	Student specific course outcome	<ul style="list-style-type: none"> • Skill enhancement • Research • Higher education 	

Objective: To equip the students/ scholars with skills to write dissertations, research papers, etc. To equip the students/ scholars with skills to communicate and articulate in English (verbal as well as writing).

Course outcomes: After completion of course, the student will be able to:

CO-1	Define various aspects of technical writing and communication skills.
CO-2	Translate scientific literatures for effective draft of technical writings.
CO-3	Apply the writing and communication skills at scientific platform.
CO-4	Relate the various scientific works on the given research ideas.
CO-5	Equip the students/scholars with skills to write dissertations, research papers, etc.

Teaching Pedagogy:

T1	Classroom Lectures Web-based Practicals Student Seminars/ Presentations/Workshop
T2	ABL activities Research paper and review paper reading Review writing

Assessment tools	
AT1-1	Review writing
AT1-2	Student Seminars/ Presentations/Workshop Report
AT1-3	Drafting a technical program for scientific research
AT1-4	Scientific profile evaluation
AT1-5	Paper publication

Practical Exercise* (Min-8)	List of practicals (field/lab exercises)	Assessment tools
	<ul style="list-style-type: none"> • Various forms of scientific writings- theses, technical papers, reviews, manuals, etc. 	

	<ul style="list-style-type: none"> • 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; pagination, numbering of tables and illustrations • Writing of numbers and dates in scientific write-ups • Editing and proof-reading • Writing of a review article • Communication Skills - Grammar (Tenses, parts of speech, clauses, punctuation marks) • Error analysis (Common errors), Concord, Collocation, Phonetic symbols and transcription • Accentual pattern: Weak forms in connected speech • Participation in group discussion • Facing an interview • Presentation of scientific papers 	
Resources:	LCD, Black/White Board, Computer Laboratory	
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.	
List of Assignments	<ol style="list-style-type: none"> 1. Abstracts writing, 2. Citations writing, 3. Review article writing, 	
Suggested reading:	<p>A. Text and Reference books:</p> <ol style="list-style-type: none"> 1. Barnes and Noble. Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. 2. Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India. 3. Collins' Cobuild English Dictionary. 1995. 4. Harper Collins. Gordon HM and Walter JA. 1970. Technical Writing. 3rd Ed. 5. Holt, Rinehart and Winston. Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford University Press. 6. James HS. 1994. Handbook for Technical Writing. NTC Business Books. 7. Joseph G. 2000. MLA Handbook for Writers of Research Papers. 5th Ed. Affiliated East-West Press. 8. Mohan K. 2005. Speaking English Effectively. MacMillan India. 9. Richard WS. 1969. Technical Writing. 10. Sethi J and Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice Hall of India. 11. Wren PC and Martin H. 2006. High School English Grammar and Composition. S. Chand & Co. 	
Suggested e-resources (Websites/e-books)	<ol style="list-style-type: none"> 1. https://link.springer.com/chapter/10.1007/978-981-16-5248-6_15 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3136027/ 	

Course Code: PGS-505	Course Name: AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES	Semester: III
-----------------------------	---	----------------------

Credits	L	T	P	Marks	Contact Hours (per week)	Independent Study Hour (per week)	Section (Group)
1	1	0	0		1		M.Sc. Agronomy
Curriculum level					Basic and applied	Student specific course outcome	Higher Education Placement Research

Objective: To enlighten the students about the organization and functioning of agricultural research systems at national and international levels, research ethics, and rural development programmes and policies of Government.

Course outcomes: After completion of course, the student will be able to:

CO-1	Define various aspects of agricultural research.
CO-2	Understand the research ethics.
CO-3	Apply the skill for rural development programmes.
CO-4	Relate the functioning of agricultural research systems at national and international levels.
CO-5	Equip the students/scholars with skills to perform research.

Teaching Pedagogy:

T1	Classroom Lectures Web-based information Student Seminars/ Presentations/Workshop
T2	ABL activities Case studies Community development programs

Assessment tools	
AT1-1	Case studies
AT1-2	Student Seminars/ Presentations/Workshop Report
AT1-3	Drafting a technical program for scientific research
AT1-4	Participation in community development programs

Prerequisites	Unit wise contents details	Assessment tools
----------------------	-----------------------------------	-------------------------

Course Contents	UNIT-I: Agricultural Research: History of agriculture in brief. Global agricultural research system: need, scope, opportunities. Role in promoting food security, reducing poverty and protecting the environment.	Student Seminars/ Presentations/Workshop Report/ Drafting a technical program
	UNIT II: NARS and CGIAR: National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions. Consultative Group on International Agricultural Research (CGIAR): 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. □ International fellowships for scientific mobility.	Student Seminars/ Presentations/Workshop Report/ Case studies
	UNIT III: Research Ethics: Research ethics: research integrity, research safety in laboratories. Welfare of animals used in research, computer ethics. Standards and problems in research ethics.	Student Seminars/ Presentations/Workshop Report
	UNIT IV: RDP- Concept and policies: 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, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/ Non-Governmental Organisations.	Participation in Community Development Programme / Case studies
	UNIT V: RDP- Evaluation and implementation: Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.	Participation in Community Development Programme / Case studies

Resources:	LCD, Black/White Board
Assignment/Tutorial:	Students are required to submit the given assignments and deliver one power point presentation as a part of their continuous evaluation system.
List of Assignments	1. Case studies on NARS 2. Case studies on RDP 3. Case studies on Research ethics
Suggested reading:	A. Text and Reference books: 1. Bhalla GS and 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.
Suggested e-resources (Websites/e-books)	1. https://www.fao.org/3/i1307e/i1307e.pdf 2. https://icar.org.in/files/reports/icar-dare-annual-reports/2013-14/NAIP-13-14.pdf 3. https://icar.org.in/files/advcn.pdf